ELVIS Mobile Application

A memory driven social media for elderly to connect with their beloved, enhancing family inclusivity and intergeneration understanding

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11 APR, 2021

ABSTRACT

[This project has been chosen to represent VTC in the upcoming ITE-VTC International Student Seminar 2022 co-organized by VTC and the Institute of Technical Education, Singapore, and at the Future Skills Community Event 2022 which celebrates VTC's 40th anniversary.]

The pandemic has inevitably and fundamentally transformed the way in which individuals live, work and learn. Such ways of life are now also commonly described as the "new normal." It is apparent that adapting to the new normal demands innovation which constantly disrupts convention. Despite the boom of video-conferencing applications such as Zoom, elderly is less ready to embrace this emerging way of social interaction.

Hong Kong's recent wave of emigration, on the other hand, imposes another challenge to the city. Local NGOs reported that they have been receiving calls from elderly whose children emigrated to other places and thus leaving them behind. Social Workers and caretakers suggested that the situation is reaching an alarming level, especially when Hong Kong's population has been ageing at an unprecedented pace. The emotional status of these "left behind" elderly is inevitably being affected.

With the above issues in mind, this project attempts to answer the driving question: "how to use the GeronTech to develop software systems for supporting elderly in the district?" by producing a smart social media platform called ELVIS - ELderly Video and Image Sharing. There are three main objectives of this proposed project: (1) to develop a system for assisting elderly in communication, (2) to develop a platform for elderly to share their daily life, and (3) to develop a platform to help caretakers to understand the elderly. With ELVIS, it is hoped that these senior citizens would be able to have social and cognitive interactions with their family members or caretakers and help the elderly feels part of a connected society, wherever they may be.

ACKNOWLEDGEMENT

First and foremost, we would like to express our deep and sincere gratitude to our supervisor, Mr SIZTO Chung Yeung Kenneth, for providing invaluable guidance throughout this project. His dynamism, vision, sincerity, and motivation have deeply inspired us. He has taught us the methodology to carry out the research and to turn the research work into a useable product. It was a great privilege and honor to work and study under his guidance.
We are extremely grateful for what he has offered us. We would also like to thank him for his friendship, empathy, and great sense of humor.

We are extending our thanks to the organizing committee of the ITE-VTC International Student Seminar 2022 for their trust in us. Without their encouragement and support during our preparation, this project will not be able to achieve its current milestone. We are also grateful to be chosen to represent VTC at the Future Skills Community Event 2022 which celebrates VTC's 40th anniversary.

We thank our co-marker Mr LEUNG Nin Hung Thomas for helping us during different stages of the project, and the Department of Information Technology at Hong Kong Institute of Vocational Education (Tsing Yi), for their support to us. Special thanks go to Mr CHOU Siu Chuen Nelson for his administrative support as Final Year Project coordinator, and as our first teacher at IVE(TY). We believe all SE students at the Department would agree that Mr CHOU is one of the most influential teachers on our journey to become a software engineer.

Finally, our thanks go to all the people who have supported us to complete the project directly or indirectly.

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INTRODUCTION

Hong Kong's population has been ageing at an unprecedented pace. The number of people aged 60 or above will rise from 2.05 million in 2021 to 3.77 million in 2050, accounting for almost 50% of the total population. The Secretary for Labour and Welfare, Dr. C K Law suggested that 1,200 elderly homes have to be built in 40 years.[1] This is virtually impossible as shortage of land has always been an issue in Hong Kong.Therefore, the Government has been investing in Gerontechnology for improving welfare and health status of the elderly as part of the "Smart City Blueprint" to prevent "Empty Nest syndrome."[2][3]

In a research conducted by the Hong Kong Federation Youth Group (青協), it is explicitly suggested that social media platform could reduce the intergenerational gap between elderly and young adult. Researchers found that the use of AI in elderly mobile applications and system "has great potential for improving the lives of older." [4][5]

On the other hand, the recent wave of emigration and the COVID-19 pandemic both have persistent influences elderly. In both cases, they are unable to see family members due to physical barriers.

[1] Law, C. K. (2020, October 18). 面對未來挑戰的安老服務發展（2020年10月18日）. https://www.lwb.gov.hk/tc/blog/post_18102020.html
[2] HKSAR Government. (n.d.). HKSmart City Blueprint | Smart City. https://www.smartcity.gov.hk/
[3]Empty nest syndrome refers to the grief that many parents feel when their children move out of home.
[4]ScienceDaily. (2021, June). AR can improve the lives of older adults, so why are apps designed mainly with youngsters in mind? https://www.sciencedaily.com/releases/2021/06/210622123229.htm
[5] Frontiers. (2021). The use of virtual and augmented reality by older adults: Potentials and challenges. https://www.frontiersin.org/articles/10.3389/frvir.2021.639718/full

INTRODUCTION

Therefore, in order to address the driving question: "In the trend of migration and affection of Covid-19, how to use the GeronTech to develop software systems for supporting elderly in the district?", the project team attempts to revolutionize the usage of social media by elderly through implementing these technologies into practice.

By producing a smart social media platform ELVIS: "ELderly Video and Image Sharing." ELVIS aims to revolutionize the way in which elderly connect their family, NGOs and caretakers, and even other elderly.

Through the use of Artificial Intelligence (AI) as well as other emerging technologies it is hoped that elderly could be part of a connected society, wherever they may be.

PROBLEMS

i. Emigration

Recently, the emigration rate of Hong Kong has increased significantly due to various reasons. According to rfi, the number of people who emigrate tripled in 2021.[6]

In many cases, people go abroad without bringing their parents along, which leads to a situation of elderly people living alone.

As a result, it is unlikely the elderly could visit their loved ones easily in the future.

Caritas, a non-governmental organization that provides a variety of services, suggested that 26 elderly people sought help because their family moved to other countries in 4 months. [7]

As a result, their emotions are largely affected by the leaves of their family members. [8]

[6] Radio France Internationale (RFI). (2021, August 13). 離港人數按年升逾3倍 總人口跌1.2% 學者料移民潮將持續多一至兩年. RFI - 法國國際廣播電台. https://rfi.my/7ecx
[7] Mingpao. (2021, August 1). Bad request. 明報新聞網. https://news.mingpao.com/pns/港聞/article/20210801/s00002/1627756071497/醫生-有長者無人接出院-因家人準備移民
[8] HK01. (2021, August 15). 移民潮下如何撫平老友記情緒 心理學家及社工有錦囊. 香港01. https://www.hk01.com/社會新聞/653981/移民潮下如何撫平老友記情緒-心理學家及社工有錦囊

PROBLEMS

ii. COVID-19, and its challenge to elderly

The pandemic has inevitably and fundamentally transformed the way in which individuals live, work and learn. [9] For instance, work-from-home and online learning becomes "the normal," owing to social distancing measures. Isolation as such, however, could be alarming for elderly, as research has been suggesting that it could result in higher chances of cognitive impairment which would ultimately lead to Alzheimer's disease (Friedler et al., 2014).[10]

The World Health Organization (WHO) also recommended individuals to stay connected with one's social network to prevent isolation (2020).[11]

It is unfortunate that, however, disadvantaged groups such as elderly is less ready to embrace this emerging way of social interaction at the moment.

[9] Pew Research Center: Internet, Science & Tech. (2021, February 18). Experts say the 'New normal' in 2025 will be far more tech-driven, presenting more big challenges. https://www.pewresearch.org/internet/2021/02/18/experts-say-the-new-normal-in-2025-will-be-far-more-tech-driven-presenting-more-big-challenges/

[10] Friedler, B., Crapser, J., & McCullough, L. (2014). One is the deadliest number: The detrimental effects of social isolation on cerebrovascular diseases and cognition. Acta

[11] World Health Organization. (2020). Mental health and psychosocial considerations during the COVID-19 outbreak (WHO/2019-nCoV/MentalHealth/2020.1). https://apps.who.int/iris/bitstream/handle/10665/331490/WHO-2019-nCoV-MentalHealth-2020.1-eng.pdf

PRPOSED SOLUTION

COMPARING EXISTING PLATFORMS

There are several existing and popular social media in the market, namely Facebook, Instagram, TikTok.

However, as shown in the table below, none of them are targeting elderly as they all aim to "connect the world," in their own ways.

Therefore, the project team identify this as a market niche and thus there is a need in producing a social media for elderly. As a result, ELVIS is more focused, with a specific aim to connect elderly with their beloved.

	Target User	Media Type	Mission
ELVIS	Elderly, Midlife & Youth	Video Call Video Sharing Photo Sharing	"A social media for elderly to connect with their beloved"
Facebook	Midlife	Text Sharing Photo Sharing	"Connect the World"
Instagram	Youth	Photo Sharing Video Sharing	"Capture and Share the World's moments"
TikTok	Youth	Video Sharing	"Capture and Present the World's creativity"

PRESERVING MEMORIES, CONNECTING GENERATIONS

On the other hand, these existing platforms focuses largely on immediate interactions among users, which in turns made them inconvenient tools to preserve memory. For instance, Instagram and facebook relies heavily on the use of Story, which disappear from user's main interface after certain period (usually one or two day(s)). TikTok, on the other hand, focus on live reel which focuses on real time interactive. All these functionalities are deemed useful to their own target audience. For ELVIS, however, the approach is different. ELVIS aims to preserve all the assets uploaded to the application as a from of collective memory, be it an old, scratched photo or a new, recent snapshot. It is hoped that these memories could be transformed into the bridge between different generations. As what the vision statement – Preserving Memories, Connecting Generations - suggests, it is believed that memories could serve as powerful tools that connect different generations.

THE ELVIS APP

To embrace the change that emerged from emigration issue, COVID-19, as well as the Hong Kong's Smart City plan, this project attempts to produce a smart social media platform exclusively crafted for elderly called ELVIS, which is the acronym of "ELderly Video and Image Sharing." It is also inspired by Elvis Presley (or commonly known as 〝貓王〞 in the Hong Kong context).

Elvis Presley was one of the most significant cultural icons of the 20th century across the world as well as in Hong Kong.

Elvis has passed away and his fans have been turning old. Such appropriation is expected to make the application a sounding brand among elderly.

THE ELVIS APP

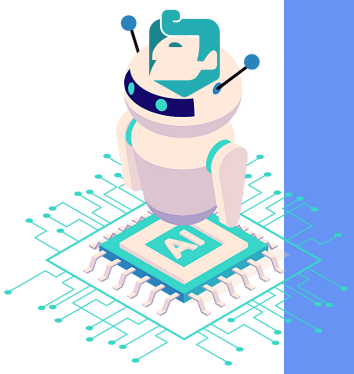
It is expected that the following functions could be achieved:

(1) AI-enabled Photo Sharing
- AI track activity/emotion
- AI interaction bot
- Recipe Template

(2) AI-powered Photo Retouching
- Photo repair
- Photo colorization
- Enhance photo resolution
- Animate photos (future extension)

(3) AI Video Call
- Face synthesis
- Drop in call

(4) Self-empowerment through Skills sharing (future extension)



THE ELVIS APP

(1) AI-enabled Photo Sharing

Barnhart & Peñaloza (2013) found that elderly is sometimes reluctant to contact their grown children. [12]

Therefore, the following functions are featured in the App. The following features shall be deployed in the application:

- AI track activity/emotion:

AI has been used extensively in elderly care. [13] [14]

However, most of the existing solutions focus on physical condition of the elderly. ELVIS aims to bring this a step further by tracking user's activity and emotion based on their uploads.

For instance, when AI tracks some dimsum on the table, it sends "grandmother yum cha with her friend" notification to other members.

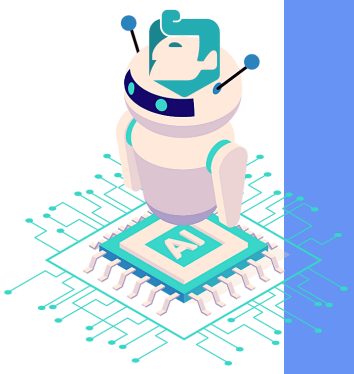
[12] AARP. (2015). Building a Better Tracker. https://www.aarp.org/content/dam/aarp/home-and-family/personal-technology/2015-07/innovation-50-project-catalyst-tracker-study-AARP.pdf
[13] Forbes. (2018, October 31). How is AI Revolutionizing Elderly Care. https://www.forbes.com/sites/shourjyasanyal/2018/10/31/how-is-ai-revolutionizing-elderly-care/?sh=7caaf1f7e07d
[14] HealthITSecurity. (2020, December 4). Using AI, data analytics to enhance person-centered care for seniors. HealthITAnalytics. https://healthitanalytics.com/features/using-ai-data-analytics-to-enhance-person-centered-care-for-seniors

THE ELVIS APP

(1) AI-enabled Photo Sharing

- AI interaction bot:

The Hong Kong Federations of Youth Group (青協) identified in their research that one of the reasons for intergenerational gaps is there is no initiative for the youngster to communicate with the elderly. [15]



Therefore, to increase interaction between family members, the artificial intelligence interactive robot of ELVIS regularly creates certain interactive events for all family members.

Such interaction may include games, image special effects and automatically generated photo albums.

Through these events, AI interactive robots bring back the common memories of the past and thus the elderly can reconnect with the family members.

[15] Hong Kong Federation of Youth Groups. (2019). Strengthening Intergenerational Understanding. https://yrc.hkfyg.org.hk/en/2019/12/10/strengthening-intergenerational-understanding-2/ p.46

THE ELVIS APP

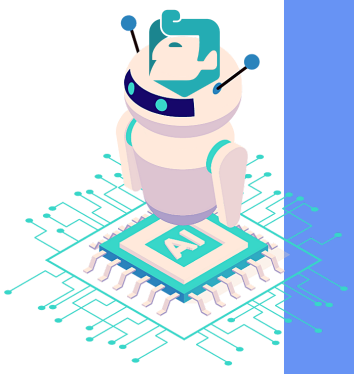
(1) AI-enabled Photo Sharing

- Recipe template:

"Because food memories form without any conscious editing, they take on all the attributes of the situations in which they were acquired." [16]

Food is the common memories of the family. It is difficult to taste exactly the same outside the home.

This function is expected to help future generations inherit the unique family value from the elderly.



The template enables easy sharing of traditional Chinese recipes. For instance, elderly could share how to cook 〝青紅蘿蔔煲豬展〞 to their family members who have emigrated.

[16] BBC. (2019, August 26). Why food memories are so powerful. BBCpage. https://www.bbc.com/travel/article/20190826-why-food-memories-are-so-powerful

THE ELVIS APP

(2) AI-powered Photo Retouching

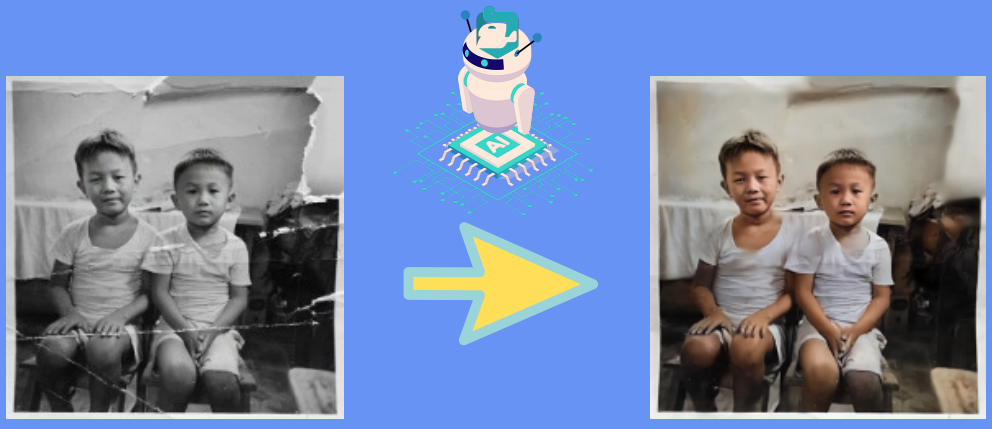
Family photos are one of the main sources of collective memory of a memory. [17] Given the physical barriers of emigration, or the social distancing measures imposed during the pandemic, it is difficult for family to share the physical family album which stores these important memories.

The AI-enabled album function of ELVIS serves as a digital hub of memories that last forever, even during difficult times.

- Photos enhance function:

It is not uncommon that old photos taken by elderly in the past were damaged due to improper storage of the photo.

The ai-enabled photo repair function of ELVIS could repair the photos from scratching, enhancing the resolution of old photos and even colorize these photos.



[17] MILK Books. (n.d.). The importance of family photo books. MILK Books - High Quality Handcrafted Photo Books & Albums. https://www.milkbooks.com/blog/family/the-importance-of-family-photo-books/

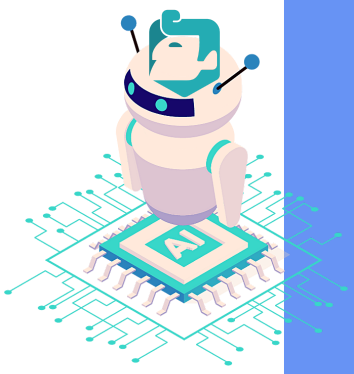
THE ELVIS APP

(3) Advanced Video Call

- Drop-in call:

The Drop-in call function has been extensively used in nursing home to let family members instantly connect with the elderly. [18] The elderly is not required to make a touch screen operation for video calls.

However, it is not included in most of the existing video call in the market. The project team brings the drop-in call function to ELVIS to enhance elderly's user experience.



- Face Synthesis:

Face Synthesis shortens the age gap between the elderly and the young.

While video calling, the function can be activated. Users of similar age will appear between the user's cameras.

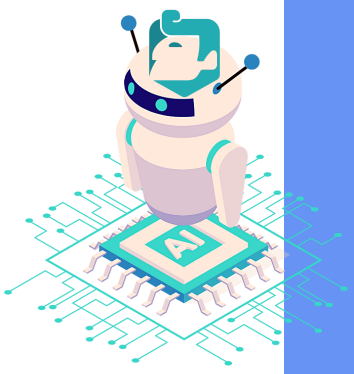
Better user experience can be obtained by peer communication.

[18] DailyCaring. (2020, September 29). Best way to make video calls to seniors with Alzheimer's or dementia in nursing homes – DailyCaring. https://dailycaring.com/best-way-to-make-video-calls-to-seniors-with-alzheimers-or-dementia-in-nursing-homes-during-coronavirus/

THE ELVIS APP

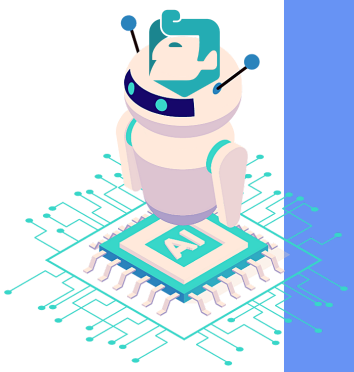
(4) Self-empowerment through Skills sharing (future extension)

- Strengthening elderly's connection with the community by breaking the physical barrier through skills sharing functionality.



WHY AI AND WHY MOOD TRACKING

AI has already been used extensively in the elderly care industry.[19] [20] However, most of the existing solutions focus on the physical condition of elderly. As a result, a lot of common practices that use AI in Gerontechnology focuses on the use of AI in enhancing hardware used by elderly (e.g., a crutch with sensor). This is because the primary focus on usually goes to their physical health (which in fact makes sense as elderly's physical condition gradually decay with time). However, this kind of products already exist in the market and thus is difficult to be successful for latecomers.

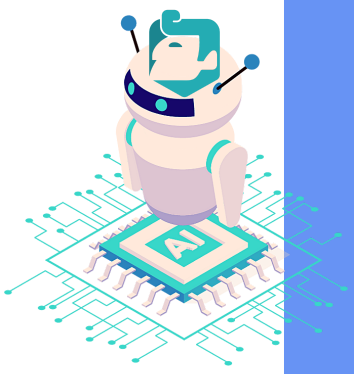


This is where the project team identified a market niche - the gap in using AI to monitor the mental status of elderly with an aim to avoid various disease such as the Alzheimer's disease mentioned in the previous section. The approach adopted by the project team is to utilize AI computer vision to analyze the photos uploaded by the elderly. For instance, the elderly uploaded a group photo of him/her with some other people after hiking.

[19] Forbes. (2018, October 31). How is AI Revolutionizing Elderly Care. https://www.forbes.com/sites/shourjyasanyal/2018/10/31/how-is-ai-revolutionizing-elderly-care/?sh=7caaf1f7e07d

[20] HealthITSecurity. (2020, December 4). Using AI, data analytics to enhance person-centered care for seniors. HealthITAnalytics. https://healthitanalytics.com/features/using-ai-data-analytics-to-enhance-person-centered-care-for-seniors

WHY AI AND WHY MOOD TRACKING



The AI computer vision would be able to recognize the elderly from the photo, followed by an analysis on the elderly's face expression.

Two goals are hoped to be accomplished through the use of mood tracking:

(1) immediately identify instance when elderly become moody (e.g., the AI computer vision shall be able to identify if the elderly is for instance sad) and

(2) in future extension the ELVIS app can be used by family members, caretakers, and staff from elderly home to monitor elderly's mental issues in the long term.

In the next section, the advantages of using ELVIS app will be discussed.

AI USED IN ELVIS

1.Computer Vision

According to IMB (n.d.), "Computer vision is a field of artificial intelligence (AI) that enables computers and systems to derive meaningful information from digital images, videos and other visual inputs — and take actions or make recommendations based on that information." [21]

ELVIS makes use of face detection and computer vision, both are sub-categories of computer vision, to identify elderly's mood through analysing the photos that they uploaded. It is hoped that by using such technique, family members would be able to track Elderly's emotion by reading the push notification automatically generated after the elderly uploads a photo.

[21] IBM. (n.d.). What is computer vision? IBM - United States. https://www.ibm.com/hk-en/topics/computer-vision

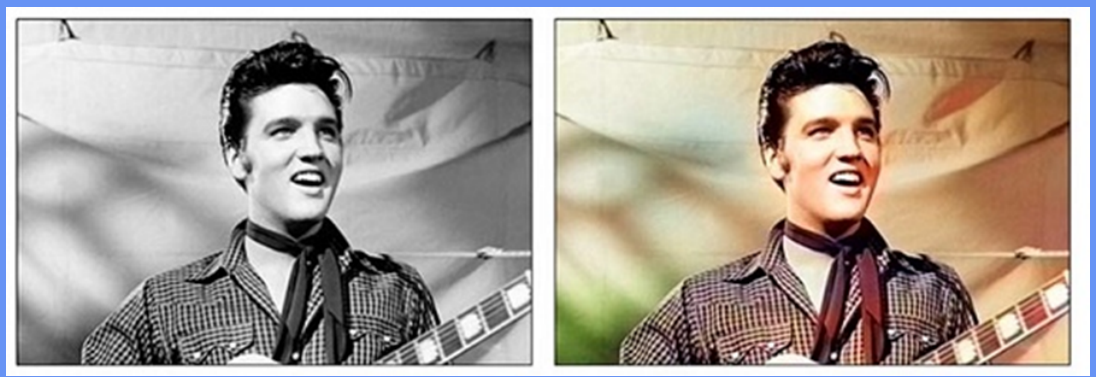
AI USED IN ELVIS

1.Computer Vision

Another technique in computer vision used by ELVIS are image enhancement and image colorization. By using these computer vision techniques, it is hoped that elderly could generate new memories out of old photos that could share with family members digitally.

As suggested by the research conducted by Hong Kong Sustainable Development Research Institute (2014) and the Hong Kong Federation of Youth Groups (2019), social media platform has the potential to strengthen international understanding. [22] [23]

However, it is unfortunate that existing platforms are unable to utilize their full power as the two generations were unable to find a common ground for them to initialize conversation when using these platforms. It is hoped that by generating new memories, i.e. new content, ELVIS can help different generation to connect.



[22] 香港可持續發展研究中心 （2014），《香港跨代關係之研究報告》：探討流動通訊科技對青年人與祖父母關係之原因及影響

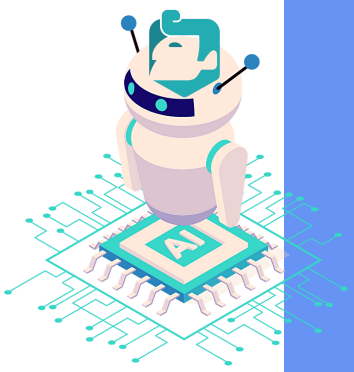
[23] Hong Kong Federation of Youth Groups. (2019). Strengthening Intergenerational Understanding. https://yrc.hkfyg.org.hk/en/2019/12/10/strengthening-intergenerational-understanding-2/

AI USED IN ELVIS

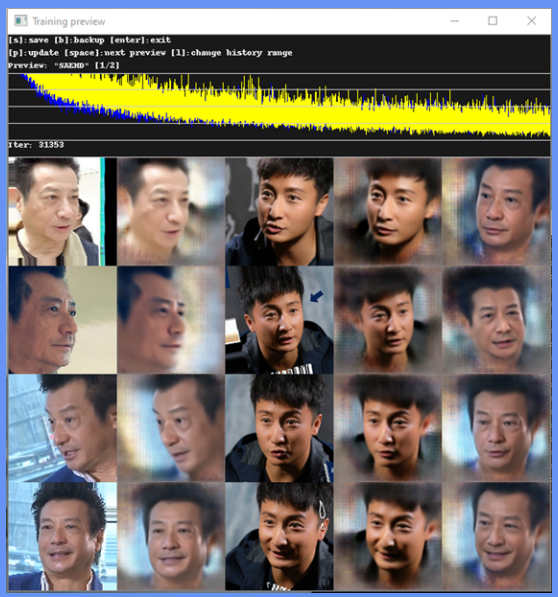
2. Deepfake Face Synthesis

Deepfake has long been accused of its negative effects to the society. [24] As a result, many digital outlets tend to condemn the use of this technology.

The project team however believes that using this technique properly could again generate new content for communication. Consider Animoji that recently introduced by Apple, as well as other face tracking stickers and the game Talking Tom in which a fat would imitate user's motions and gestures, this technology in fact shares the same backend technology as deepfake. They are all very successful in their own field as they have explicitly told their users that these Animoji, stickers, and the cat are not real.



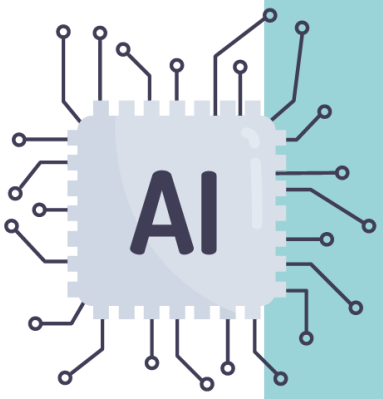
In ELVIS, the project team shares the same idea that users are explicitly known about the fact that the synthesized face is fake. After all, they are all family members and thus would definitely identify who the user at the other end us. The project team hopes to use deepfake face synthesis as yet another tool to help generations break their ice virtually.



[24] Guardian. (2020, January 13). What are deepfakes – and how can you spot them? the Guardian. https://www.theguardian.com/technology/2020/jan/13/what-are-deepfakes-and-how-can-you-spot-them

Advantages

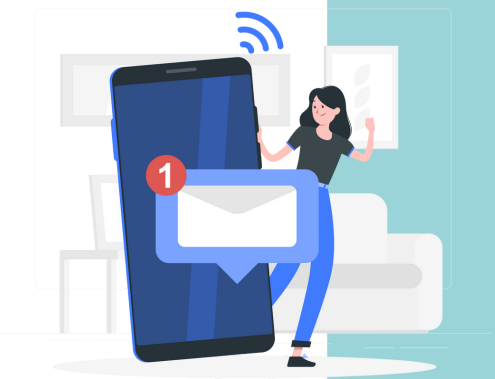
1.RECONNECTION OF PAST MEMORY



Collective memory is the root of a family. It is unfortunate that for people who have emigrated, this memory, usually in the form of family album, is not easily accessible due to physical barrier. As a result, ELVIS provides a unique digital platform for family members to create photo album enhanced by AI functionality.

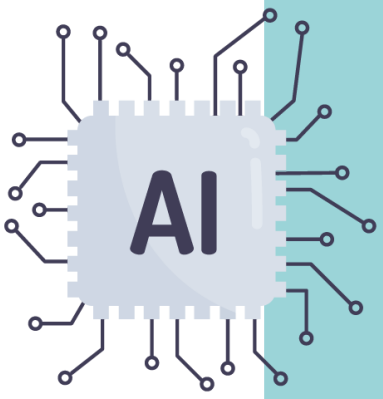
Tools:

- **Content sharing** (post photos to family posts): Elderly can see the latest situation of the young people, and vice versa.
- **Add image effect to random photo** (example: Images people get younger): Make the pictures look more interesting.
- **Image colorization and restoration**



Advantages

2.EASE OF PHYSICAL BARRIER



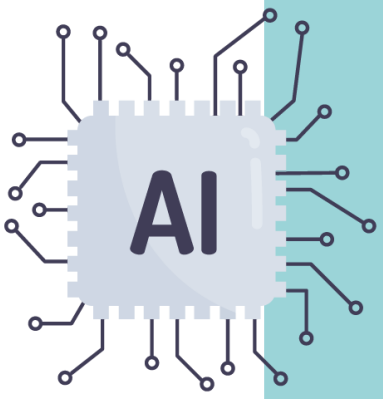
As suggested by research by HKFYG mentioned earlier, there is not enough contact between the elderly and the young. Therefore, ELVIS is an application that establish contact with each other through memory. In this way, users can have the same communication topic.

Tools:

- **Video call** (example: call grandma): Elderly can see the latest situation of the young people, and vice versa.
- **Randomly post images** (example: Feel free to post some photos of Christmas party in the family post.): It is an effective way for families to revisit the past.
- **Gamification** (example: Name-tagging game): Let children know more about their parent's past.

Advantages

3.EMOTIONAL SUPPORT FROM FAMILY MEMBERS



When the elderly lives alone, they might face different problems that they cannot solve by themselves. For example, there might be situation that they are not able to switch on the electric cooker. Therefore, ELVIS aims to provide remote family support when family members do not live near the elderly.

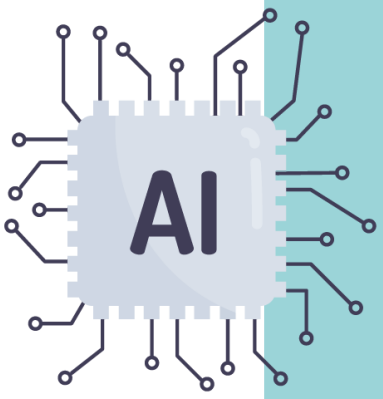
Tools

- **Drop in Video Call** (example:Help grandma to connect the rice cooker by drawing AR notation on screen real time): Elderly solves the problem with the help of the.

- **AI emotional detection** (example: Through the photos, AI found that the old man was emotionally unstable during this period.): Send a notice to the family members to make them take this problem seriously.

Advantages

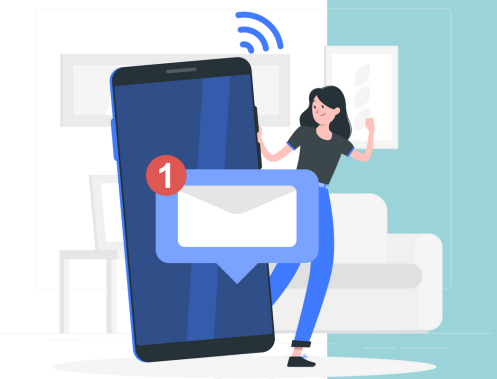
4.INHERITANCE OF ELDERLY/TRADITIONAL WISDOM



In many cases, elders are treasures –"家有一老如有一寶"– there are many traditional know-hows that elders can teach their children. It is unfortunate that due to physical barriers, it is not easy for them to learn them because of the distance between the elderly. Therefore, the application needs to provide a function to solve the problem.

Tools

- **Recipe template** (example: elderly use templates to share the practice of "青紅蘿蔔煲豬展" with immigrant family members): Family members can learn cooking skills of family recipes more easily.



Advantages

5.IMPROVEMENT IN NGO RESOURCES ALLOCATION (FUTURE EXTENSION)

The data collected by the ELVIS app shall help NGOs to have better resources allocation on elderly services.

With the ELIVS app, caretakers could easily gather data concerning elderly of the neighborhood, with an aim to enhanced community connection as well as to provide customized services for the elderly.

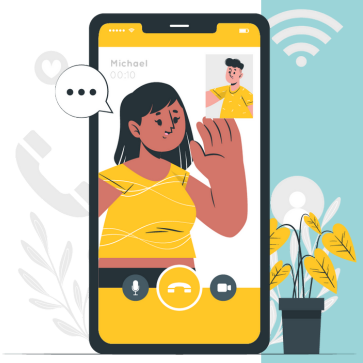
For instance, the app could put several elderlies into category (e.g., sporty) by analyzing the photos uploaded by them.

With such data, NGOs could organize a particular type of events and activities more often by targeting certain groups as suggested by the AI. It is expected that this could also lead to better resources management and allocation.

Drawbacks

1. Restricted By Price
Users need to have their own personal electronic device (cell phone) when using the ELVIS app. However, due to the price of mobile phones, elderly may not buy them.

Solution:
Partner with non-governmental organizations (NGOs) : Attracting elderly with subsidy



2. Restricted By education level
Due to the low level of education, the elderly does not know how to use mobile phones and applications.

Solution:

- provide user guides in video format: clearly introduce the functions in the application
- perform role play in the video: easy to master the use of the application.

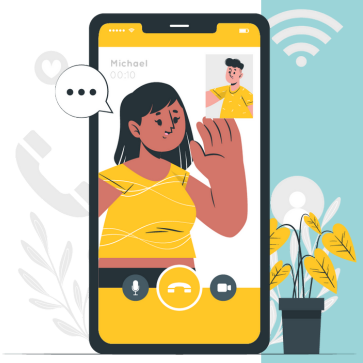
Drawbacks

3. Restricted By Social Circle

The App is forming a family group. If one has no children, their use of application will be reduced.

Solution:

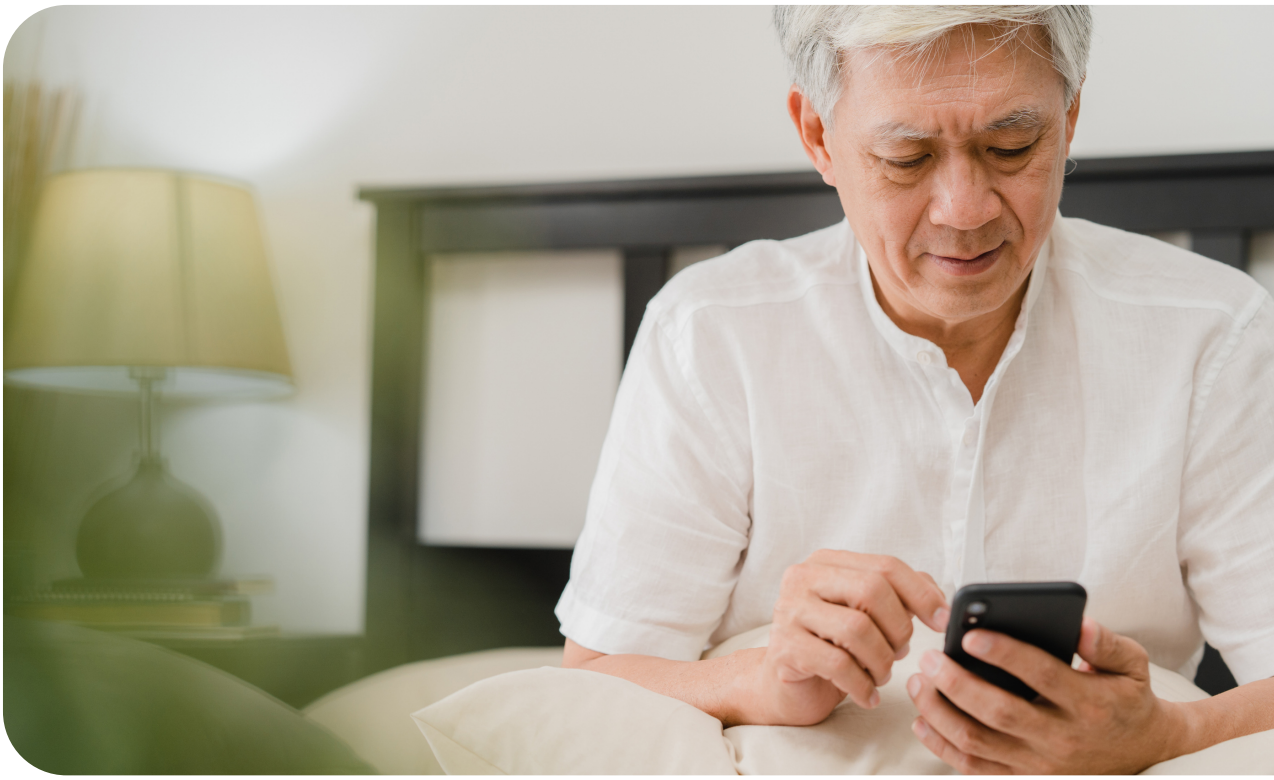
- chat with NGO social workers and volunteers: Reduce the loneliness of the elderly
- face synthesis function: protect their privacy and let them through safety



Functional Requirements

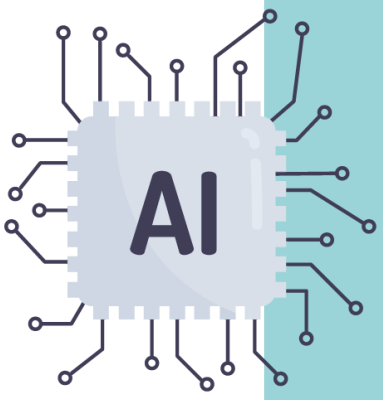
There shall be four crucial functions for the proposed ELVIS app, namely:

1. Smart Album with Photo Retouching,
2. Photos sharing with AI-enabled analysis,
3. Video conferencing with advanced functions, and
4. Web-based Application for NGOs



Functional Requirements

1. SMART ALBUM WITH PHOTO RETOUCHING



The system will

- store a variety of file formats including JPG, TIFF, PNG
- allow users to delete unnecessary photos right away
- allow users to organize photos into albums or folder
- allow users to edit photos as needed
- allow users to download and back up photos
- display the photos in group automatically
- allow users to restore the damaged photos by AI technologies
- allow users to colorize the monochrome photos by AI technologies
- contains face detection to identify the members of family

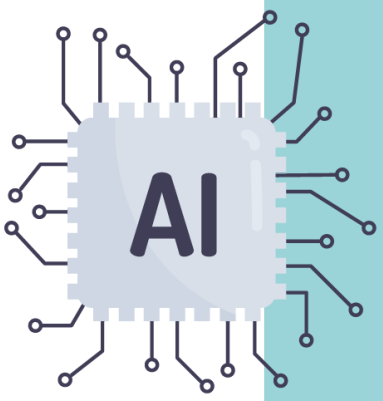
Functional Requirements

2. PHOTOS SHARING WITH AI-ENABLED ANALYSIS

The system will

- allow users to upload his photos as a post.

- allow users to add captions.



- analyze the content (photos and captions) with AI technology.

- generate results based on the analysis of AI. The results could be but limited to health status, activity, behaviour and emotion.

- store the results and related data on the cloud server.

- put hashtags or stickers on post according to AI analysis.

- push notifications to family members or close friends.

Functional Requirements

3. VIDEO CONFERENCING WITH ADVANCED FUNCTIONS

The system will

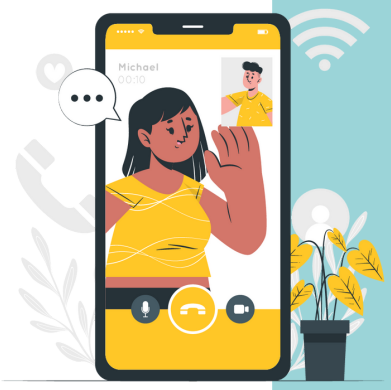
- contain a scrollable contact list for video call.

- allow users to make ordinary video call.

- allow users to choose front-facing or rear-facing camera during video streaming.

- allow the users impose digital content such as images, text over video calls.

- display a button for drop-in call



Functional Requirements

4. WEB-BASED APPLICATION FOR NGOS [FUTURE EXTENSION]

- The system will record different information, such as login time, details of photo posted, and sentiment information etc.

- NGOs staff can login the report system via web-based application.

- NGOs staff can filter information of report by specifying attribute.

- The system can generate report and export in csv, Excel format.

- The system will popup alert message if level of negative sentiment is alarming in past weeks.

- The system will allow NGOs staff to post notice according to AI suggestions

- Display a button which allows user to enable Face synthesis function.

Non-Functional Requirements

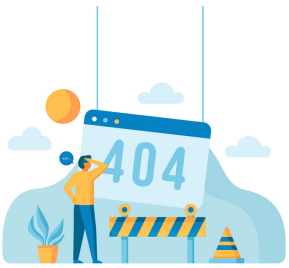
1. SECURITY REQUIREMENTS

Regarding security, the following requirements should be achieved:

- Physical security
  - Within the workplace, physical security should be strengthened. Physical security is an outer protection to prevent hacker access inner systems. All servers should be set up in a privacy server room. In addition, the server room should be locked, and only certain staff members should be allowed to enter.

- Network security
  - To protect hacker attack from network, firewalls should be used. It protects network system from denial-of-service attack (DoS). Also, the organization's network should have an access control lists. It means that only authorized staff can access the network system.

- Application security
  - In the ELVIS application, users have many different roles. For example, elderly, family member, NGO. They all have their specific account, so set up a password policy can enhance security level comprehensively.



Non-Functional Requirements

2. BACKUP AND RECOVERY

Concerning the types of backups, full back up pluses differential backup should be used in this situation.

This technique is more efficiency when backing up the data, and it requires less time than incremental backup when restoring the data.

On Monday, it would implement full backup for all data. On Tuesday to Sunday, the system will back up the data that has been changed since the last full backup.

All data will be saved in external drives. It helps to protect user's personal information and business asset.

Non-Functional Requirements

3. AVAILABILITY

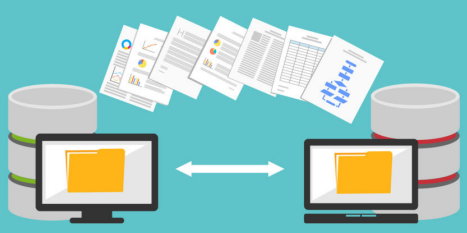
Availability can be measured by

Availability = uptime / (uptime + downtime) * 100%.

Uptime is the duration that users can use the system. All the ELVIS system included webpage and application would be 99% availability.

99% availability is calculated based on running 24/7(24 hours 7 days) per month and minus the half day for maintenance.

Therefore, all systems run full time except maintenance. Although the target is to maintain 99% availability, there may be some unplanned factors like attack on website and hardware and software failures. This risk can be handled by backup and recovery solution.



Non-Functional Requirements

4. PERFORMANCE REQUIREMENTS

A superior performance can improve the expectation of customers.

In the same way, high performance can increase the employee productivity.

According to the website Speedysite, it is reported that the average page load time on mobile is 11.4 seconds, average number of resources is 70 requests, and average server delay is 2.59 seconds. [25]

There Project team set below standard:

- Page load time < 11 seconds
- Average number of resources maintains between 70 to 75 requests
- Average server delay < 2.5 seconds

[25] Speedy. (2019, December 15). Average page load times for 2020 - Are you faster? - Speedy.Site Wordpress speed optimization service guaranteed. Speedy.Site Wordpress Speed Optimization Service Guaranteed. https://speedy.site/average-page-load-times-for-2020/

Non-Functional Requirements

5. USABILITY

The ELVIS Application should be viewable on various electronic devices such as mobile phone and tablet.

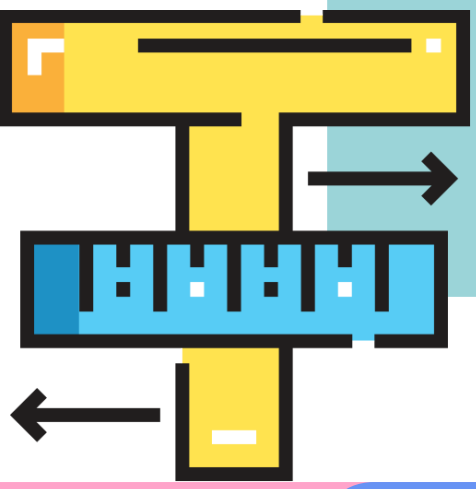
Also, the application should be user friendly.

The bottom navigation of the application should include all the functions, it helps user to understand all the functions we have.

Extra larger font style and graphic should be used in application, it boosts elderly 's user experience.

A simple user tutorial should be run once the application starts.

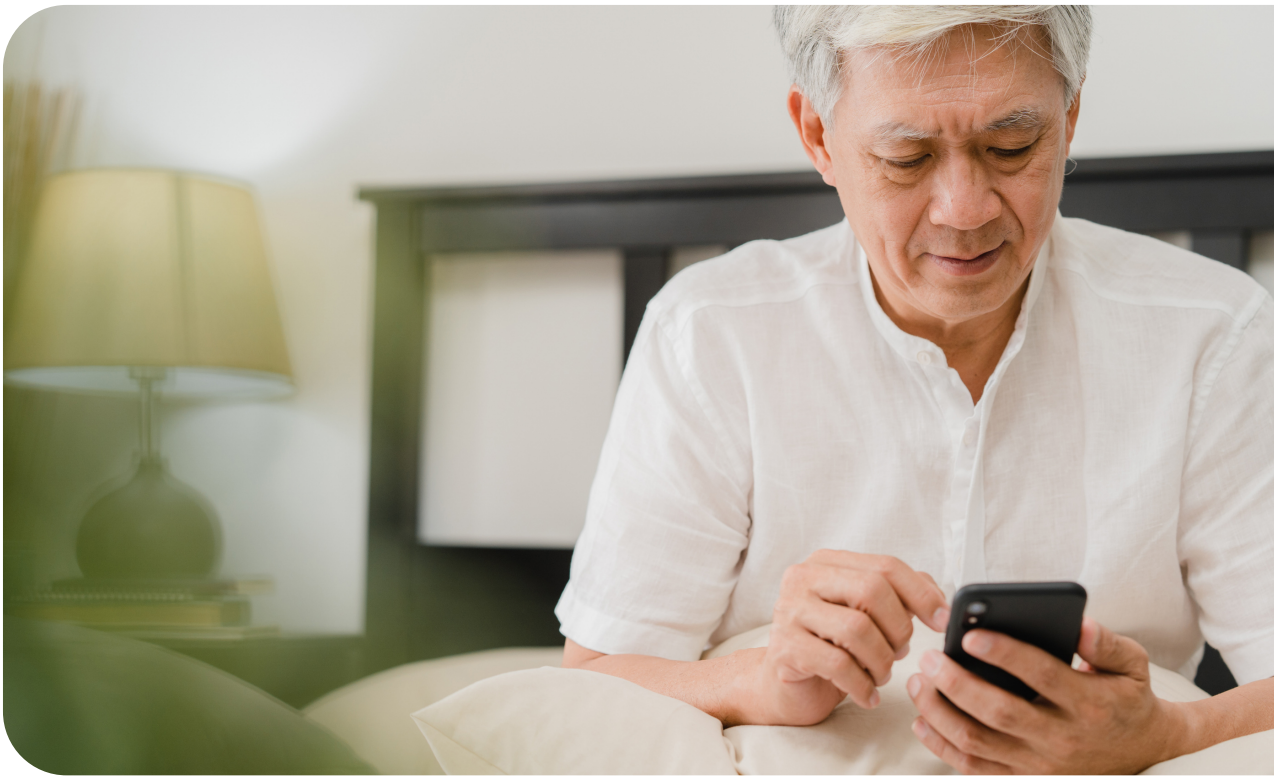
The tutorial should cover all the essential function in the applicaion.



Documentation for problem analysis

In this section, the following will be covered:

1. Use Case Descriptions and Use Case Diagrams,
2. Class Diagram,
3. State Machine Diagram, and
4. Sequence Diagrams



Use case: Family Connect

MAJOR ACTORS

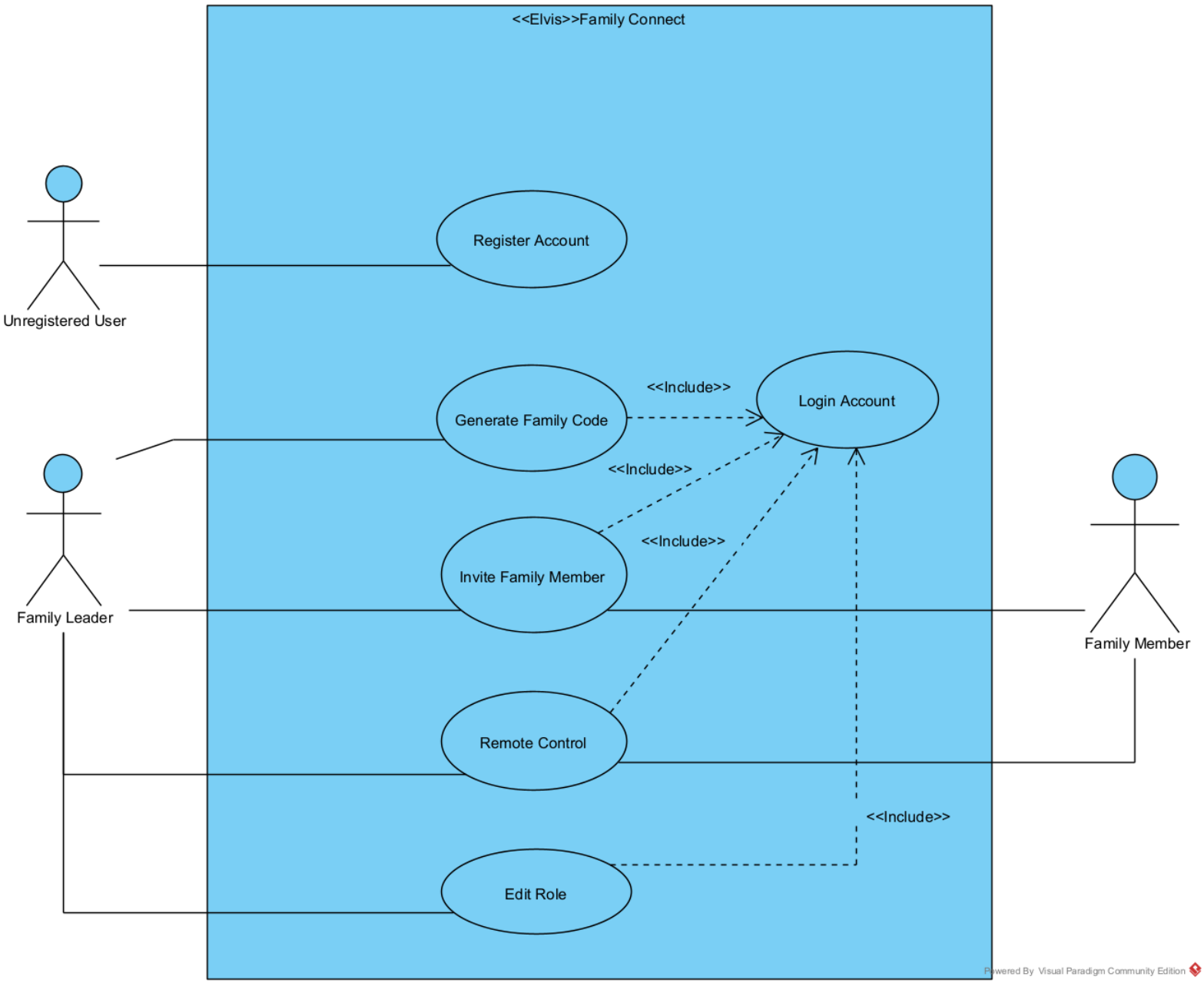
Actor Specification
Actor name: Unregistered User
Description: Unregistered User is the first-time user of the system. This type of user needs to finish the register process to activate the functions in the application. After registration user can either be family leader or family member

Actor Specification
Actor name: Family Leader
Description: Family Leader who has been registered an account. Family Leader is responsible to be the admin of a group of family. For example, he can edit the role of family member and invite family member to join the group.

Actor Specification
Actor name: Family Member
Description: Family Member who is invited by the family leader through invite link or family code. The specific role is assigned by family leader such as mom, grandmother etc. Also, this role can use most of the functions in the application.

Use case: Family Connect

USE CASE DIAGRAM



Use case: Family Connect

USE CASE DESCRIPTION

Use case name:	Register Account
Use case ID:	UC-100
Primary Actor:	Unregistered User
Secondary Actor:	
Brief description:	Before using the functions in application, user must have a valid account. There are some information users needed to provide during the register account progress such as name, sex, and age.
Precondition:	The user does not have a valid account
Flow of events:	1. Unregistered User click "Register account" 2. User input valid phone number and sex. System sends a passcode to user through SMS. 3. User input the passcode. 4. System shows register success if the passcode is correct.
Postconditions:	System saves the new account information to database
Alternative flows and exception	If the passcode is wrong, user will head back to step 2, and input the phone number and sex again.

Use case name:	Generate Family Code
Use case ID:	UC-200
Primary Actor:	Family Leader
Secondary Actor:	
Brief description:	Before using the functions in application, user must have a valid account. The host of family can generate a specific family code and share it to other family members.
Precondition:	The user has a valid account
Flow of events:	1.<<include>>Login Account 2. User can go to "setting" and find "generate family code". 3. User clicks generate family code. 4. System returns a specific family code to the user.
Postconditions:	System saves the family code as a constant variable.
Alternative flows and exception	

Use case: Family Connect

USE CASE DESCRIPTION

Use case name:	Invite Family Member
Use case ID:	UC-300
Primary Actor:	Family Leader
Secondary Actor:	
Brief description:	Before using the functions in application, user must have a valid account. The host of family can send invitation link to others through different channel such as WhatsApp and WeChat
Precondition:	The user has a valid account
Flow of events:	1.<<include>>Login Account 2. User can go to "setting" and find "Invite Family Member". 3. User clicks "Invite Family Member". 4. System returns few methods to user to send invitation link such as WhatsApp and WeChat. 5. User chooses one of the methods. 6. System calls the API which is chose by user.
Postconditions:	
Alternative flows and exception	

Use case name:	Remote Upload
Use case ID:	UC-400
Primary Actor:	Family Leader
Secondary Actor:	
Brief description:	Before using the functions in application, user must have a valid account. The family leader can upload images for other family member opens the "need assist" functions
Precondition:	User's family group must have other family members, and the family members turn on the "need assist functions".
Flow of events:	1.<<include>>Login Account 1. User can go to "setting" and find "Remote Upload". 2. User click "Remote Upload". 3. System return a list of family member who can be remote upload 4. User chooses a family member 5. System gains the control of the selected family member in Elvis.

Use case: Family Connect

USE CASE DESCRIPTION

Use case name:	Edit Role
Use case ID:	UC-500
Primary Actor:	Family Leader
Secondary Actor:	
Brief description:	The family leader can assign different role to different his family member, also edit their role. Every role has its own permission. For example, children should have less permission in the system.
Precondition:	User's family group must have other family members.
Flow of events:	1.Login Account 2. User can go to "setting" and find "Edit Family". 3. User click "Edit Family". 4. System return a list of family member who can be edit 5. User chooses a family member and assign a new family role to the selected family member. 6. System updates the information.
Postconditions:	System saves the new family role in database.
Alternative flows and exception	

Use case name:	Login Account
Use case ID:	UC-600
Primary Actor:	Family Leader
Secondary Actor:	
Brief description:	The family leader need to login account to active various functions
Precondition:	The user created an account.
Flow of events:	1. User need to input his phone number 2 System validate the phone number and show login successful if the phone number is valid.
Postconditions:	
Alternative flows and exception	

Use case: Content Sharing

MAJOR ACTORS

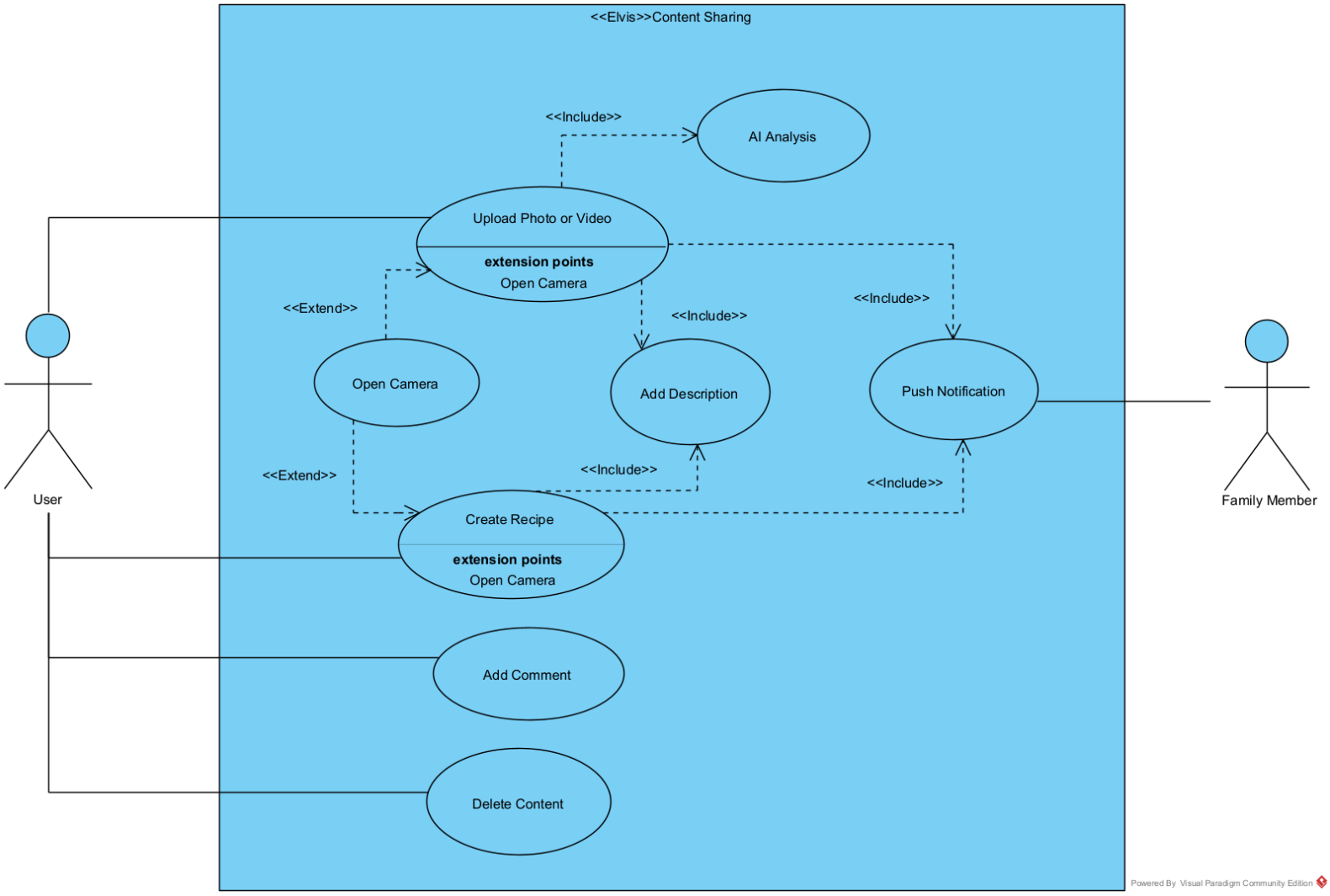
Actor Specification
Actor name: User
Description: User who has been registered an account. User can use most of the functions in the application.

Actor Specification
Actor name: Social Worker
Description: Social Worker can post elderly-related content or family related content that help to solve generation gap problem.

Actor Specification
Actor name: Family Member
Description: Family Member who is invited by the family leader through invite link or family code. The specific role is assigned by family leader such as mom, grandmother etc. Also, this role can use most of the functions in the application.

Use case: Content Sharing

USE CASE DIAGRAM



Use case: Content Sharing

USE CASE DESCRIPTION

Use case name:	Upload Photo or Video (content)
Use case ID:	UC2-100
Primary Actor:	User and Social Worker
Secondary Actor:	Family member
Brief description:	User can upload photo or video through their phone's album and phone's camera. After the user upload the content, user need to input some description about the content. If it is photo AI will analyse the content and predict the activity inside the photo. At the end, system push the notification to other family members
Precondition:	The user has a valid account
Flow of events:	1. User click the "upload content" button. 2. System opens the phone's album of the user. 3. User can either choose the content from his own album or open the camera to capture the live moment. 4. After user pick a content, system return a description page. 5.<<include>>Add Description 6. User click "post" at the end of the page. 7. System use computer vision to analyse the activity of the content, and push notification to other family members. 8. System share the content to other family members.
Postconditions:	System saves the content to database
Alternative flows and exception	In Step 3, user can open the camera to take picture or video. In Step 6, if the content is video, system will not analyse the activity of the content.

Use case: Content Sharing

USE CASE DESCRIPTION

Use case name:	Create Recipe
Use case ID:	UC2-200
Primary Actor:	User
Secondary Actor:	Family member
Brief description:	User can create recipe on a template by adding image through their phone's album and phone's camera. Then, user should add description on each image. At the end, system push the notification to other family members
Precondition:	The user has a valid account
Flow of events:	1. User click the "Recipe" button. 2. System returns some template to the user. 3. User select a template. 4. System returns a template with blanks 5. User add image inside the blank of the template 6.<<include>>Add Description 7. User click "Post" at the end of the page. 8. System push notification to other family members. 9. System share the content to other family members.
Postconditions:	System saves the content to database
Alternative flows and exception	In Step 3, user can open the camera to take picture or video.

Use case: Content Sharing

USE CASE DESCRIPTION

Use case name:	Add Comment
Use case ID:	UC2-300
Primary Actor:	User
Secondary Actor:	
Brief description:	User can add comment to the content including other family member's content and himself content.
Precondition:	There are content exists in the application.
Flow of events:	1. User view a specific content, and click the "comment" button 2. System returns an input cell to user 3. User use phone keyboard to leave some words or emojis. 4. User click "Enter". 5. System upload comment to specific content.
Postconditions:	System saves the comments to database
Alternative flows and exception	

Use case name:	Delete Content
Use case ID:	UC2-400
Primary Actor:	User
Secondary Actor:	
Brief description:	User can delete his content
Precondition:	User has posted content in the application
Flow of events:	1. User find his own content. 2. User click "Delete" button 3. System return a prompt "Are you sure to delete the content?" 4. User click "Yes". 5. System delete the content.
Postconditions:	System delete content from database
Alternative flows and exception	In Step 4, if user answer "No", the content will remain unchanged.

Use case: Content Sharing

USE CASE DESCRIPTION

Use case name:	Add Description
Use case ID:	UC2-500
Primary Actor:	User
Secondary Actor:	
Brief description:	User can add descriptions in their content including the recipe, photo, and video
Precondition:	Users need to post content to active this function.
Flow of events:	1. System return a description page to user. 2. User input the description. 3. System saves the description with the content.
Postconditions:	
Alternative flows and exception	

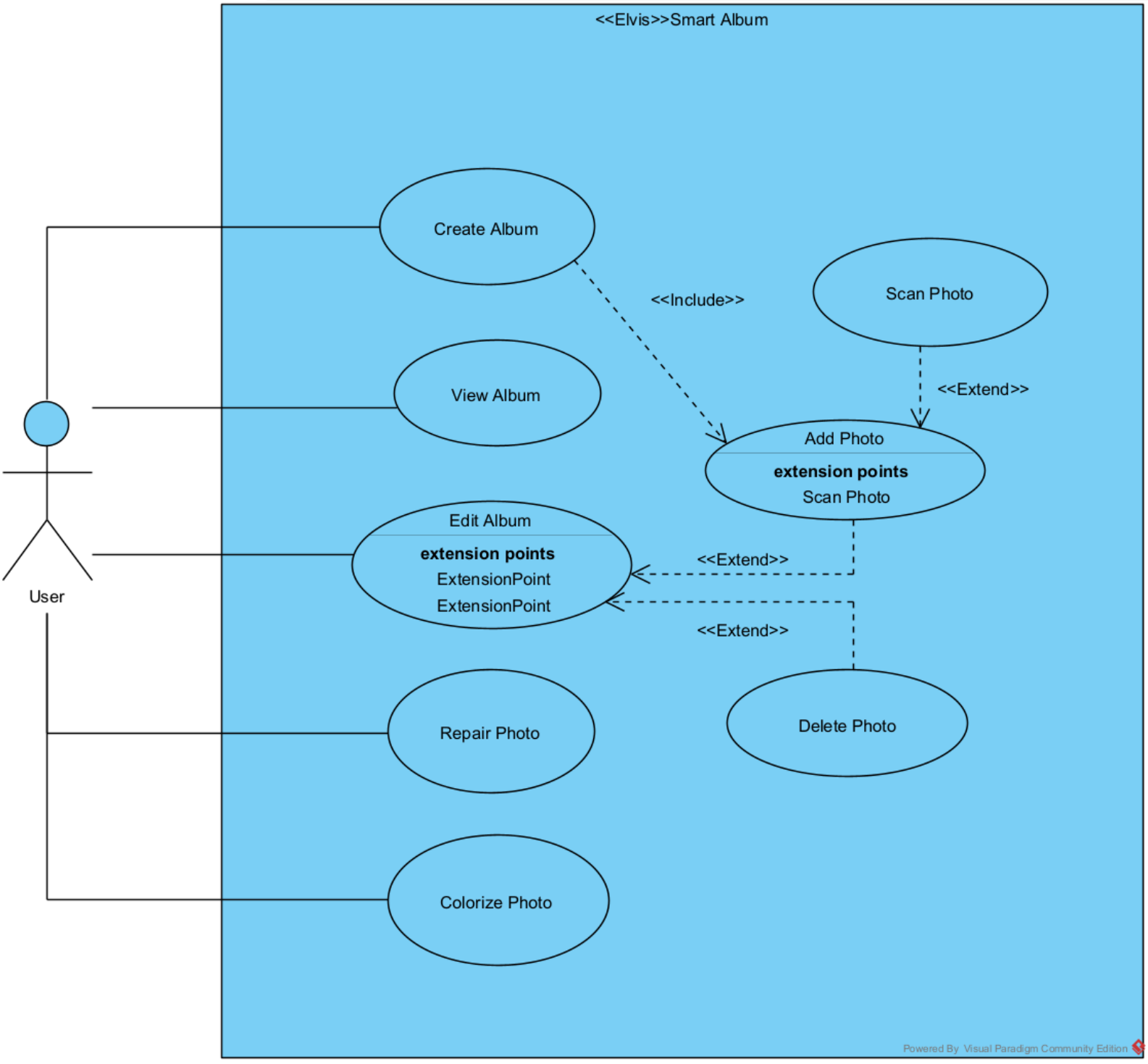
Use case: Smart Album

MAJOR ACTORS

Actor Specification
Actor name: User
Description: User who has been registered an account. User can use most of the functions in the application.

Use case: Smart Album

USE CASE DIAGRAM



Use case: Smart Album

USE CASE DESCRIPTION

Use case name:	Create Album
Use case ID:	UC3-100
Primary Actor:	User
Secondary Actor:	
Brief description:	User can create album to store multiple images and video.
Precondition:	User has a valid account.
Flow of events:	1. User navigate to album page and select “create album”. 2. System return an album description page. 3. User input details of the album and click “OK”. 4. <<include>> Add Photo 5.User clicks “Confirm” to finish the process of photo selection. 6. System creates an album with selected photo.
Postconditions:	System delete content from database
Alternative flows and exception	In Step 4, if user answer “No”, the content will remain unchanged.

Use case name:	View Album
Use case ID:	UC3-200
Primary Actor:	User
Secondary Actor:	
Brief description:	User can read photos in album
Precondition:	There is an album is created
Flow of events:	1. User navigate to album page. 2. Systems show all the created album 3. User select one album 4. System shows the photos in the selected album
Postconditions:	
Alternative flows and exception	

Use case: Smart Album

USE CASE DESCRIPTION

Use case name:	Edit Album
Use case ID:	UC3-300
Primary Actor:	User
Secondary Actor:	
Brief description:	User can edit the information of album. Also, it is possible to add or delete photo inside the album.
Precondition:	There is an album is created
Flow of events:	1. User navigate to album page. 2. System shows all the created album 3. User select one album 4. System open the selected album 5. User click “edit” 6. User can add image to the album by pressing the “+” symbol. 7. <<include>>Add Photo 8. User clicks “Confirm” to finish the process of photo selection 9. System append the selected photos into album
Postconditions:	System delete content from database
Alternative flows and exception	In Step6, it is alternative to delete photo after pressing the edit button. The “x” symbol will be appeared on the top right corner of the photo. Once you click the “x” button, the photo will be deleted.

Use case: Smart Album

USE CASE DESCRIPTION

Use case name:	Repair Photo
Use case ID:	UC3-400
Primary Actor:	User
Secondary Actor:	
Brief description:	User can repair broken image by using this function. The AI will find the defect part of the image and repair it.
Precondition:	User must upload a photo to album to use this function.
Flow of events:	1. User navigate to album page. 2. System show all the created album. 3. User select one album 4.System shows the photos in the selected album. 5. User choose one of the photos in the album and activate the repair image function. 6. System will ask user whether save an original copy or not. 7. User answer yes. 8.System will return a repaired image and keep the original image.
Postconditions:	
Alternative flows and exception	In Step6, user can answer not to save original copy. Then, system will return a repaired photo and not keep the original copy.

Use case: Smart Album

USE CASE DESCRIPTION

Use case name:	Colorize photo
Use case ID:	UC3-500
Primary Actor:	User
Secondary Actor:	
Brief description:	User can colorize black and white image by using this function. The AI will add colour on the photo
Precondition:	User must upload a photo to album to use this function.
Flow of events:	1. User navigate to album page. 2. System show all the created album. 3. User select one album 4.System shows the photos in the selected album. 5. User choose one of the photos in the album and activate the colorize image function. 6. System will ask user whether save an original copy or not. 7. User answer yes. 8.System will return a colour image and keep the original image.
Postconditions:	In Step6, user can answer not to save original copy. Then, system will return a repaired photo and not keep the original copy.
Alternative flows and exception	In Step 4, if user answer "No", the content will remain unchanged.

Use case: Smart Album

USE CASE DESCRIPTION

Use case name:	Add Photo
Use case ID:	UC3-600
Primary Actor:	User
Secondary Actor:	
Brief description:	Use can add photo when creating or editing an album
Precondition:	In the progress of creating or editing an album
Flow of events:	1.User clicks add photo 2. System opens user's phone album 3. User selects photos from his phone' album 4.System add selected photos to album
Postconditions:	
Alternative flows and exception	

Use case: Video Call

MAJOR ACTORS

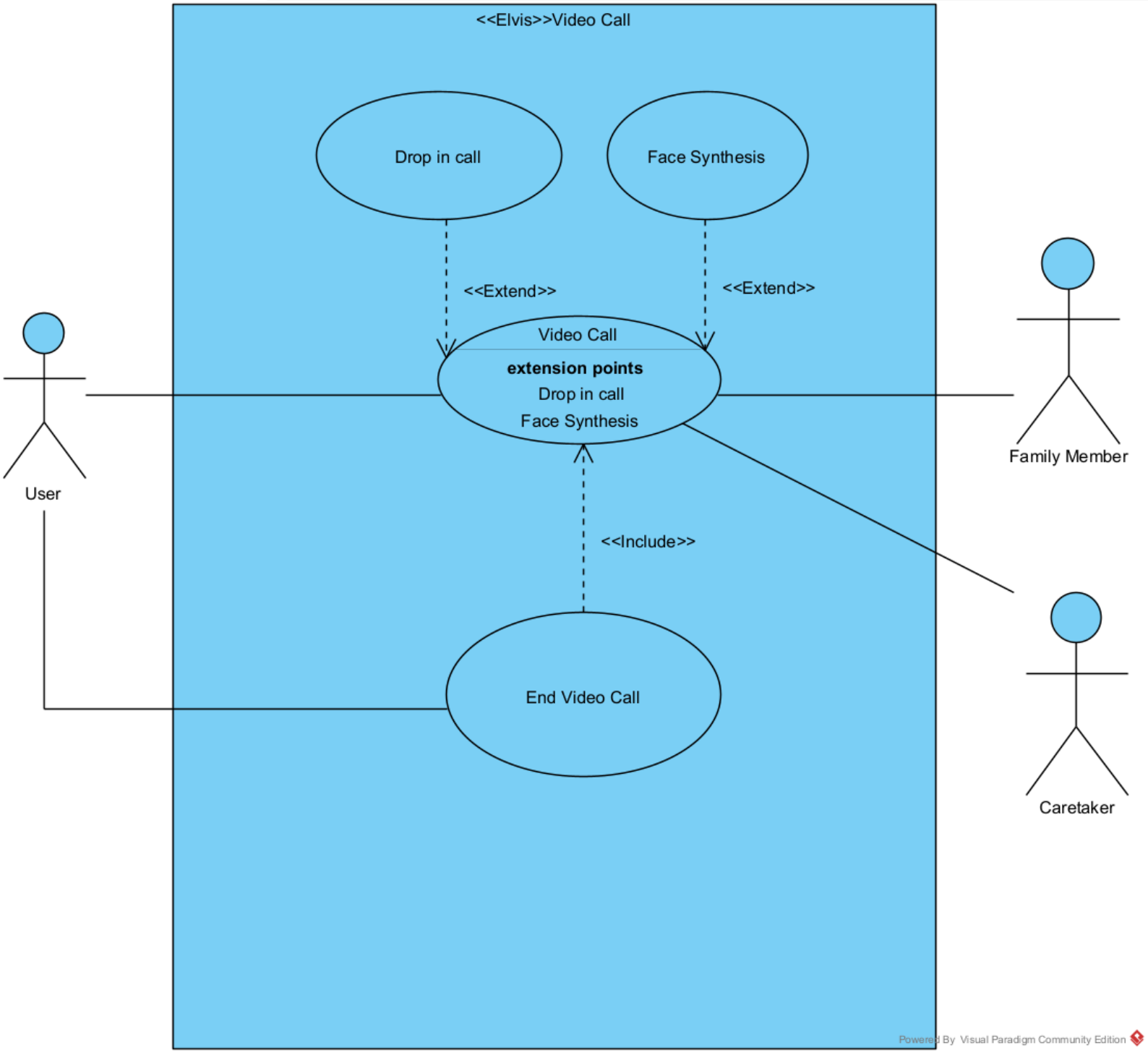
Actor Specification
Actor name: Unregistered User
Description: Unregistered User is the first-time user of the system. This type of user needs to finish the register process to activate the functions in the application. After registration user can either be family leader or family member

Actor Specification
Actor name: Family Leader
Description: Family Leader who has been registered an account. Family Leader is responsible to be the admin of a group of family. For example, he can edit the role of family member and invite family member to join the group.

Actor Specification
Actor name: Family Member
Description: Family Member who is invited by the family leader through invite link or family code. The specific role is assigned by family leader such as mom, grandmother etc. Also, this role can use most of the functions in the application.

Use case: Video Call

USE CASE DIAGRAM



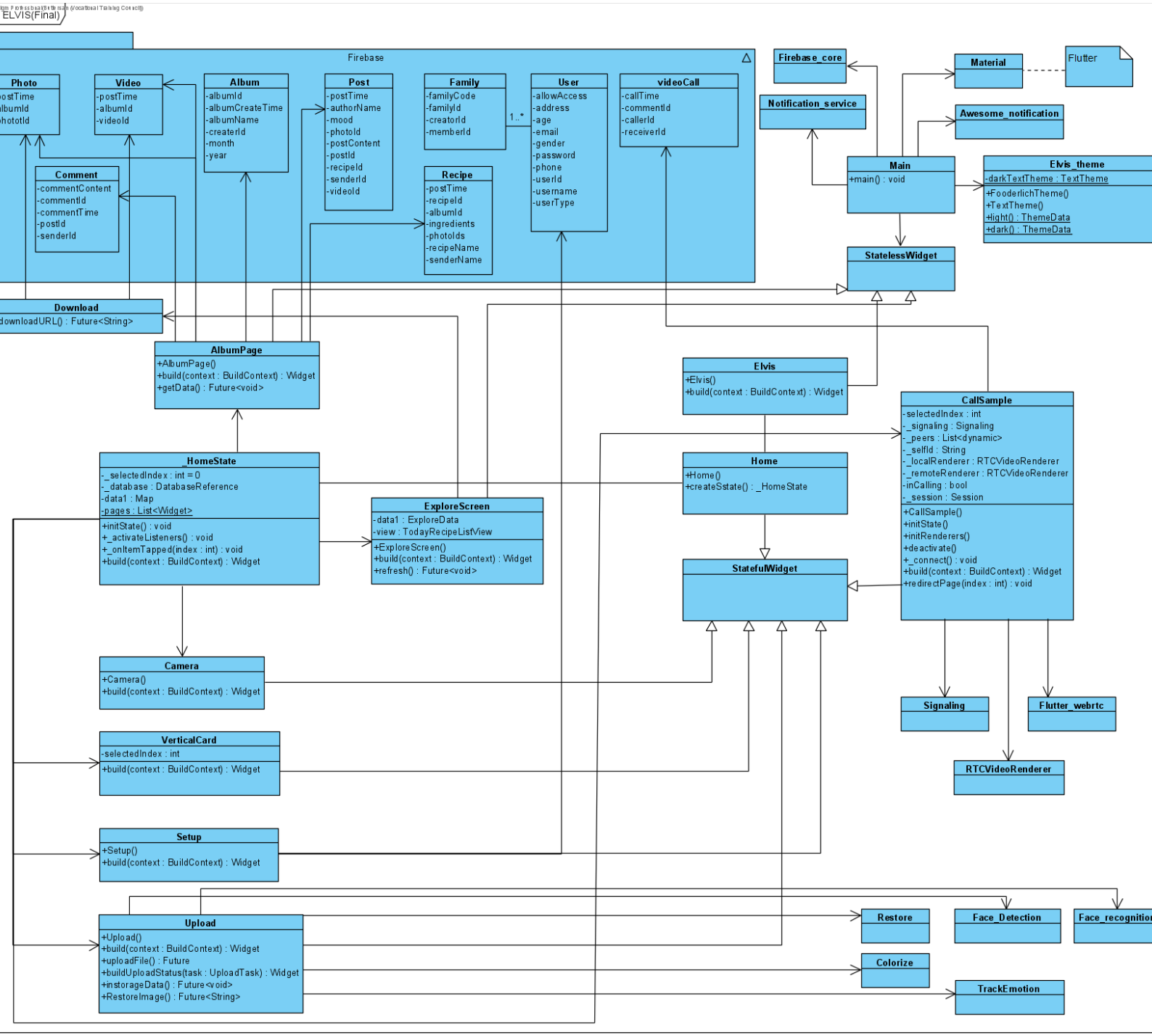
Use case: Video Call

USE CASE DESCRIPTION

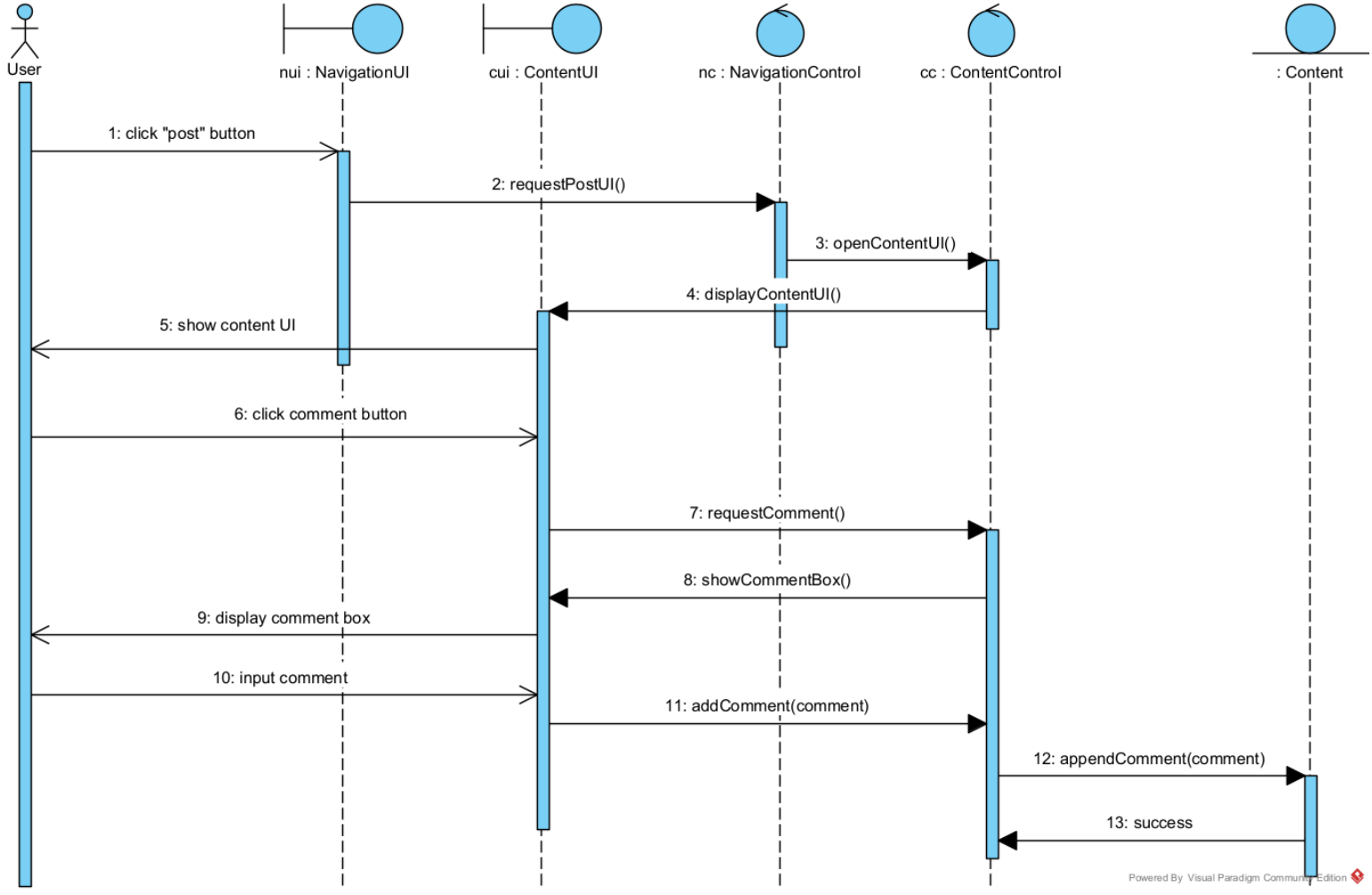
Use case name:	Video Call
Use case ID:	UC4-100
Primary Actor:	User
Secondary Actor:	Family member and caretaker
Brief description:	User can have video call with their family member.
Precondition:	User has a valid account.
Flow of events:	1. User navigate to video call page. 2. System return a list of family members. 3. User select one family member to call. 4. System helps user connect family member through video call until the family member accepts the call. 5. User can select a face and user face synthesis during the call. 6. System place AI face to user's whole face.
Postconditions:	
Alternative flows and exception	In Step 4, if the receiver (family member) has enabled the drop in call function, system will connect the call without accepting the call.

Use case name:	End Video Call
Use case ID:	UC4-200
Primary Actor:	User
Secondary Actor:	Family member and caretaker
Brief description:	User can end the video call whenever he wants.
Precondition:	User has video call connected with other family member
Flow of events:	1.<<include>>Video Call 2. User press the "decline" button. 3. System end the call immediately
Postconditions:	
Alternative flows and exception	

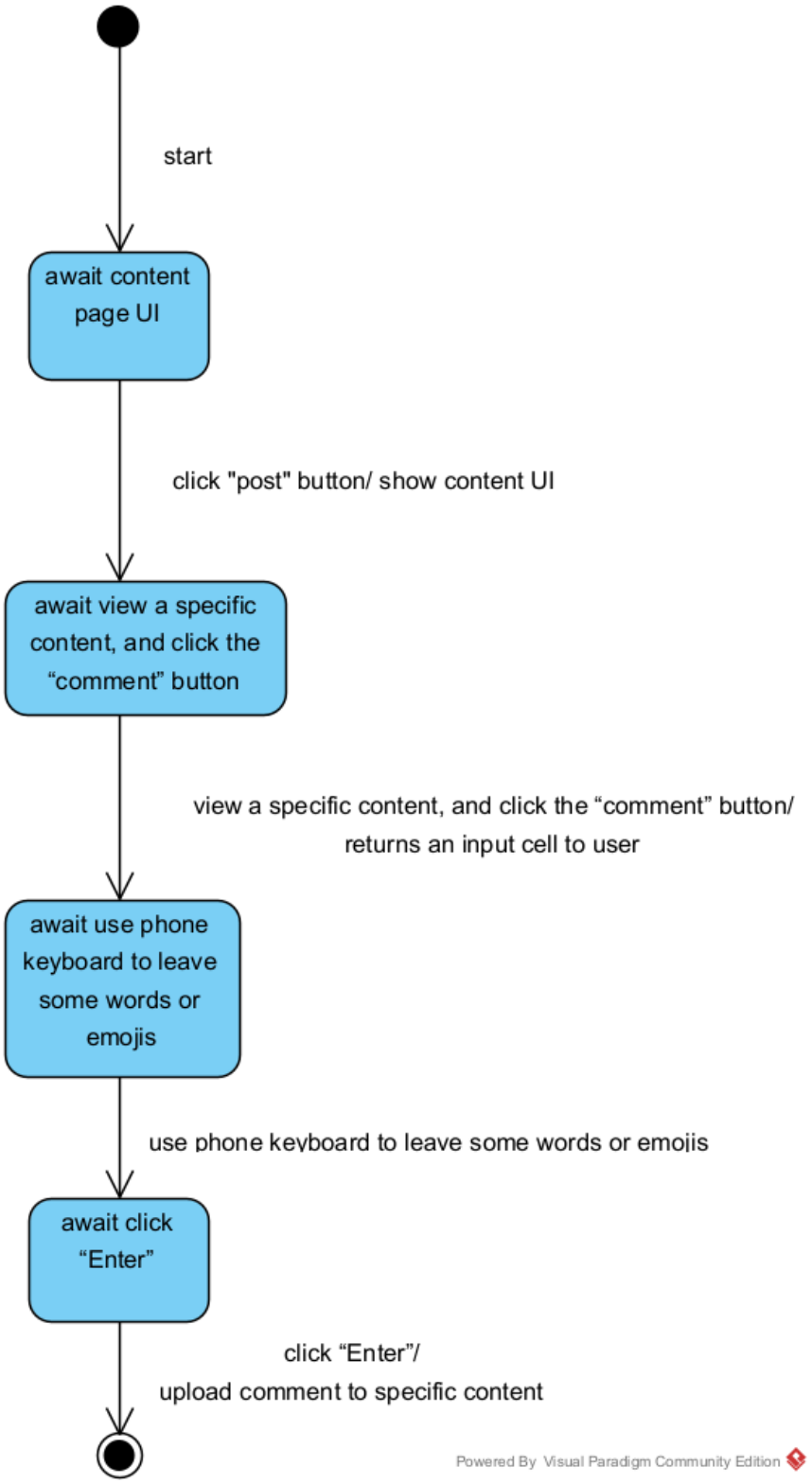
Class Diagram



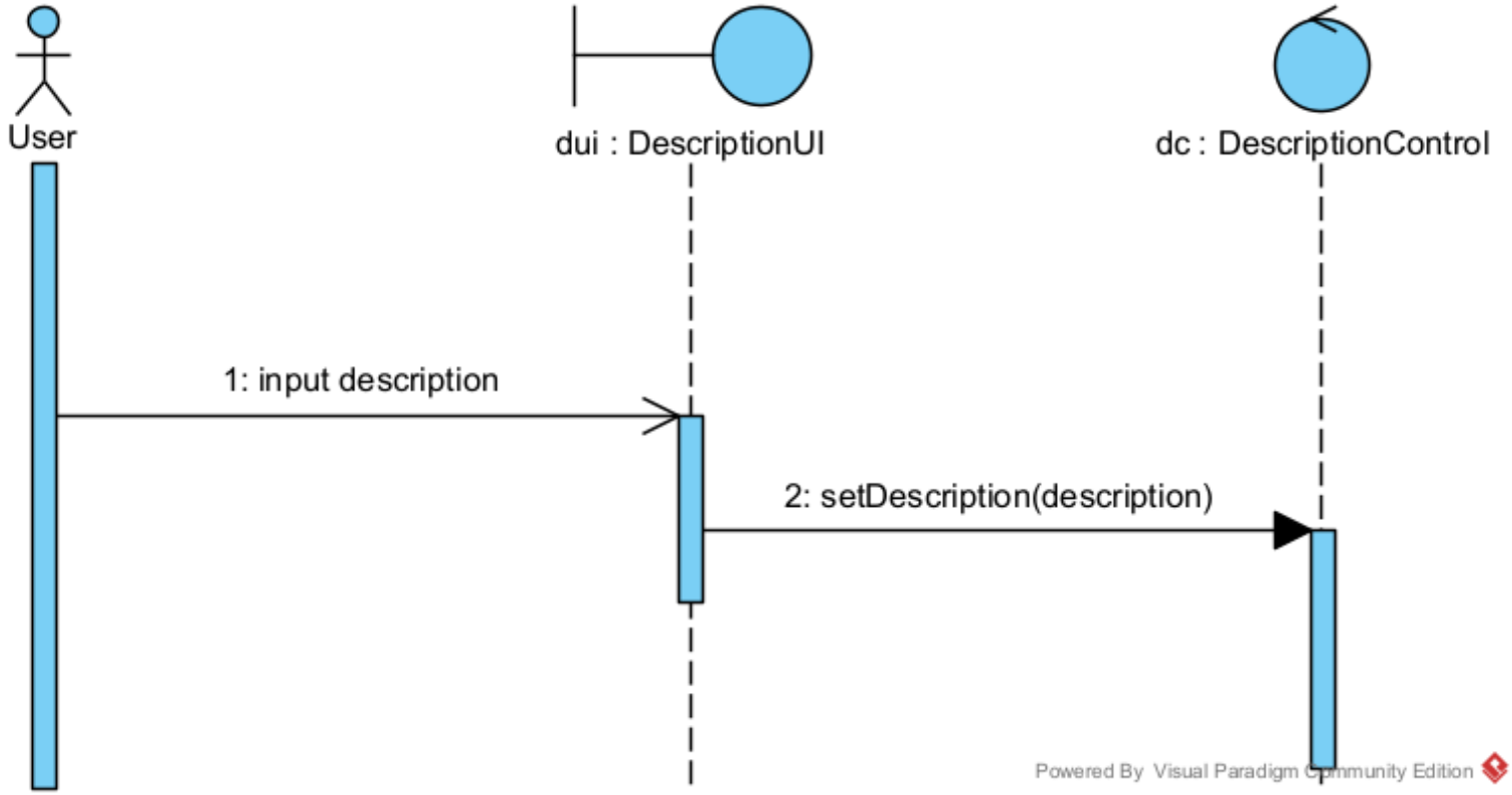
Sequence Diagram: Add Comment



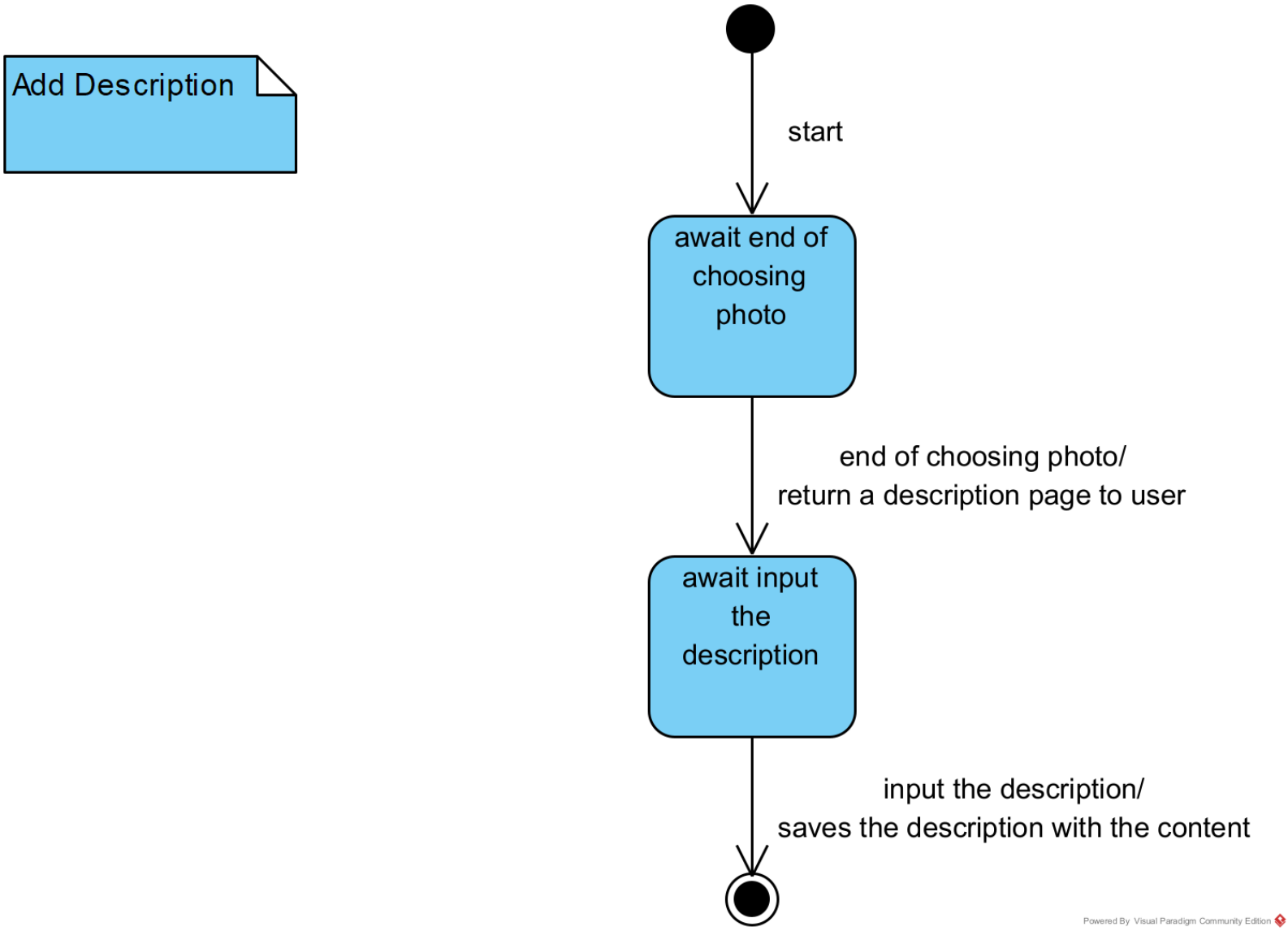
State Machine Diagram: Add Comment



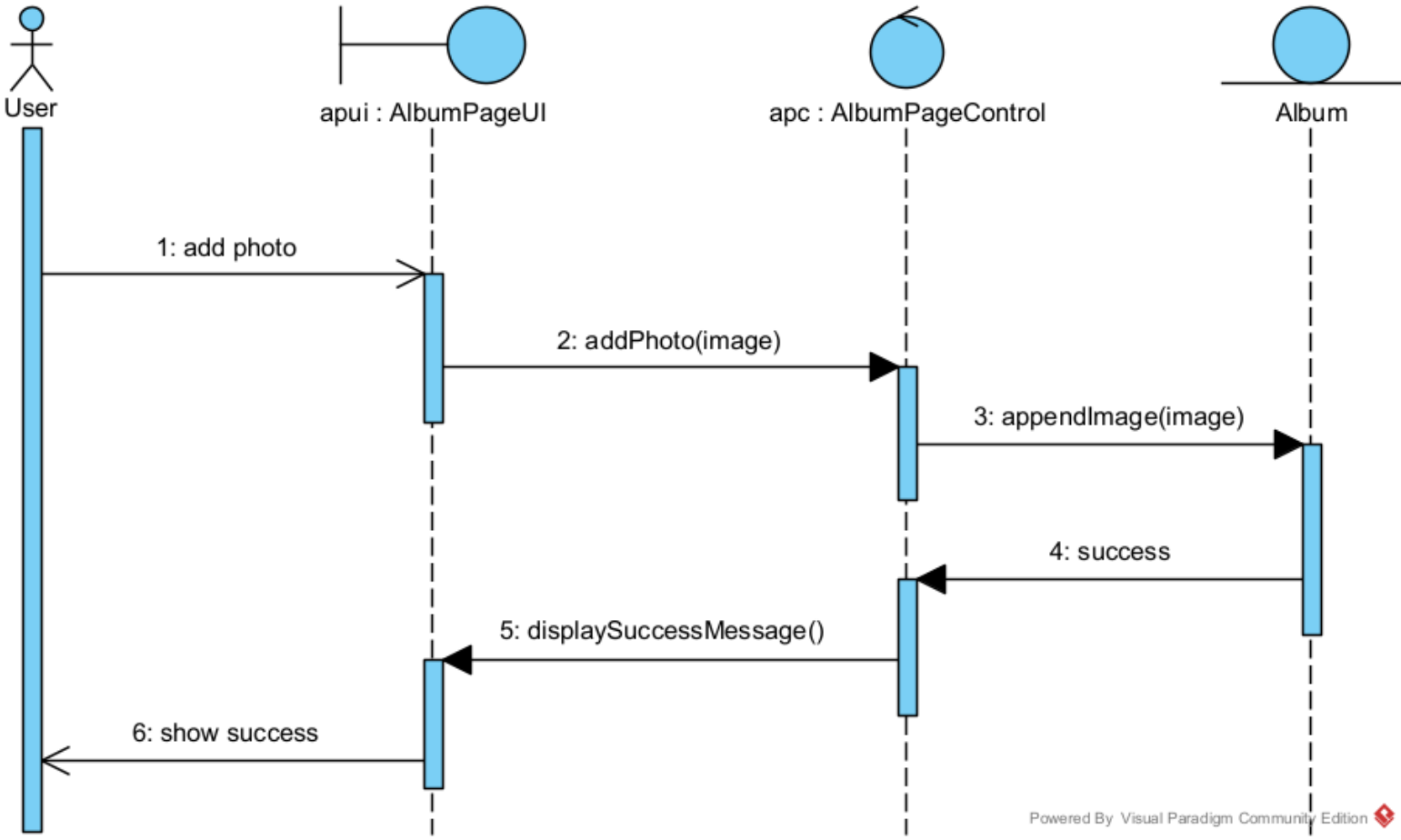
Sequence Diagram: Add Description



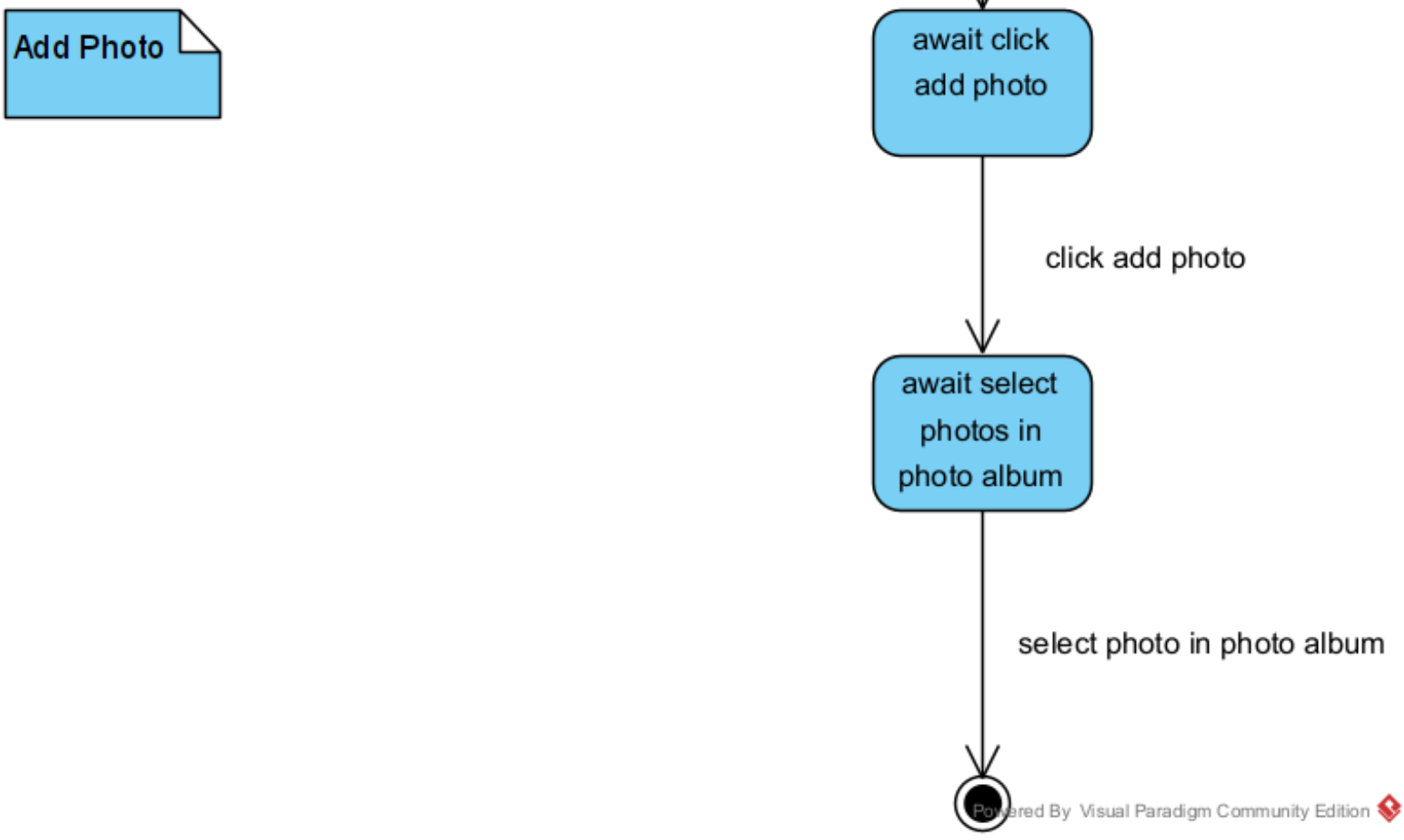
State Machine Diagram: Add Description



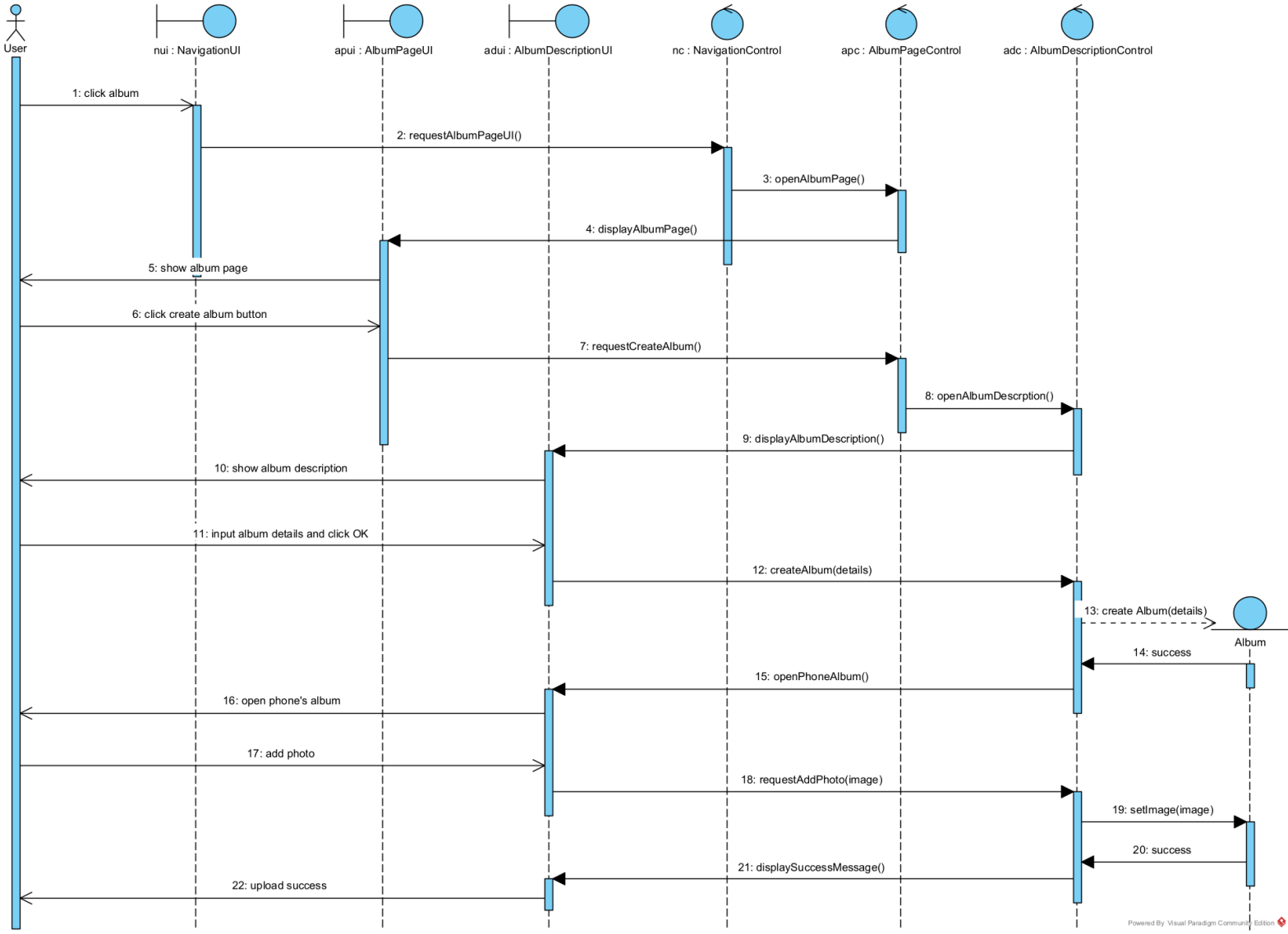
Sequence Diagram: Add Photo



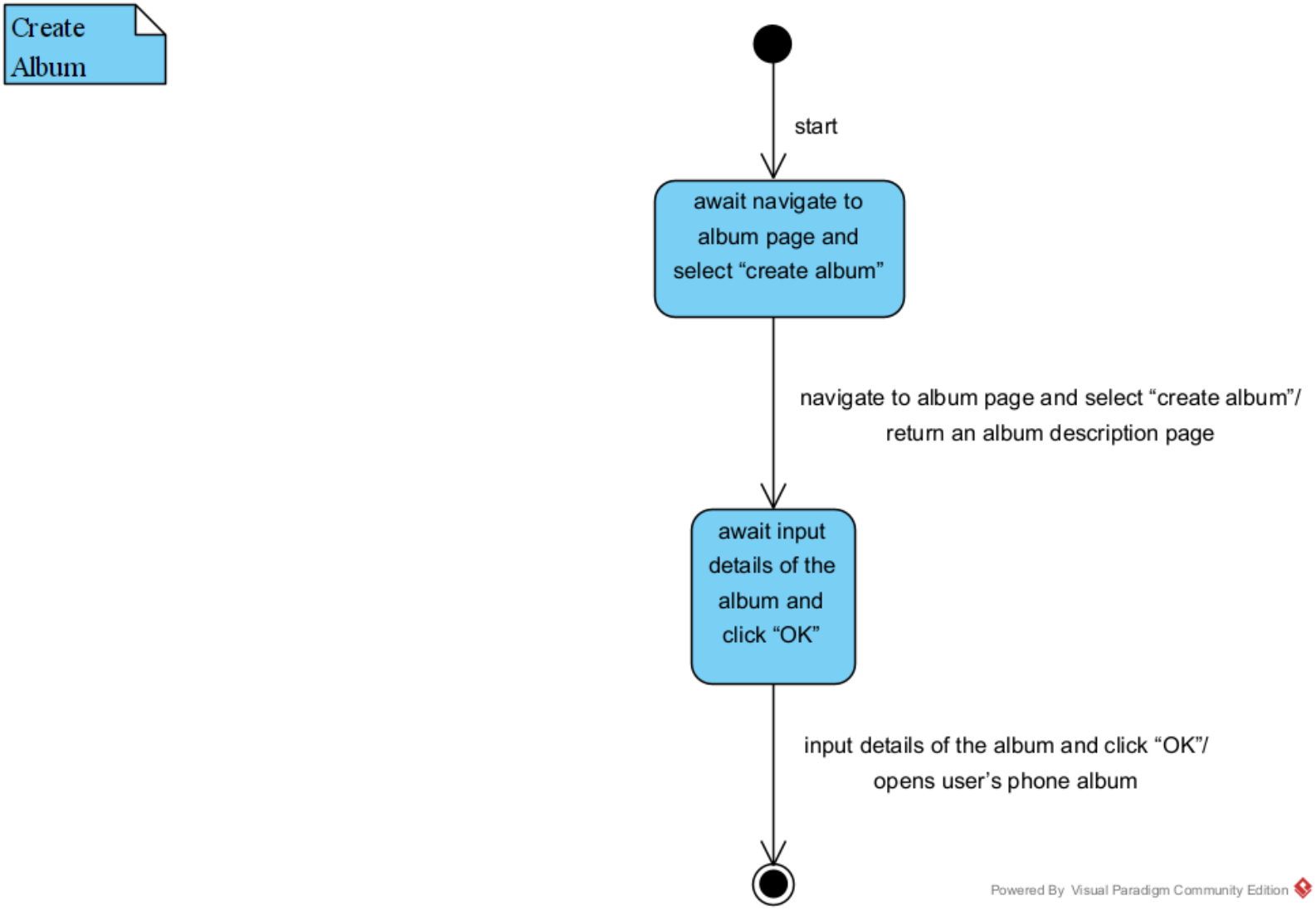
State Machine Diagram: Add Photo



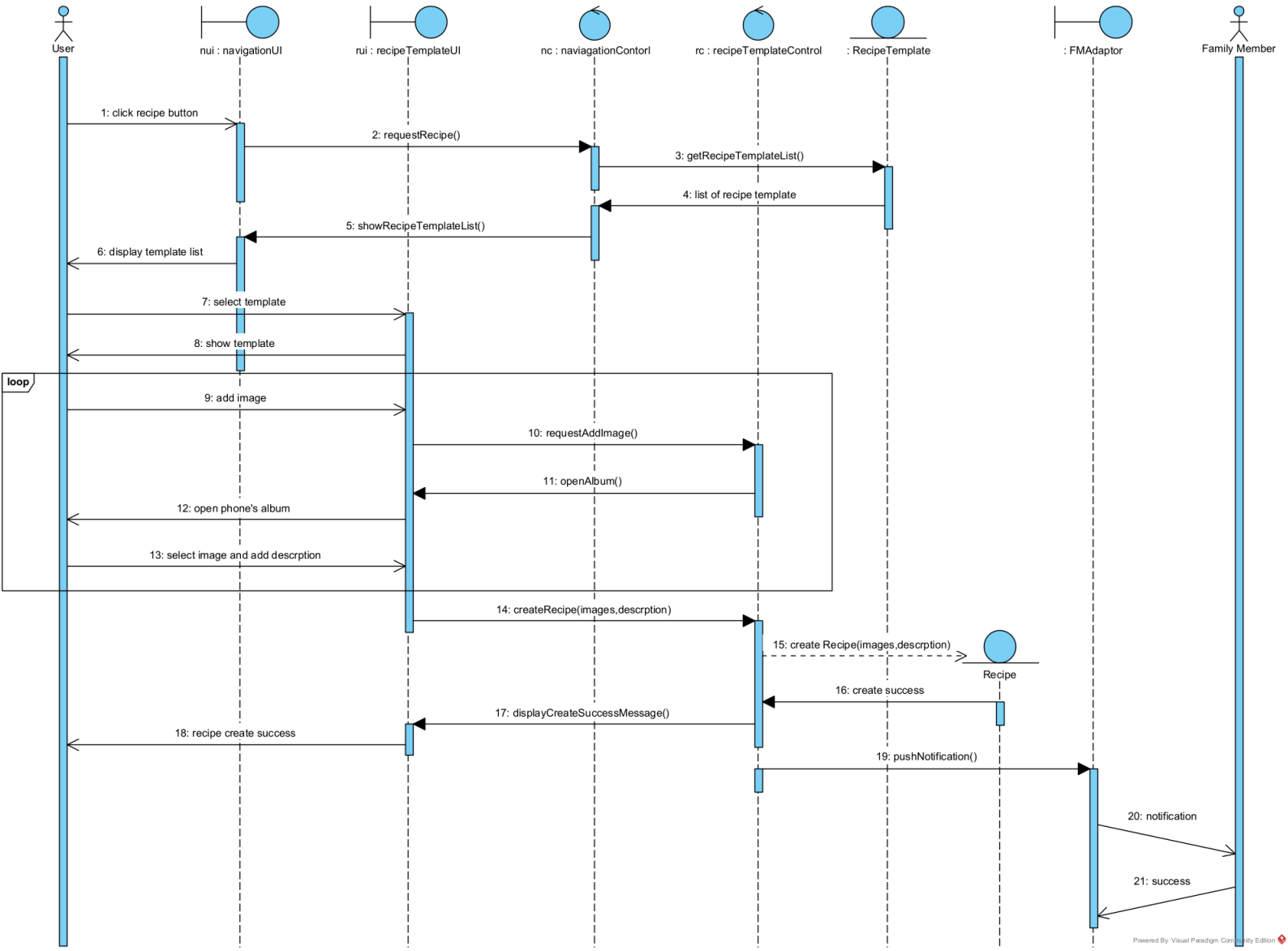
Sequence Diagram: Create Album



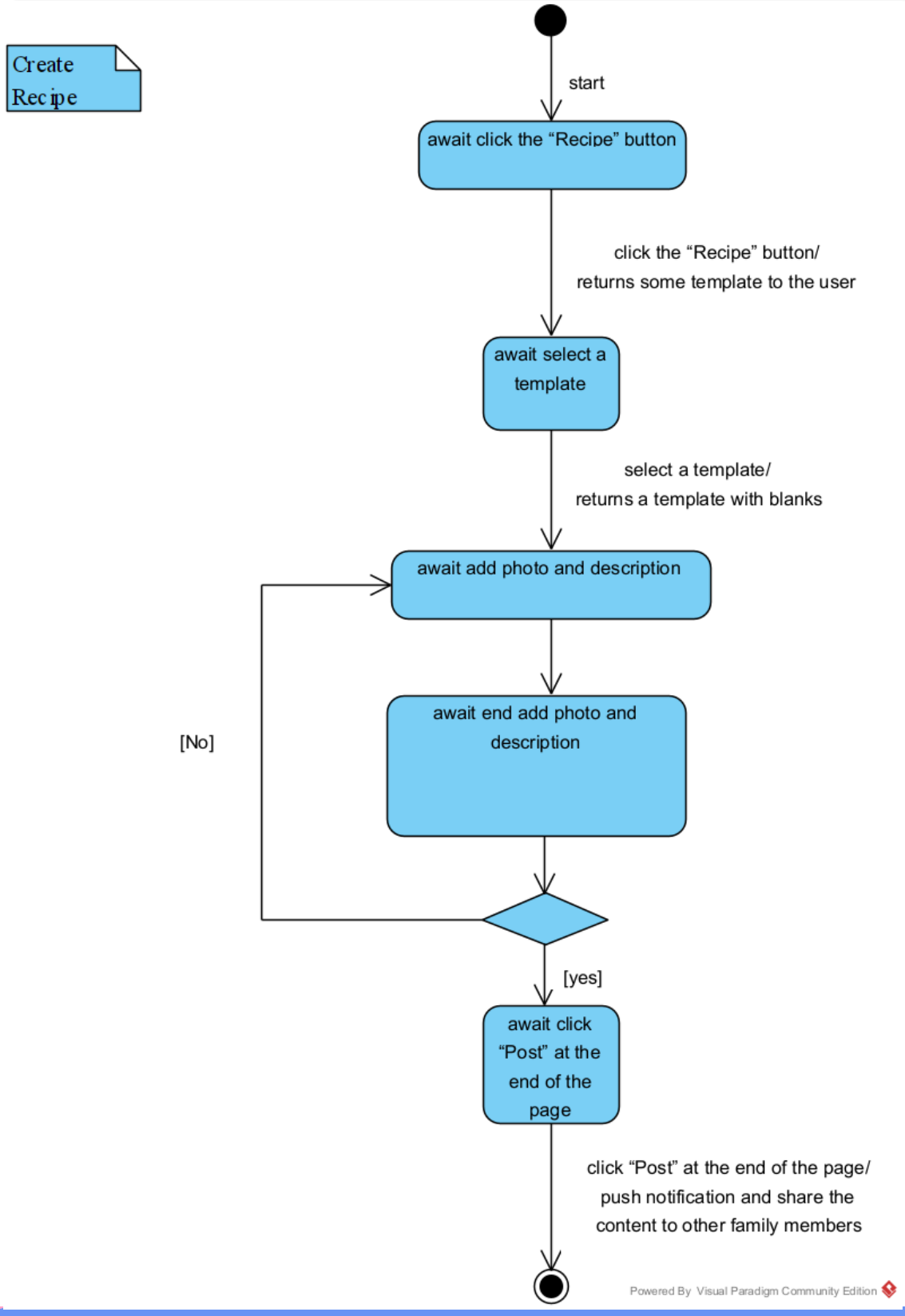
State Machine Diagram: Create Album



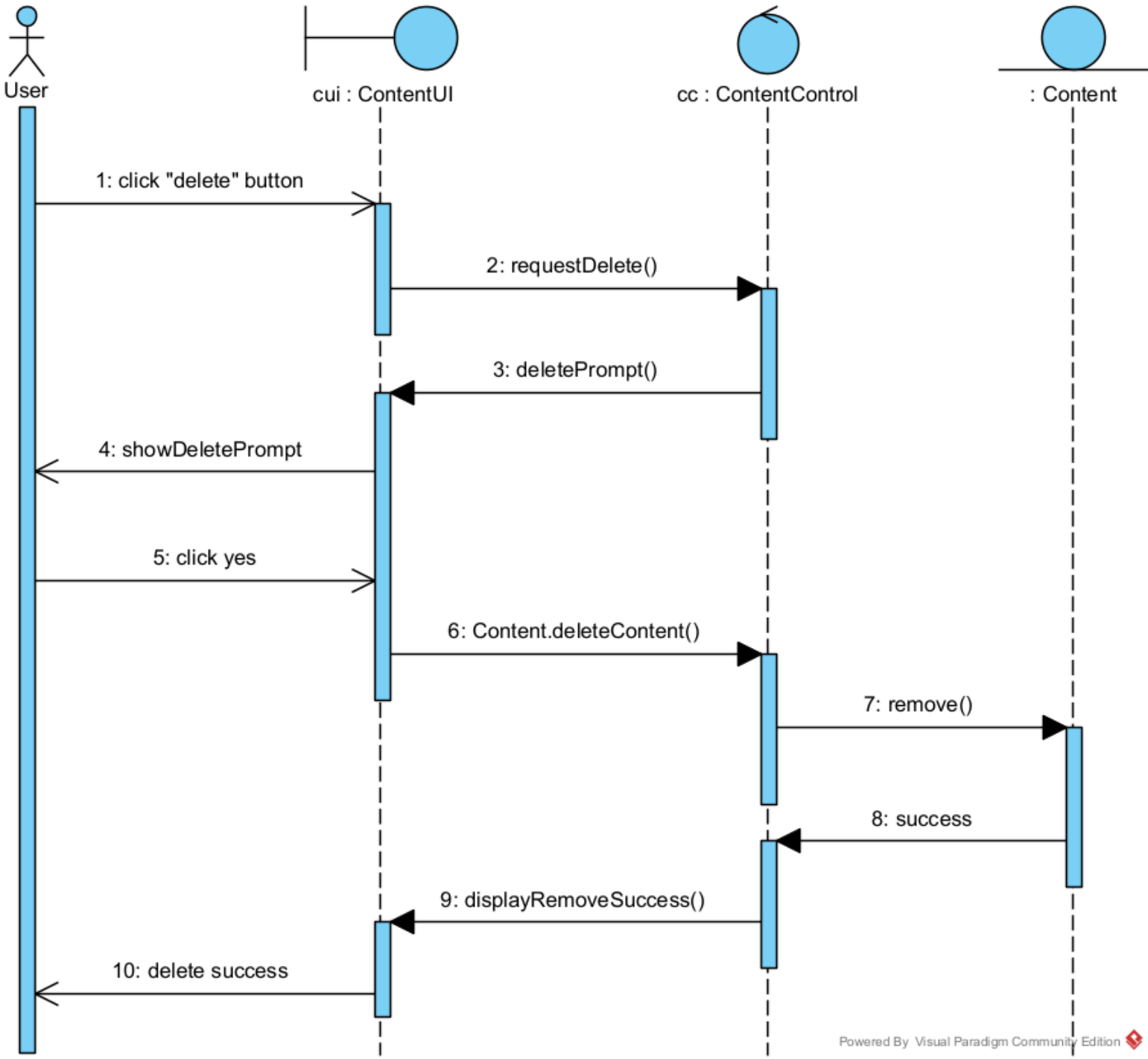
Sequence Diagram: Create Recipe



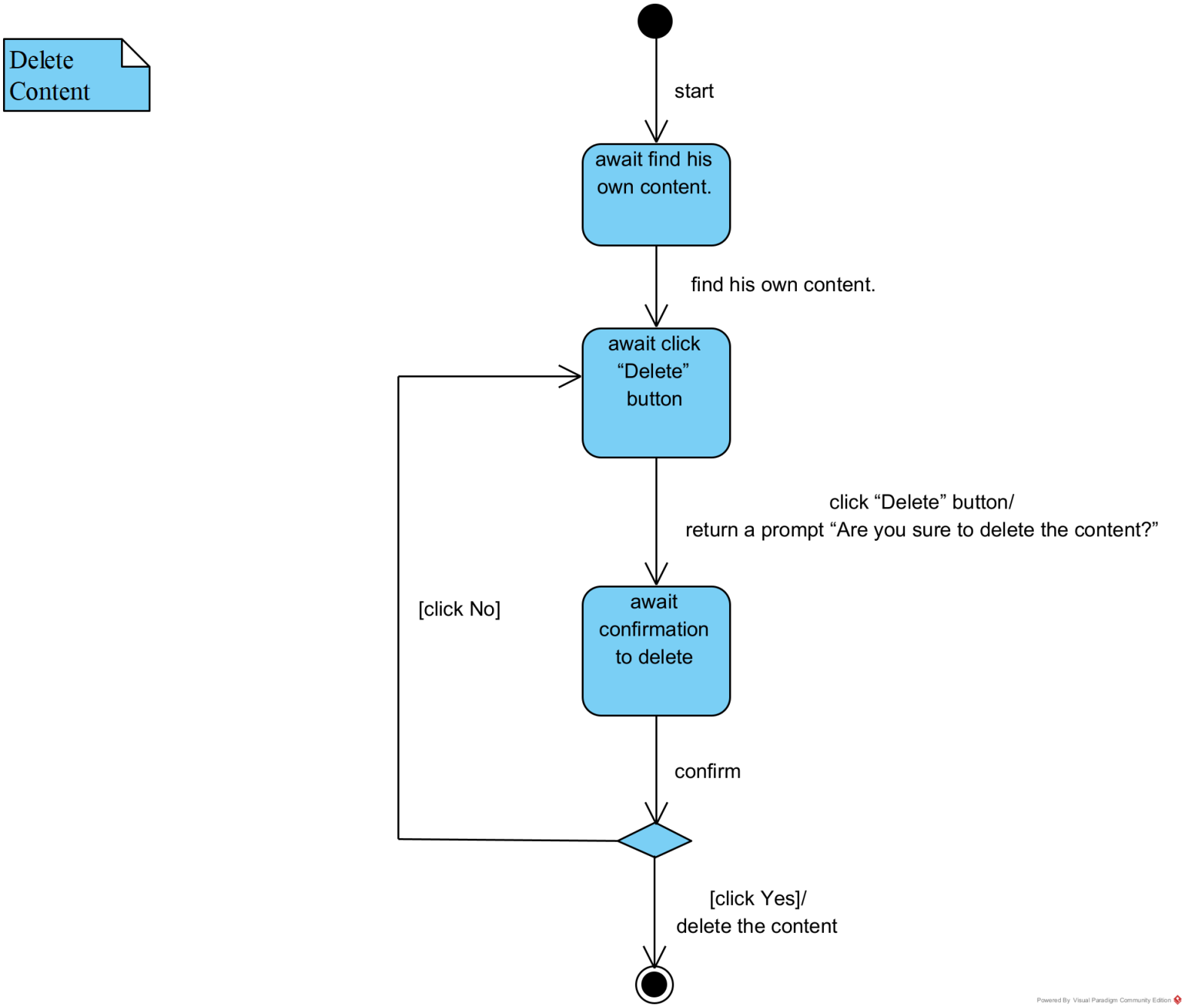
State Machine Diagram: Create Recipe



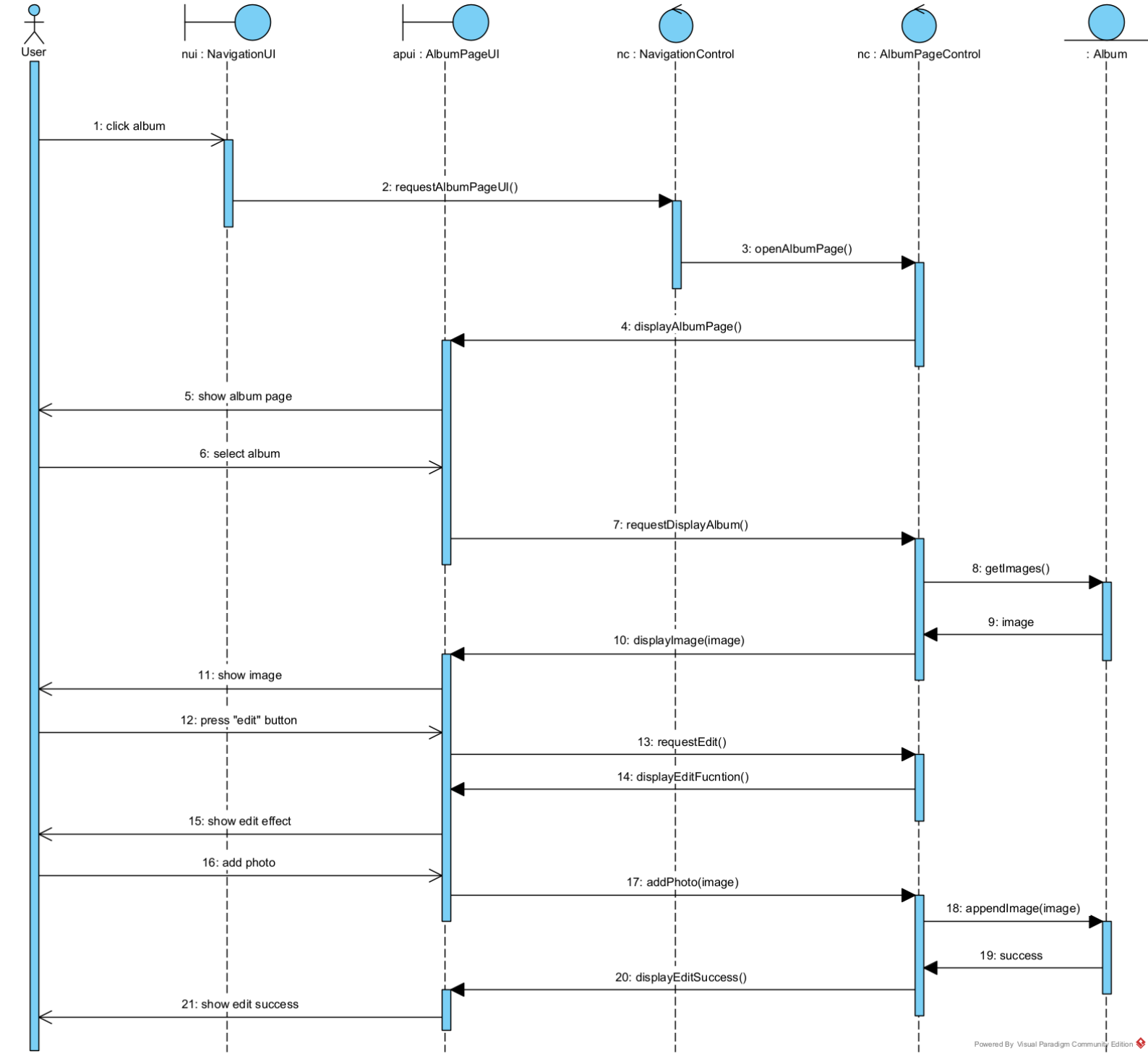
Sequence Diagram: Delete Content



State Machine Diagram: Delete Content

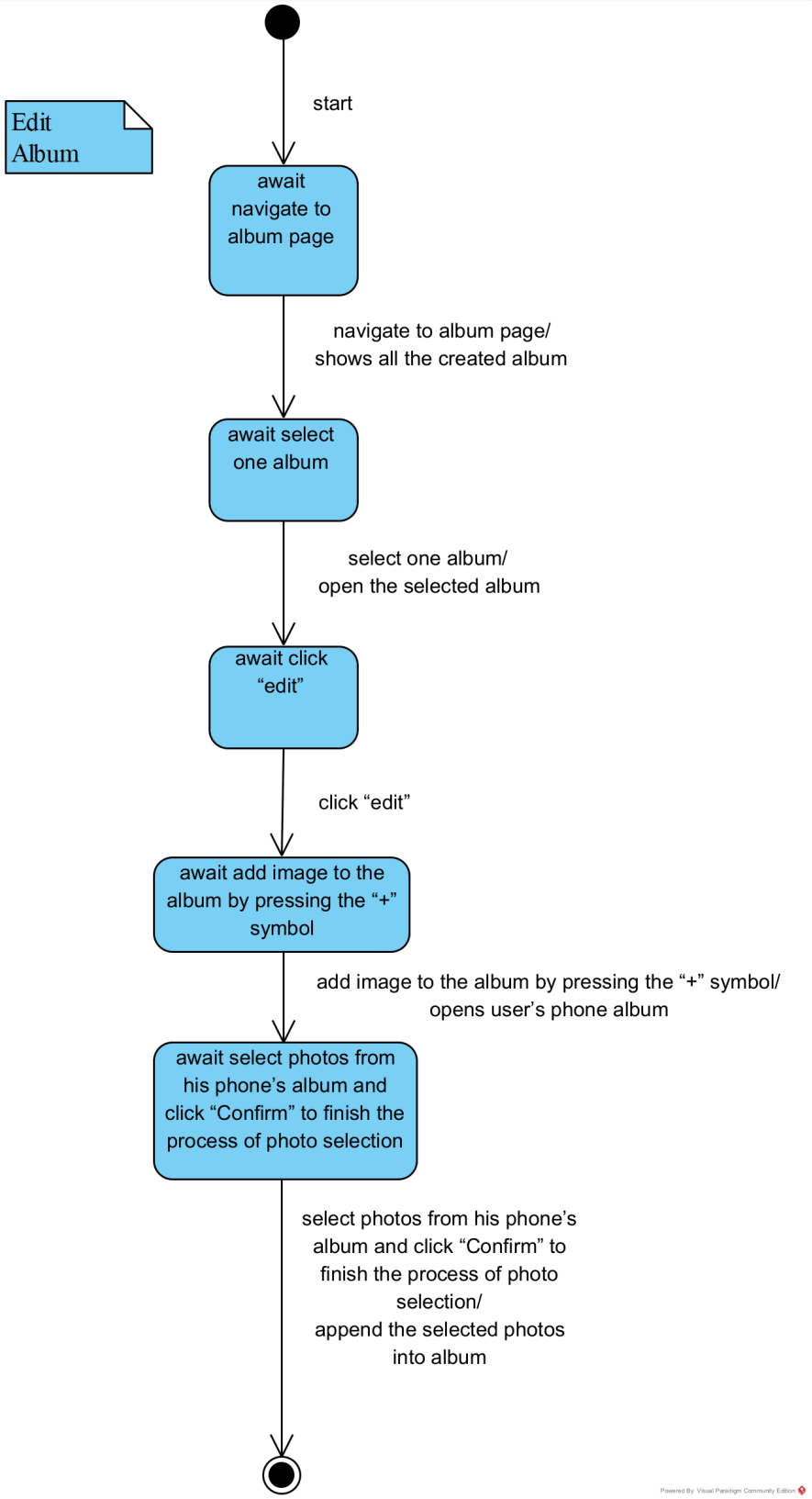


Sequence Diagram: Edit Album

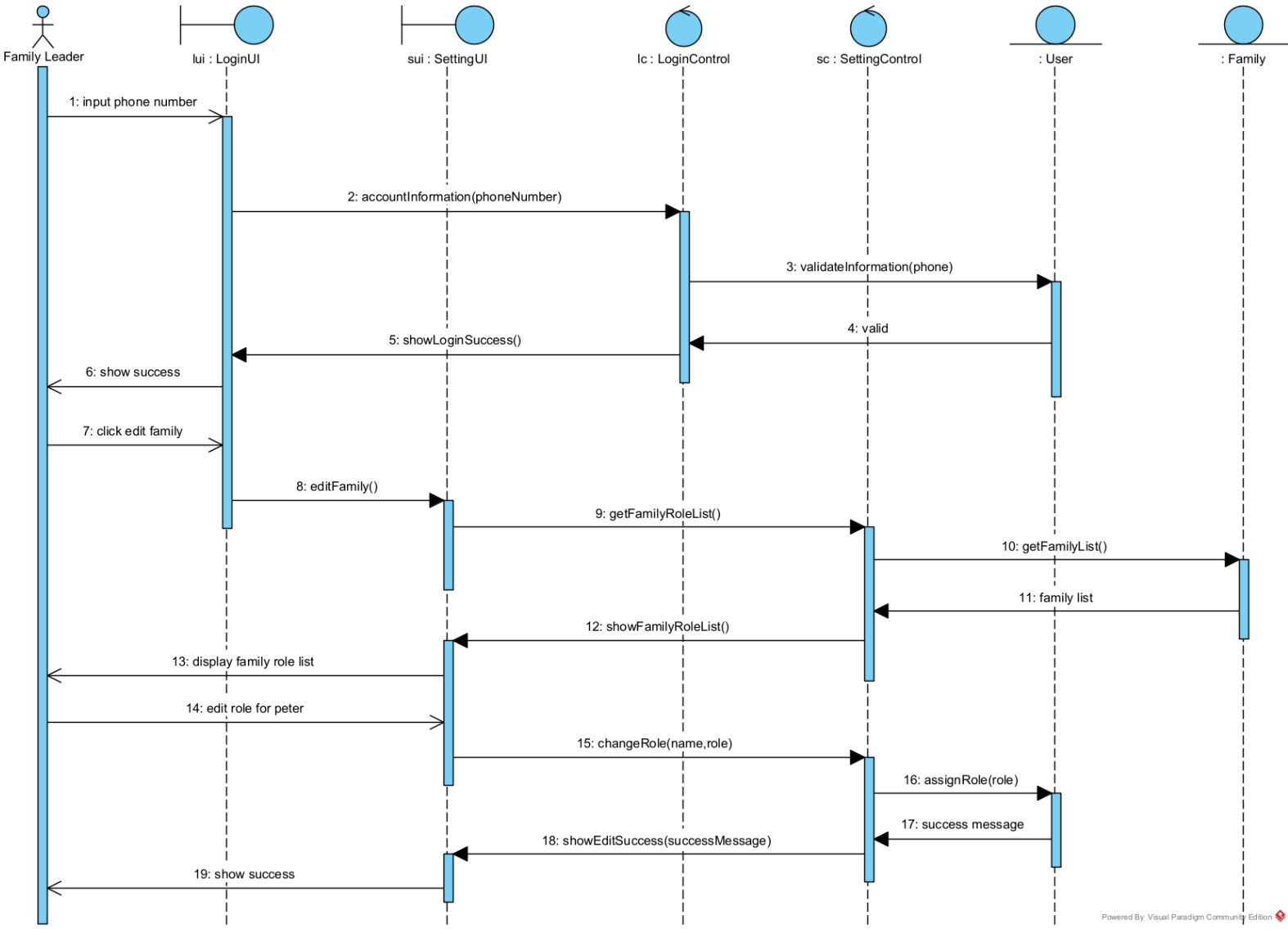


State Machine Diagram: Edit Album

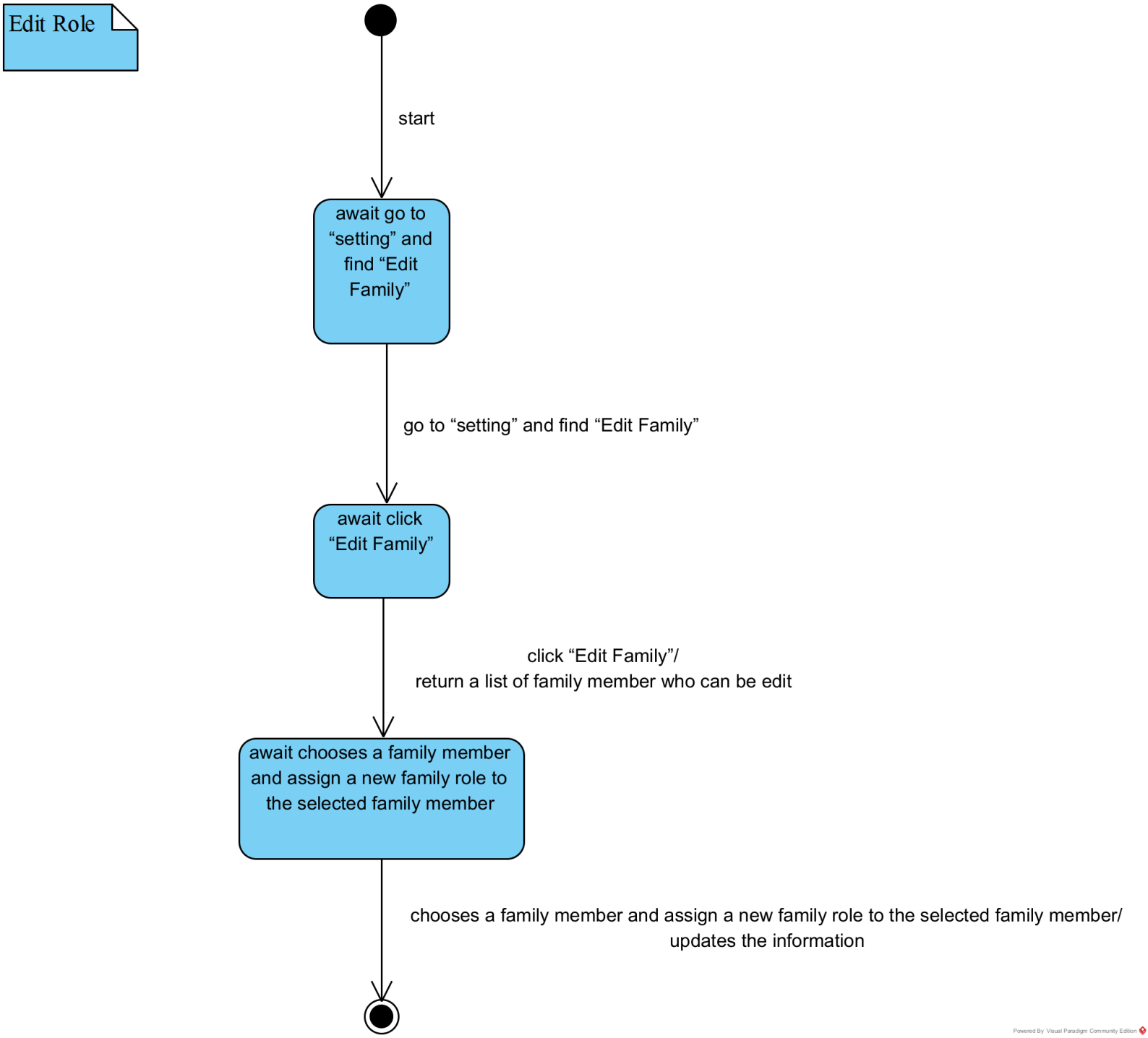
Figure 1 State Machine Diagram: Edit Album



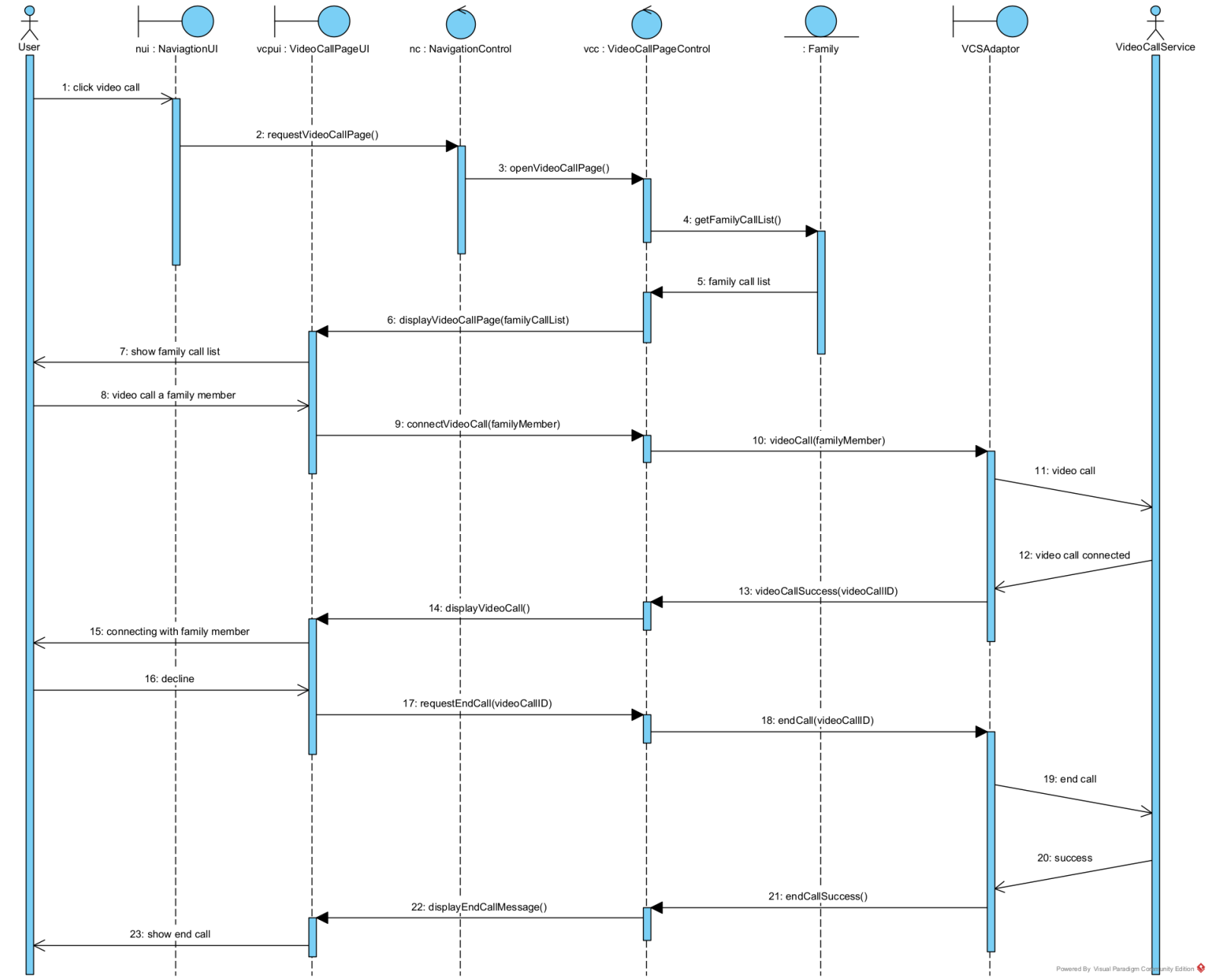
Sequence Diagram: Edit Role



State Machine Diagram: Edit Role

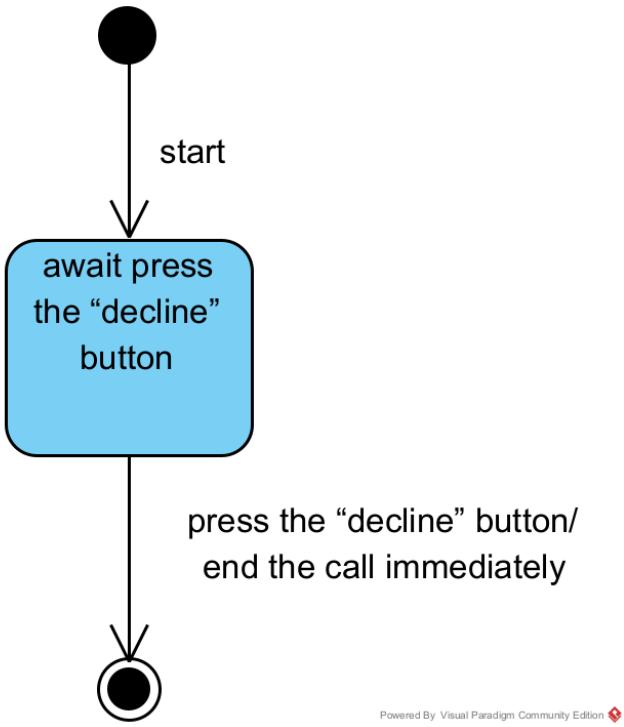


Sequence Diagram: End Video Call

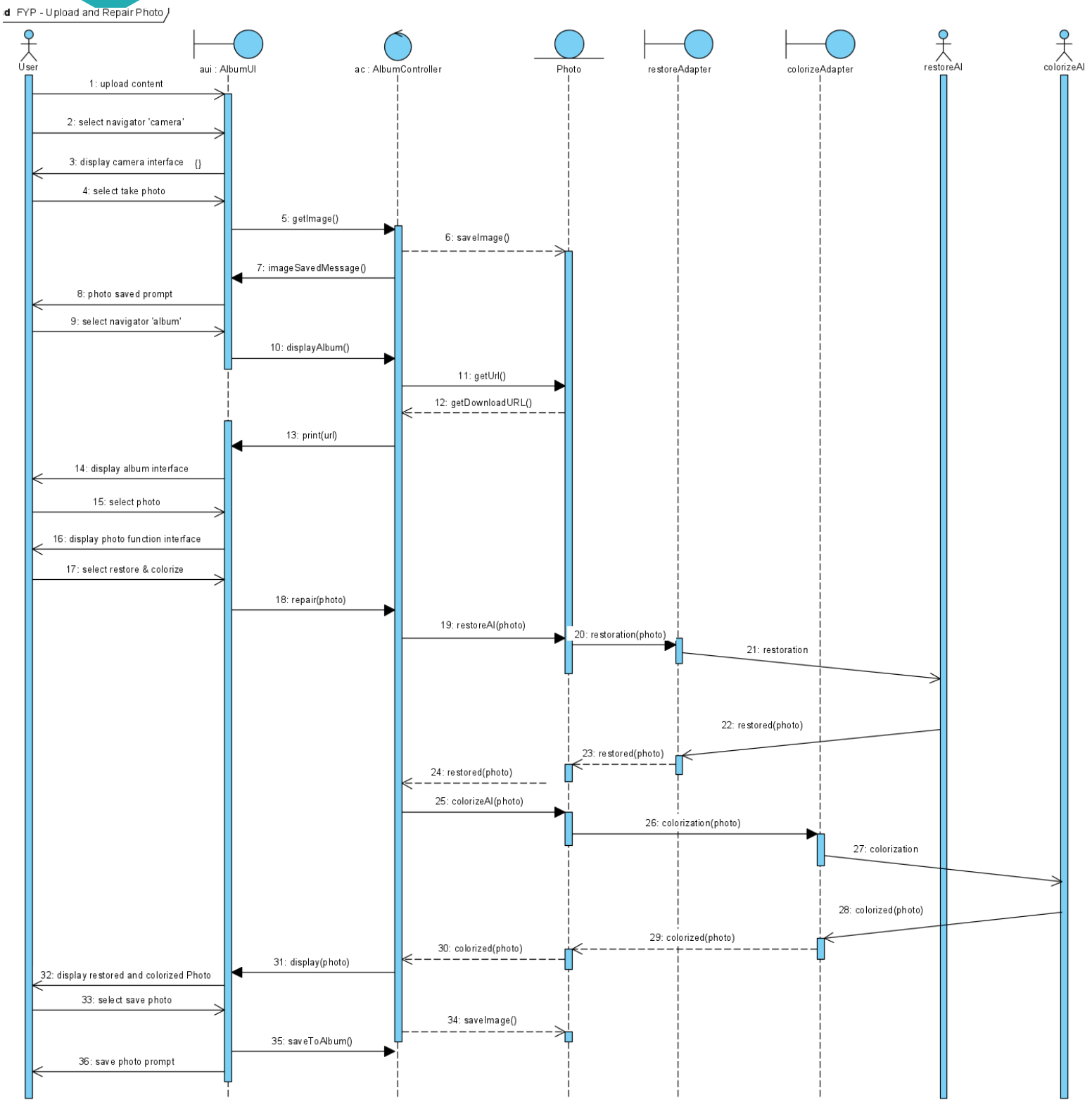


State Machine Diagram: End Video Call

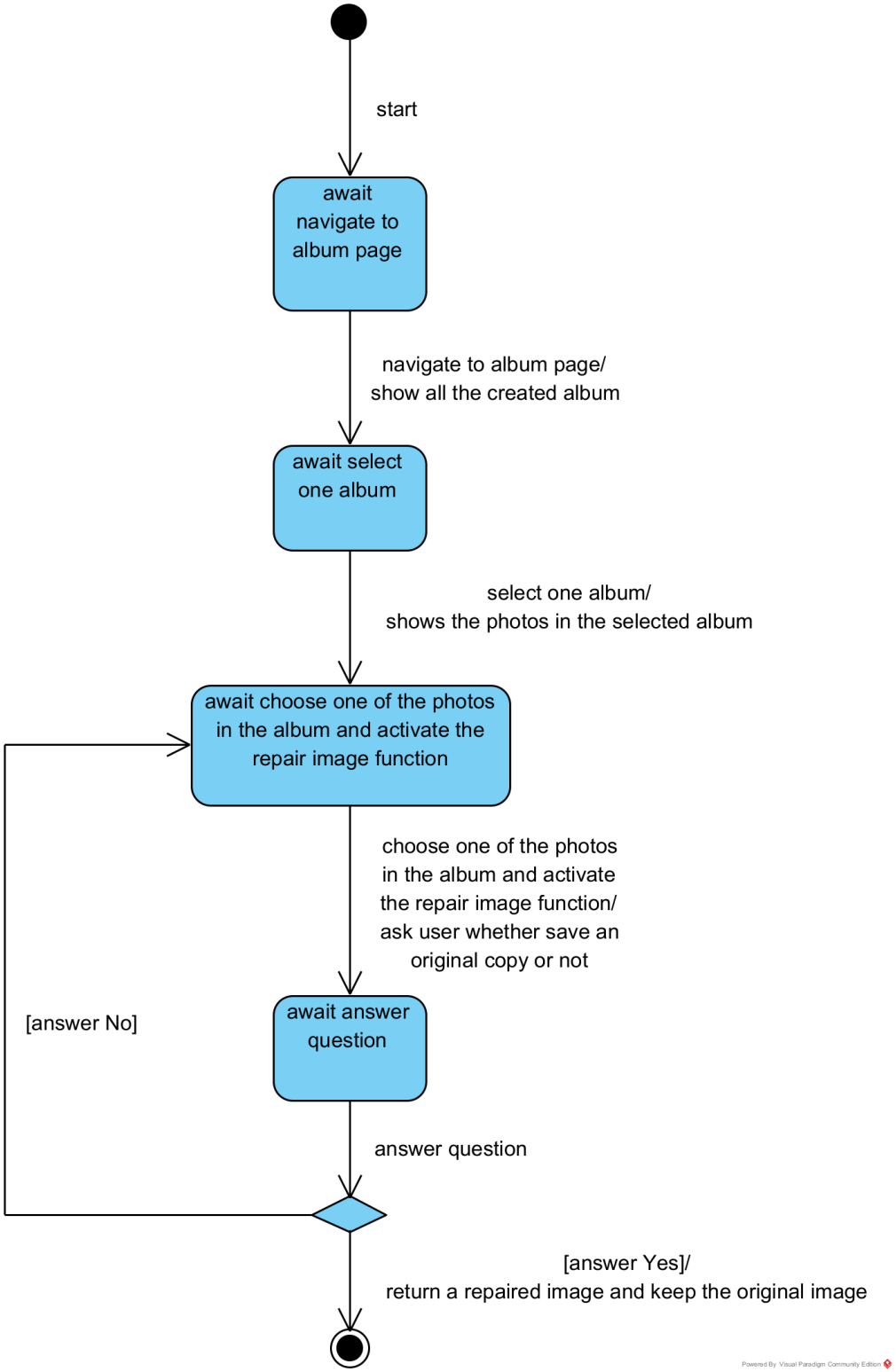
End Video Call



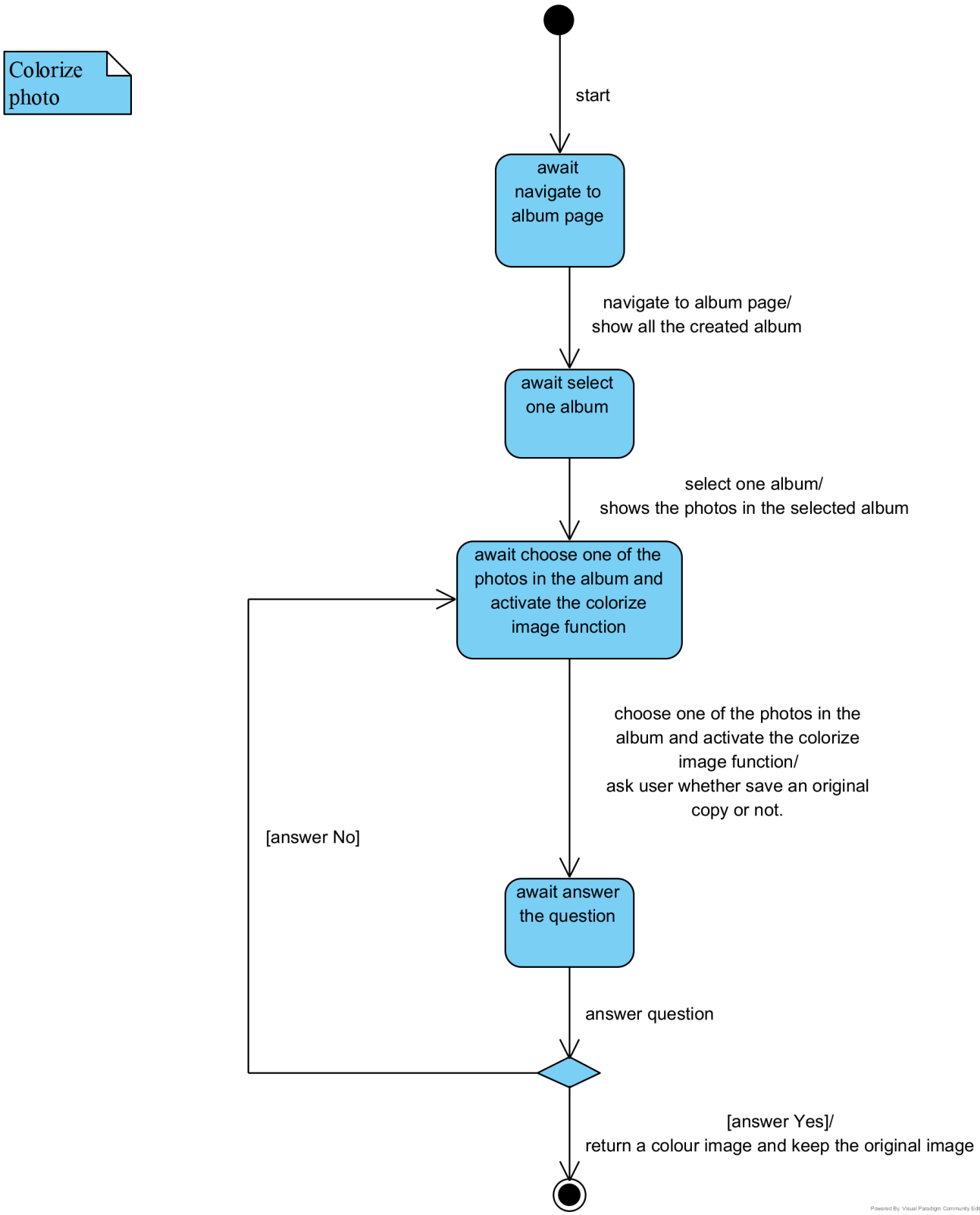
Sequence Diagram: Upload and Repair Photo



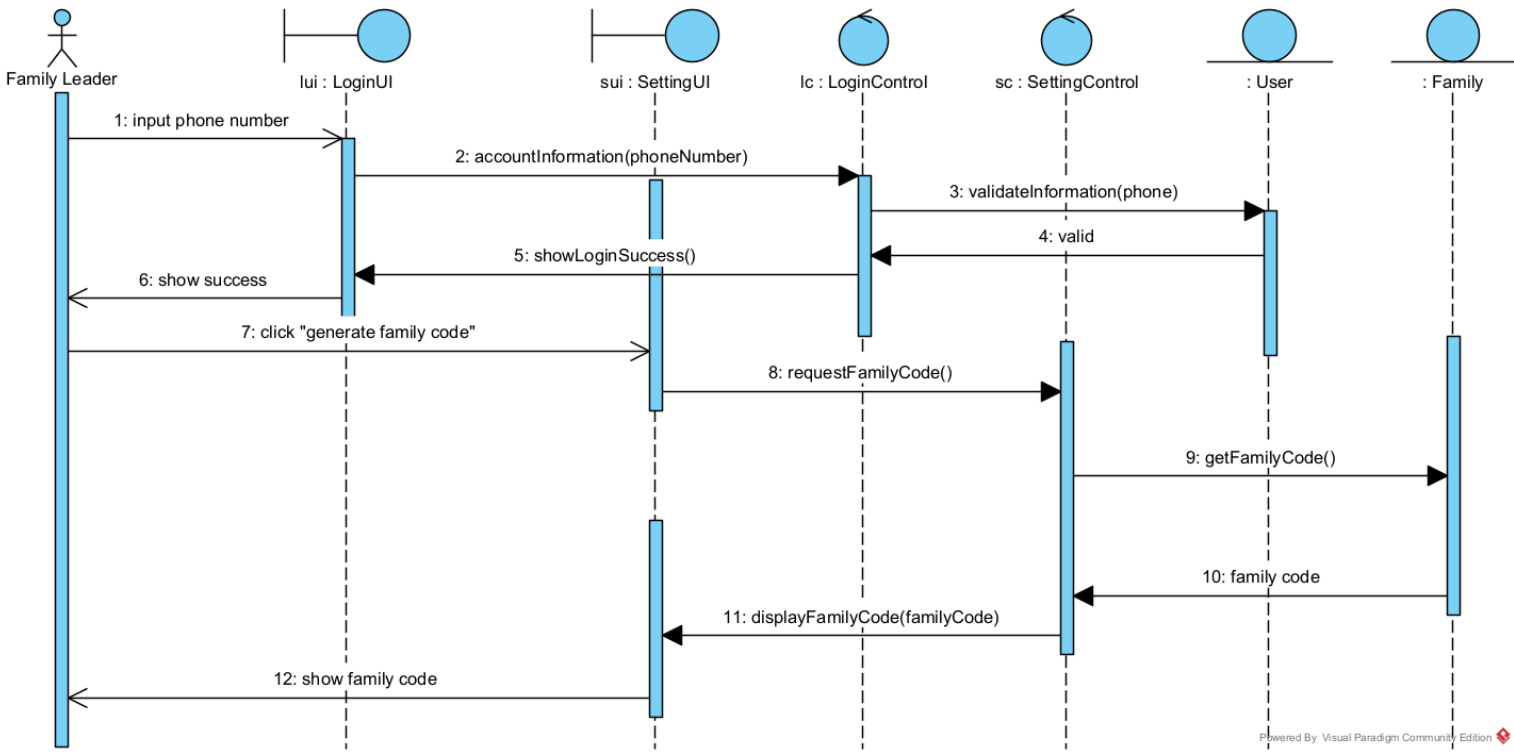
State Machine Diagram: Upload and Repair Photo



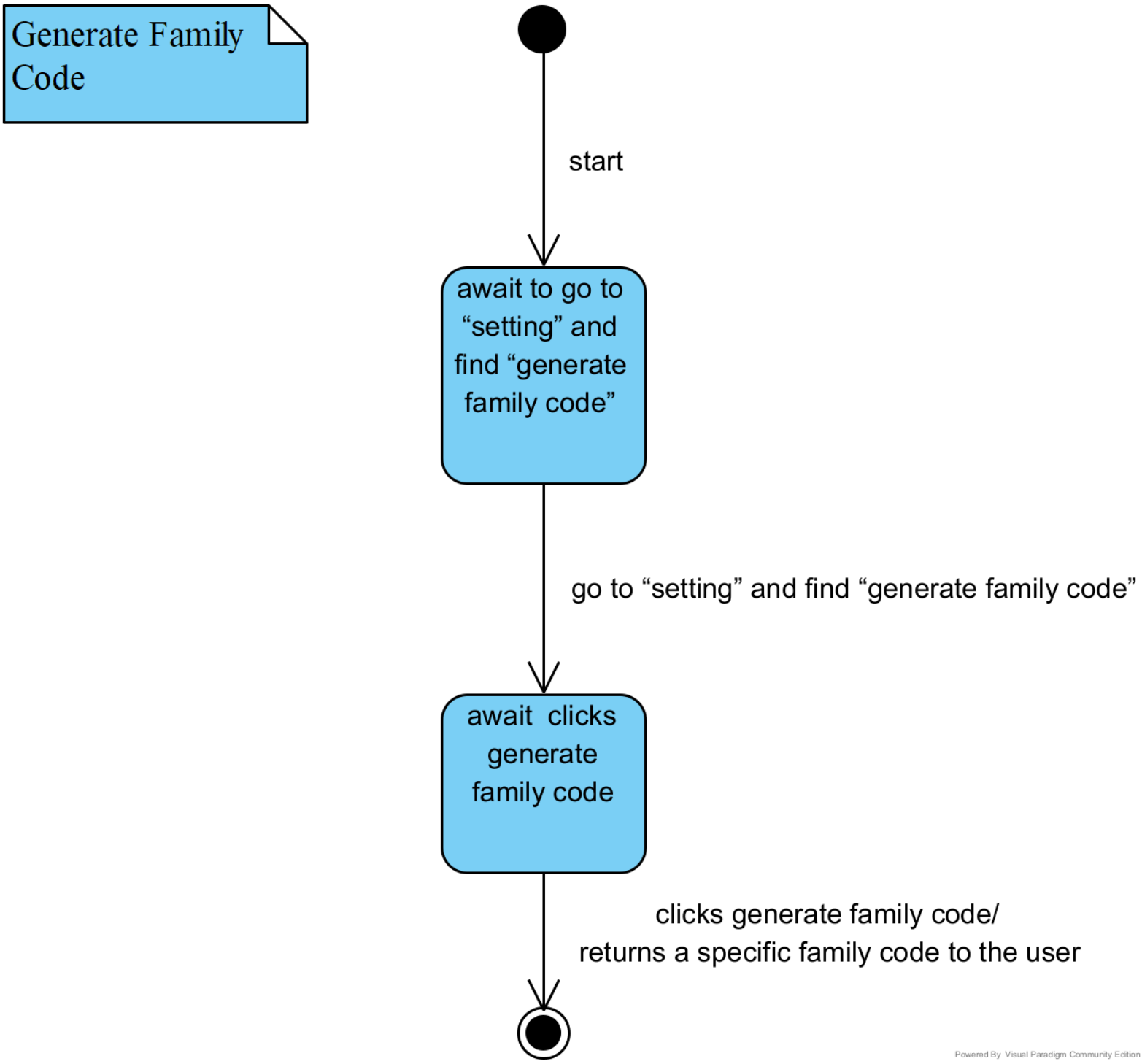
State Machine Diagram: Upload and Colorize Photo



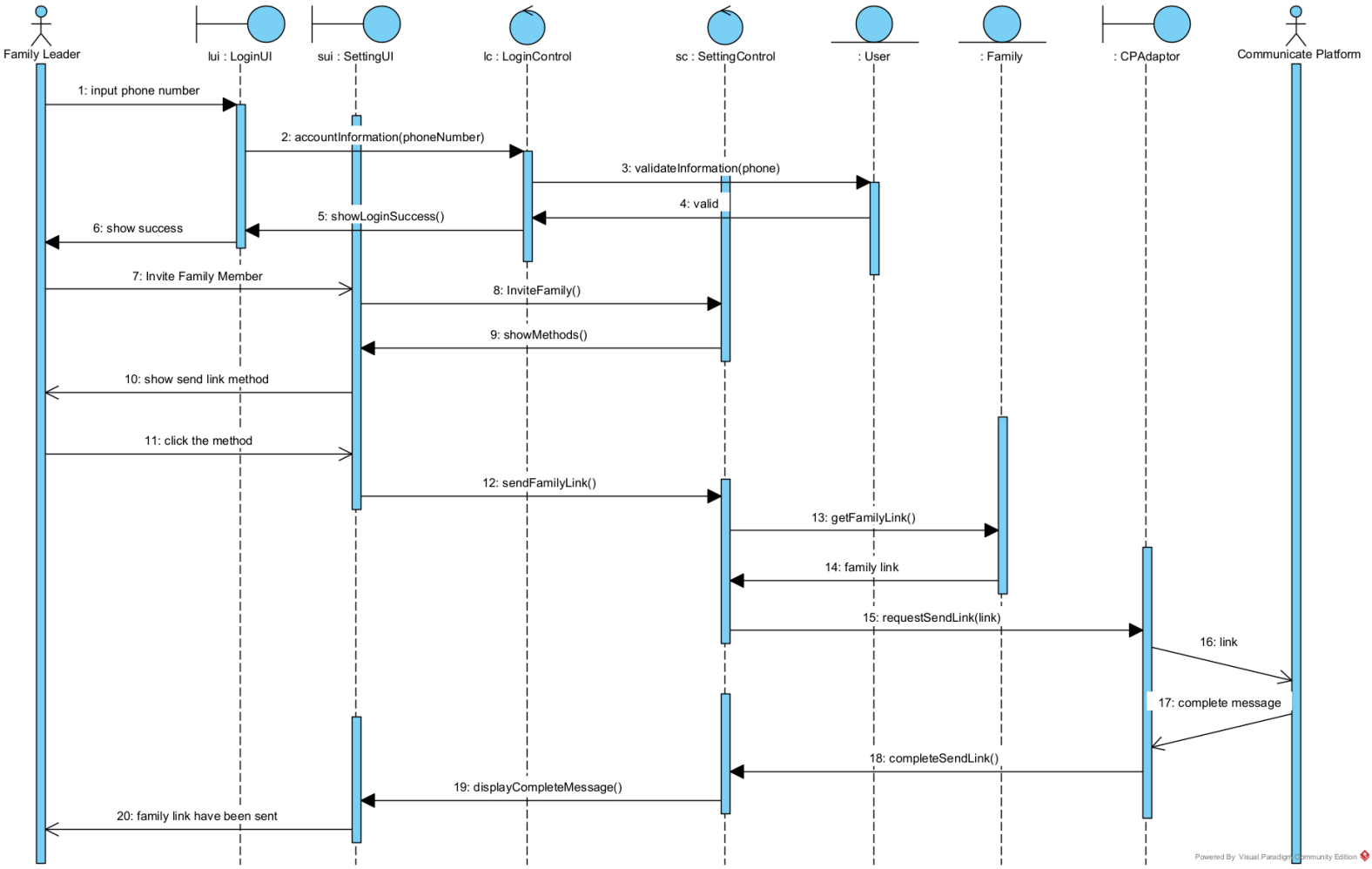
Sequence Diagram: Generate Family Code



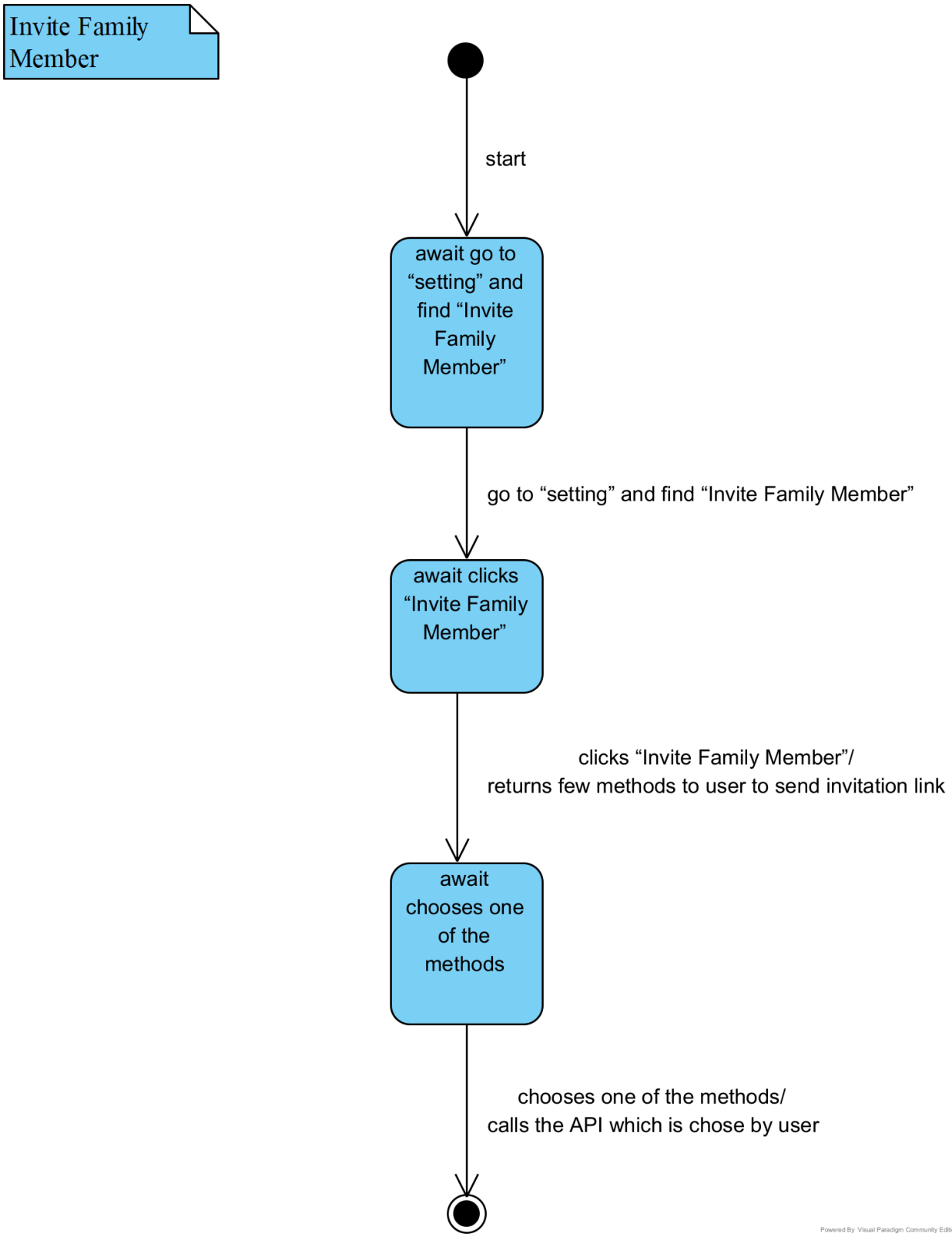
State Machine Diagram: Generate Family Code



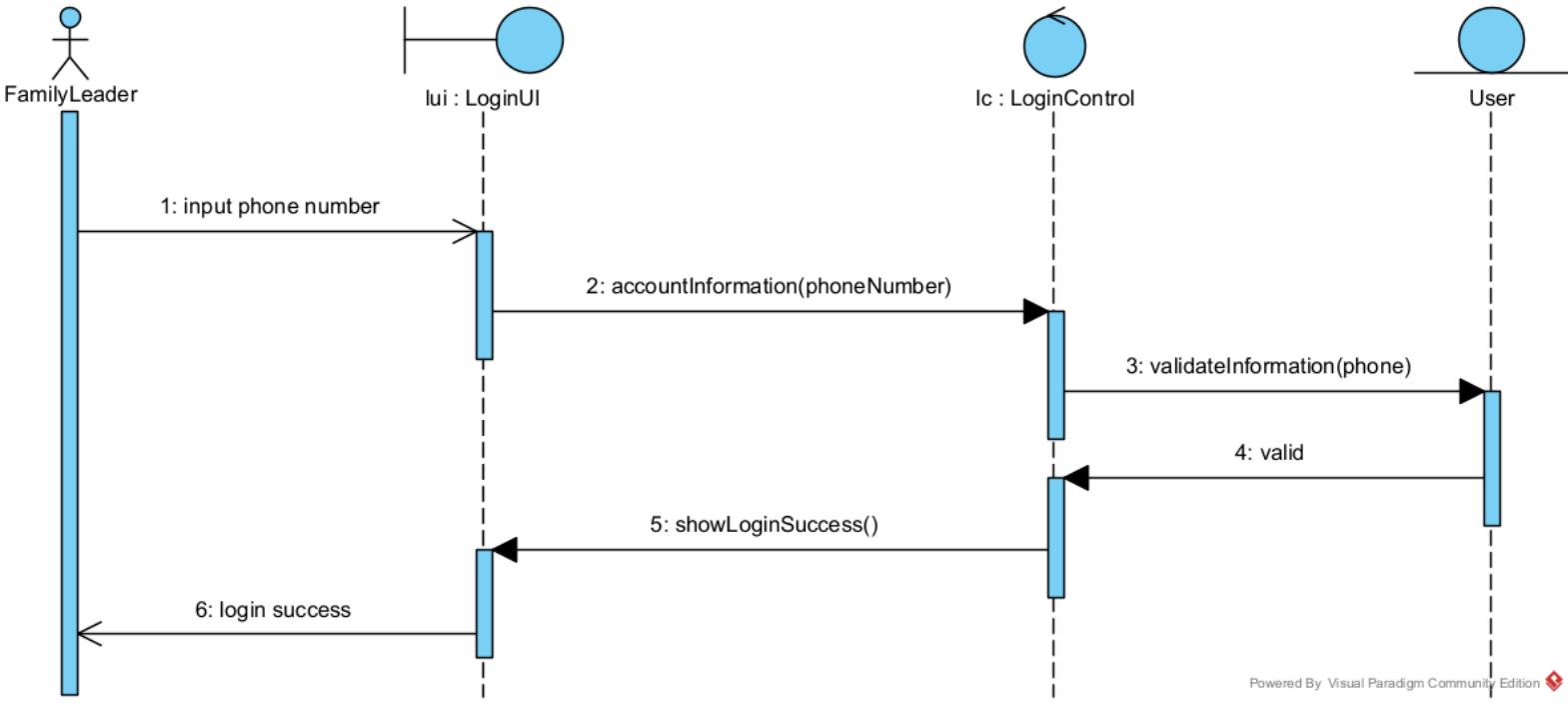
Sequence Diagram: Invite Family Member



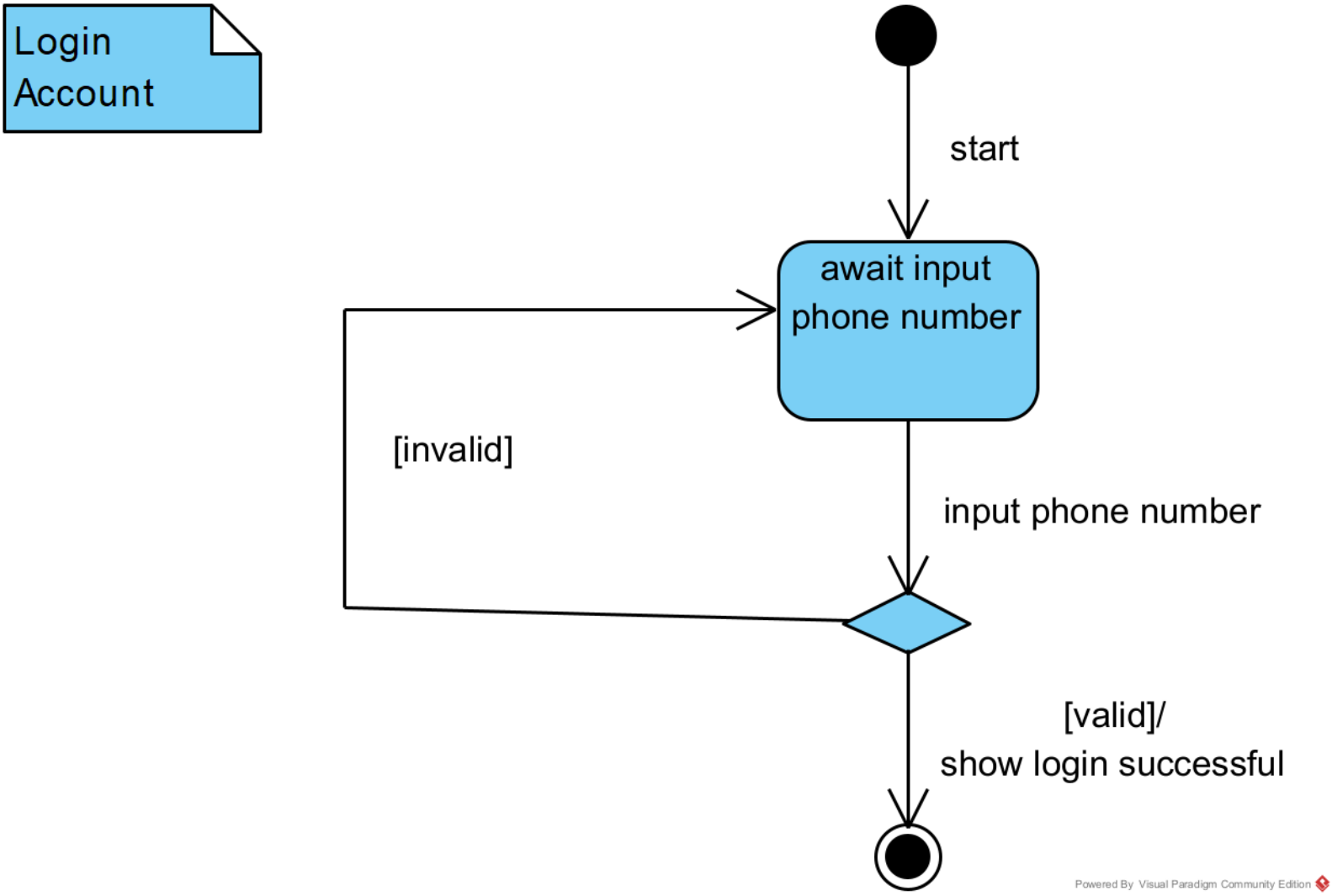
State Machine Diagram: Invite Family Member



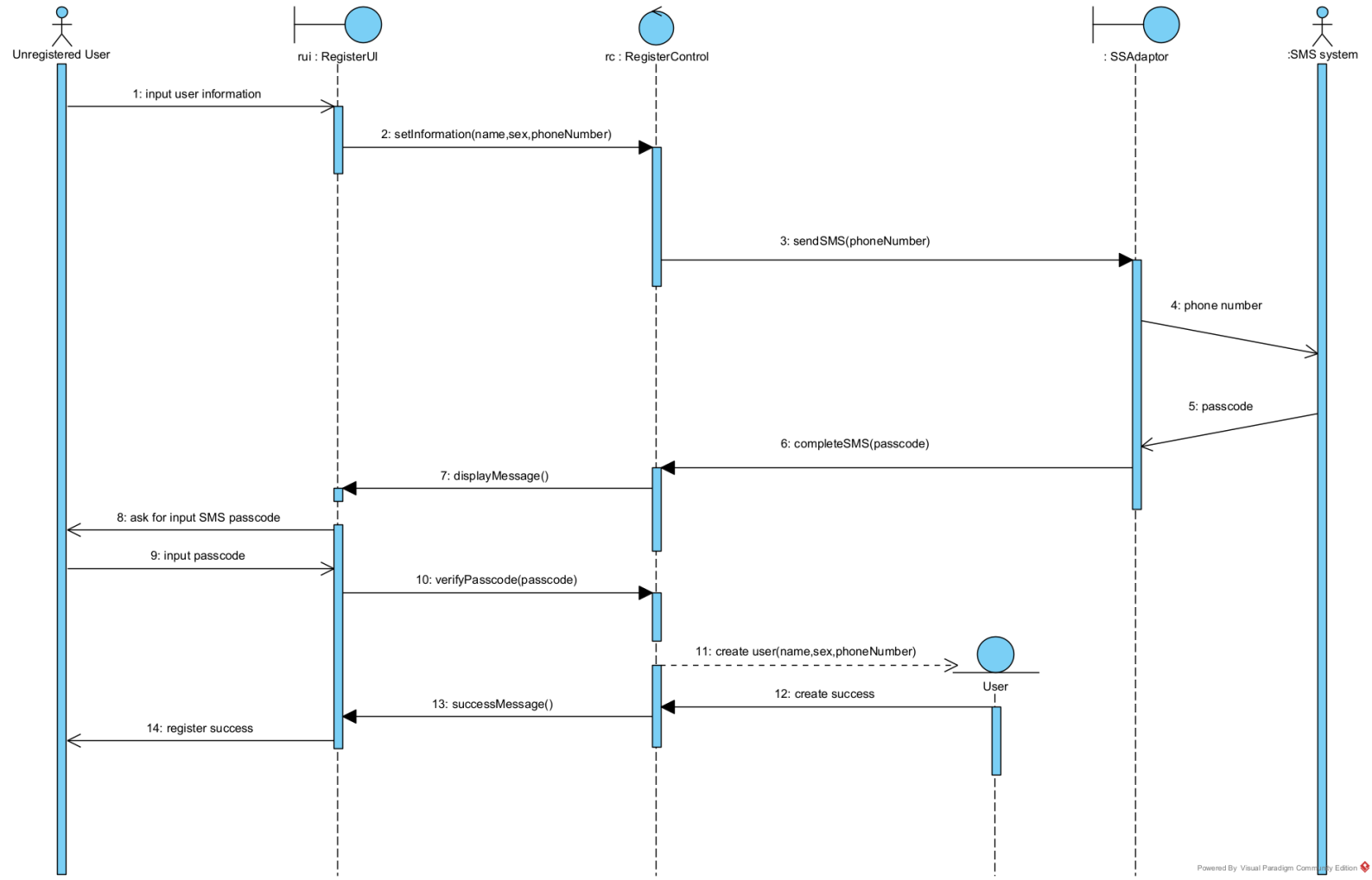
Sequence Diagram: Login Account



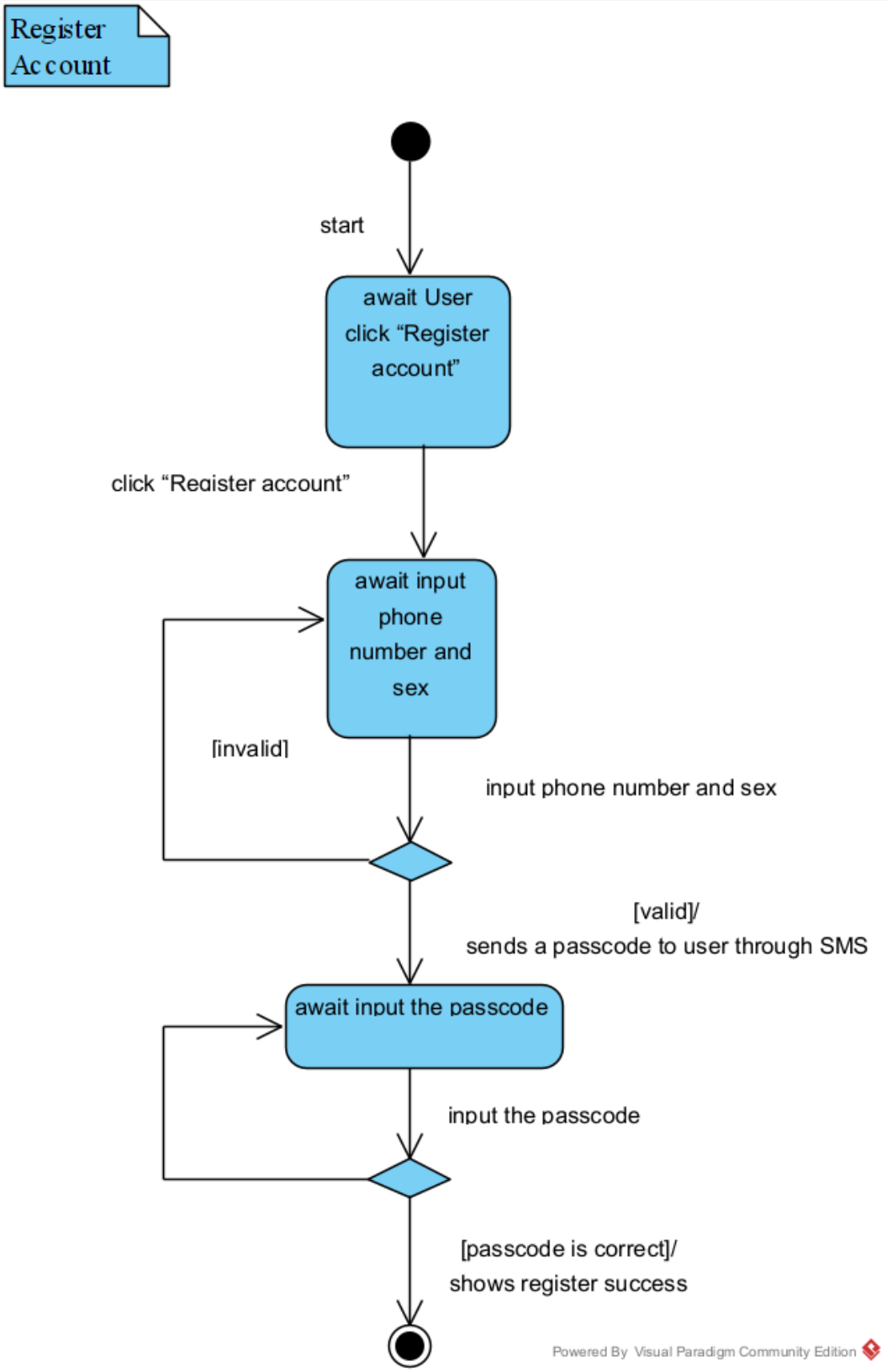
State Machine Diagram: Login Account



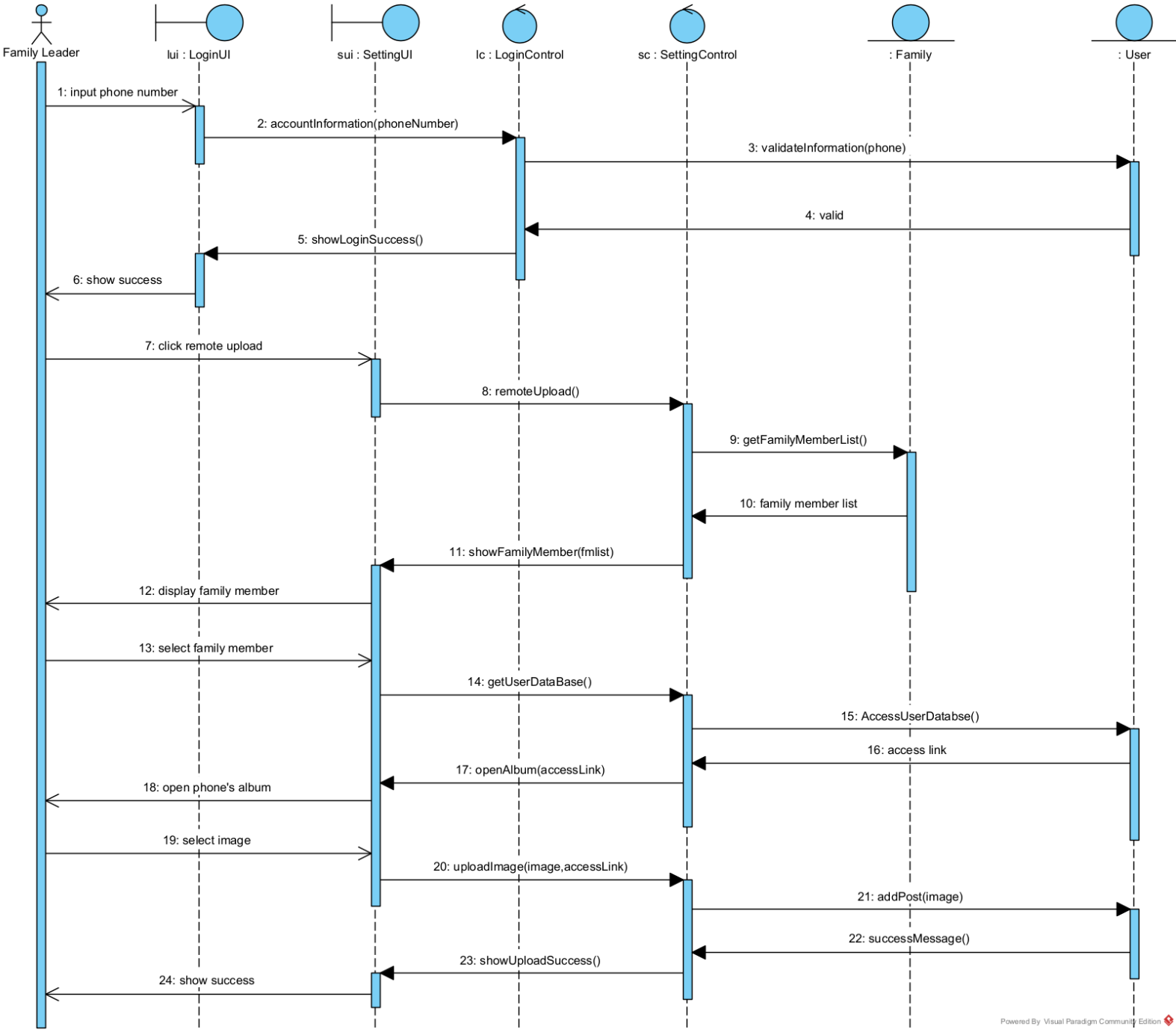
Sequence Diagram: Register Account



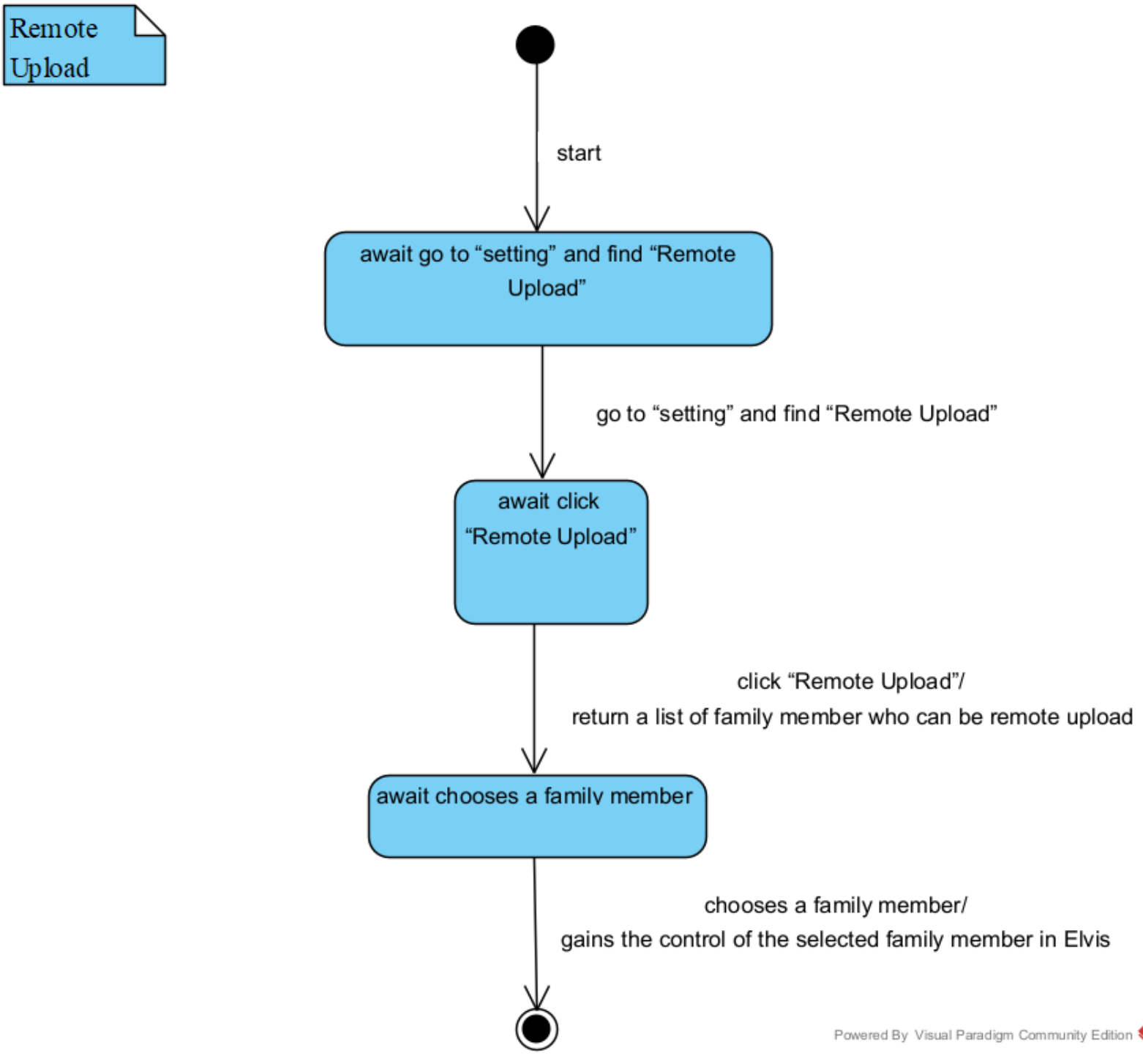
State Machine Diagram: Register Account



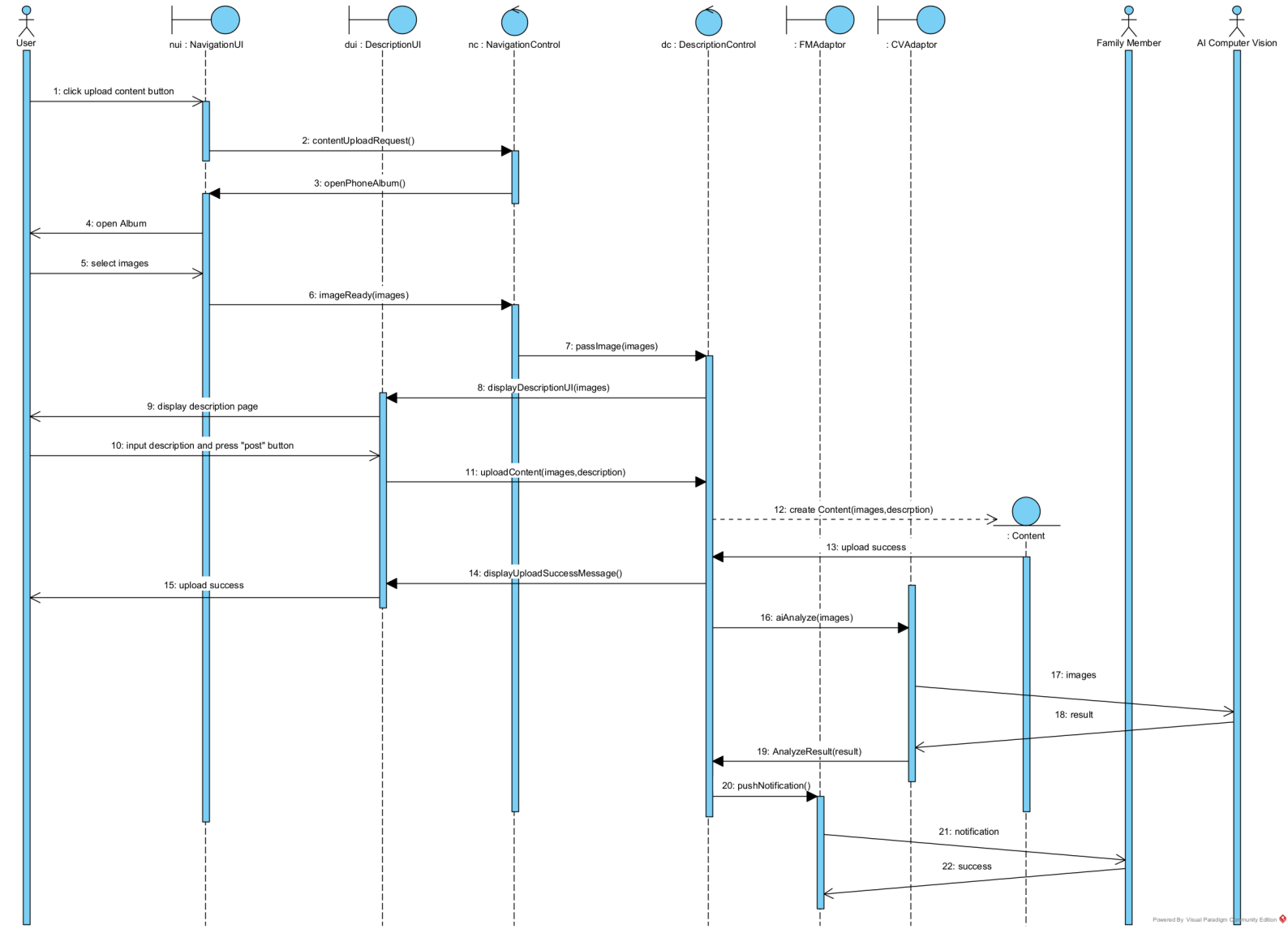
Sequence Diagram: Remote Upload



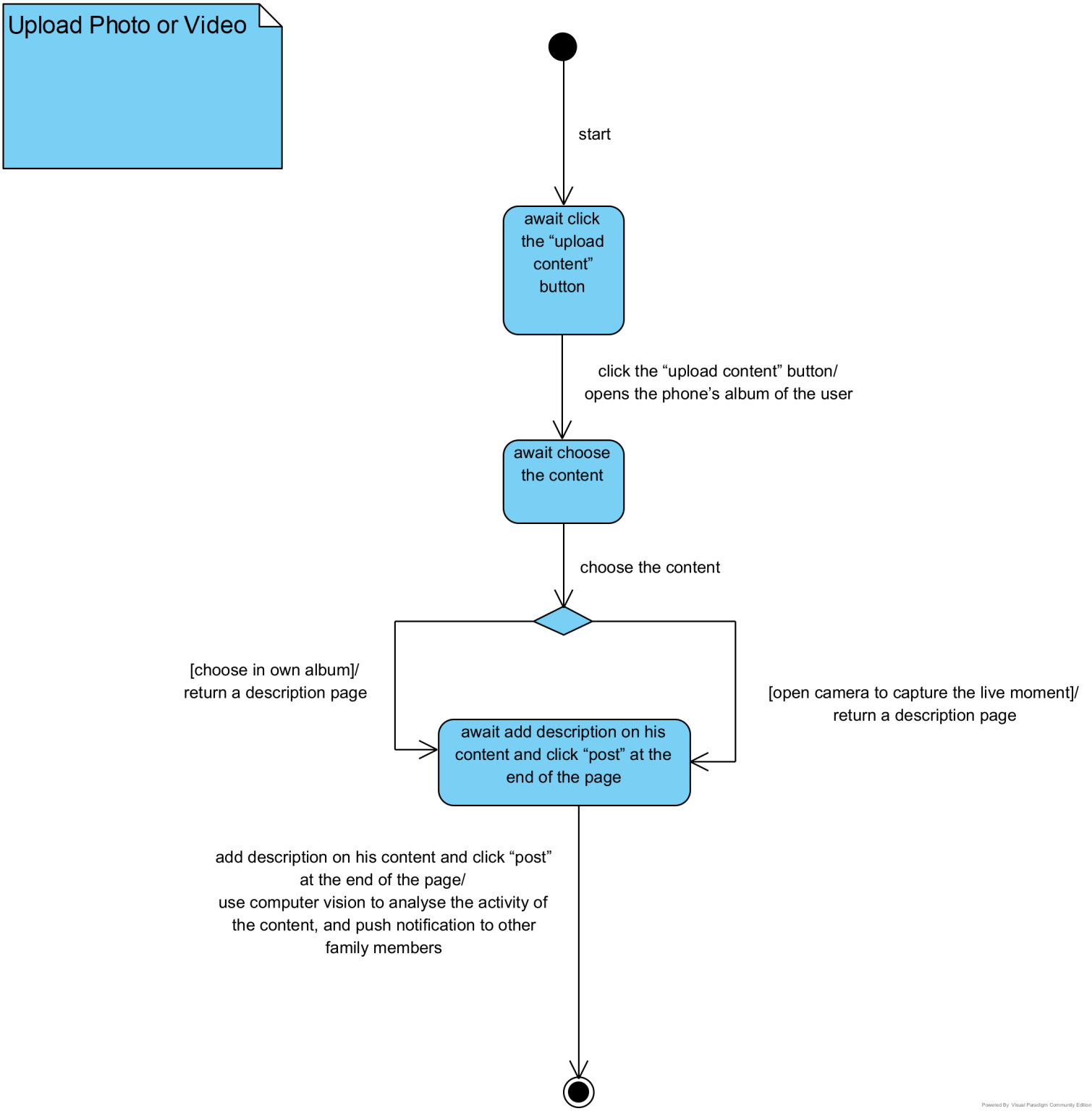
State Machine Diagram: Remote Upload



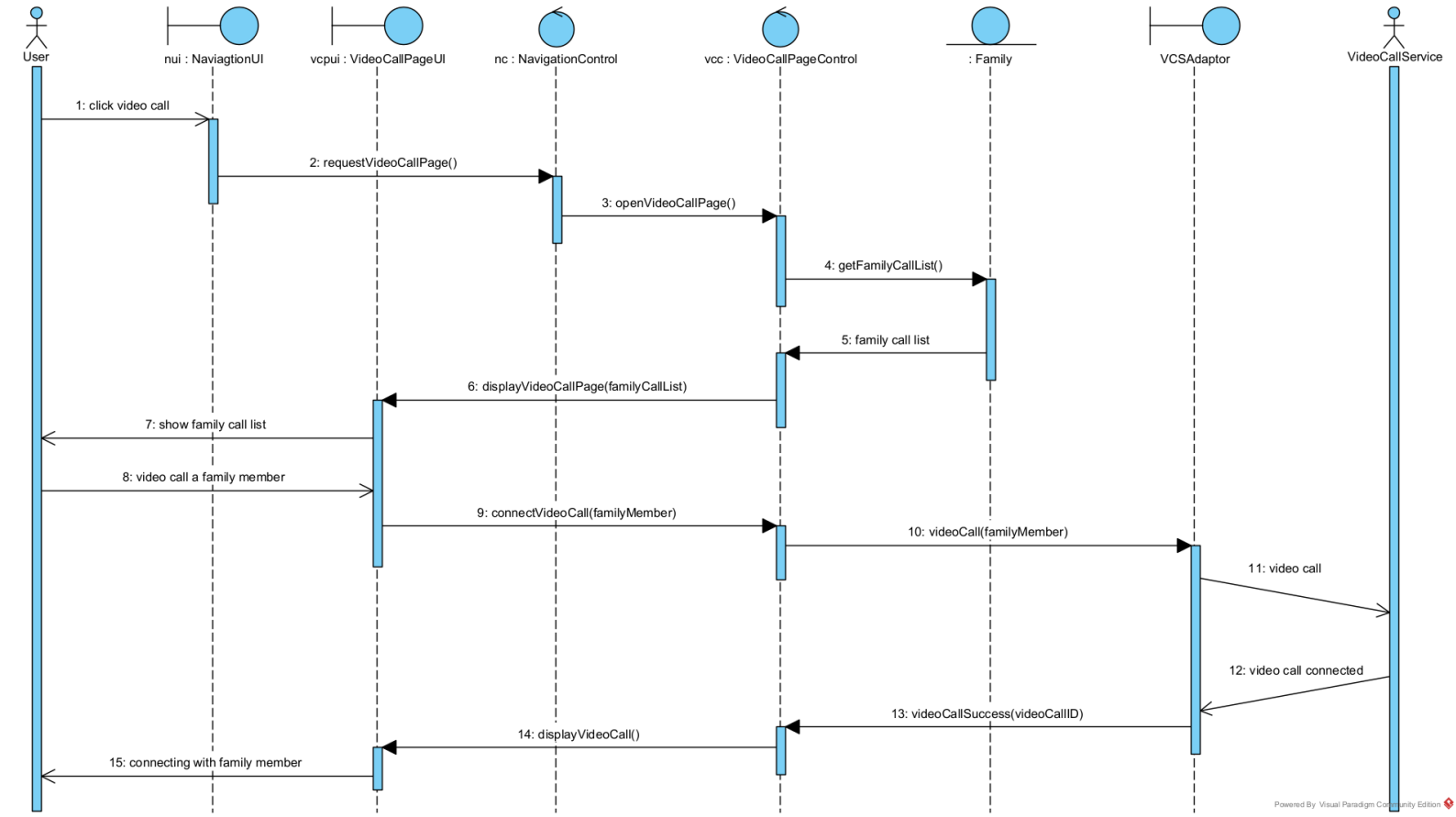
Sequence Diagram: Upload Photo or Video



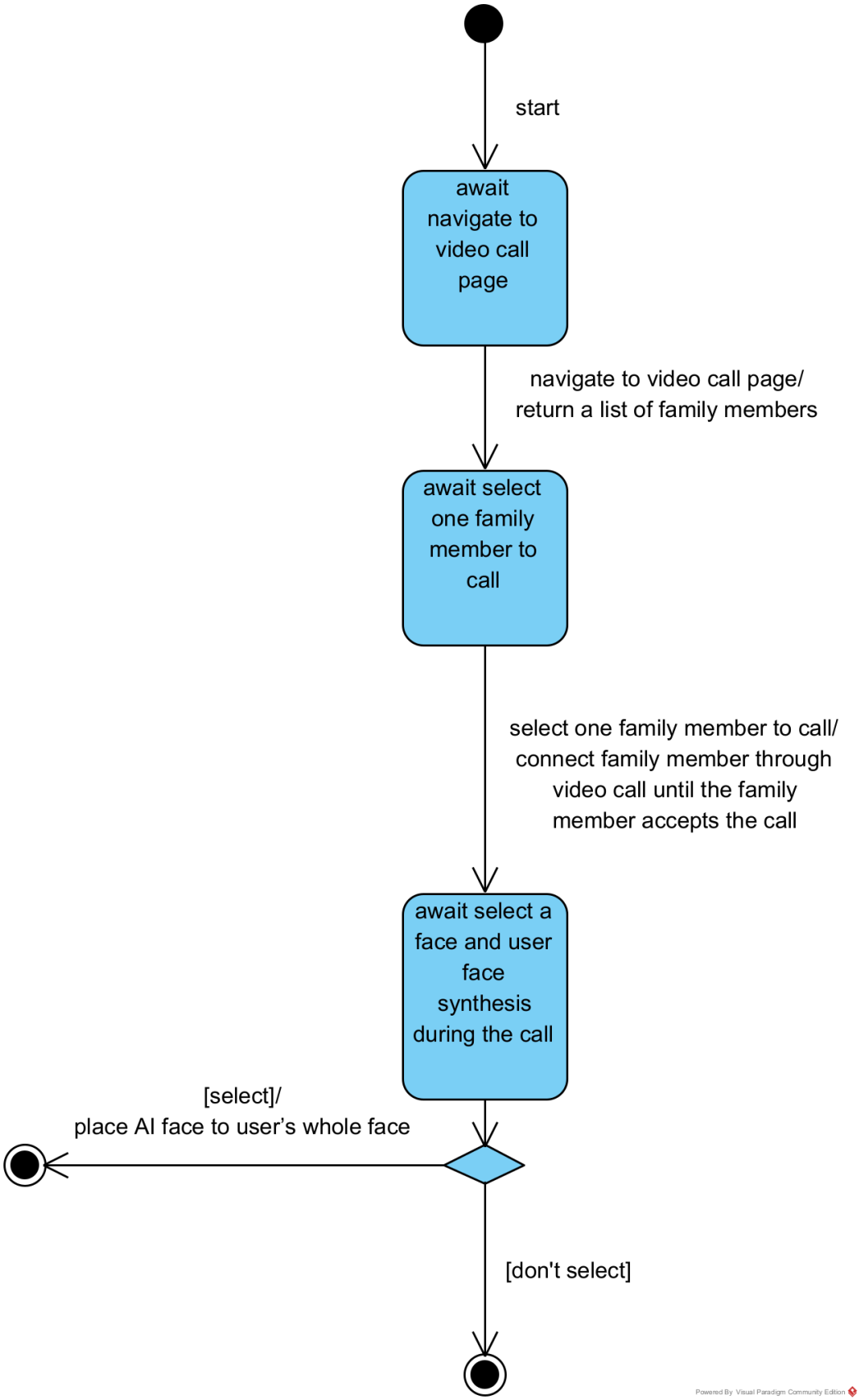
State Machine Diagram: Upload Photo or Video



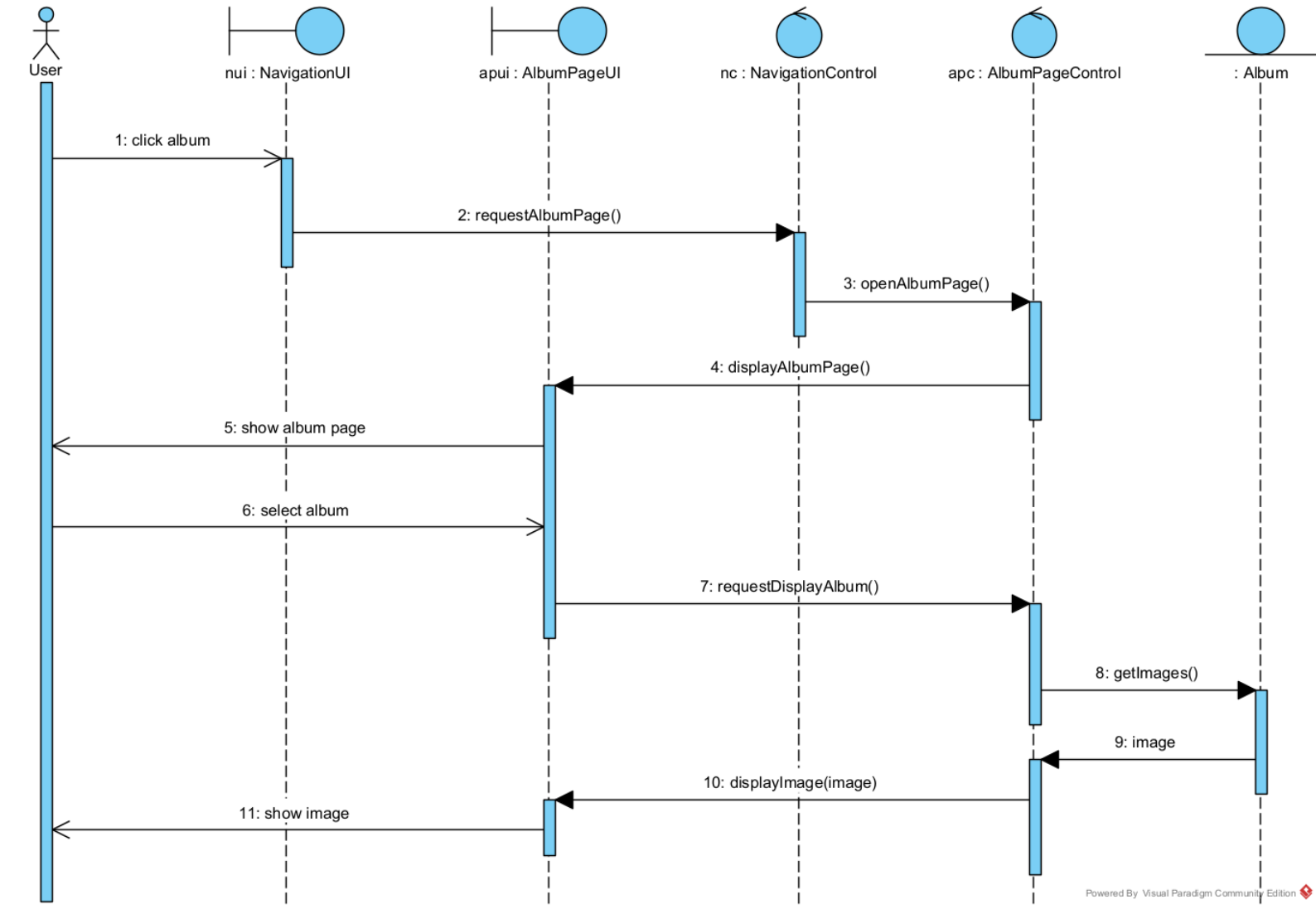
Sequence Diagram: Video Call



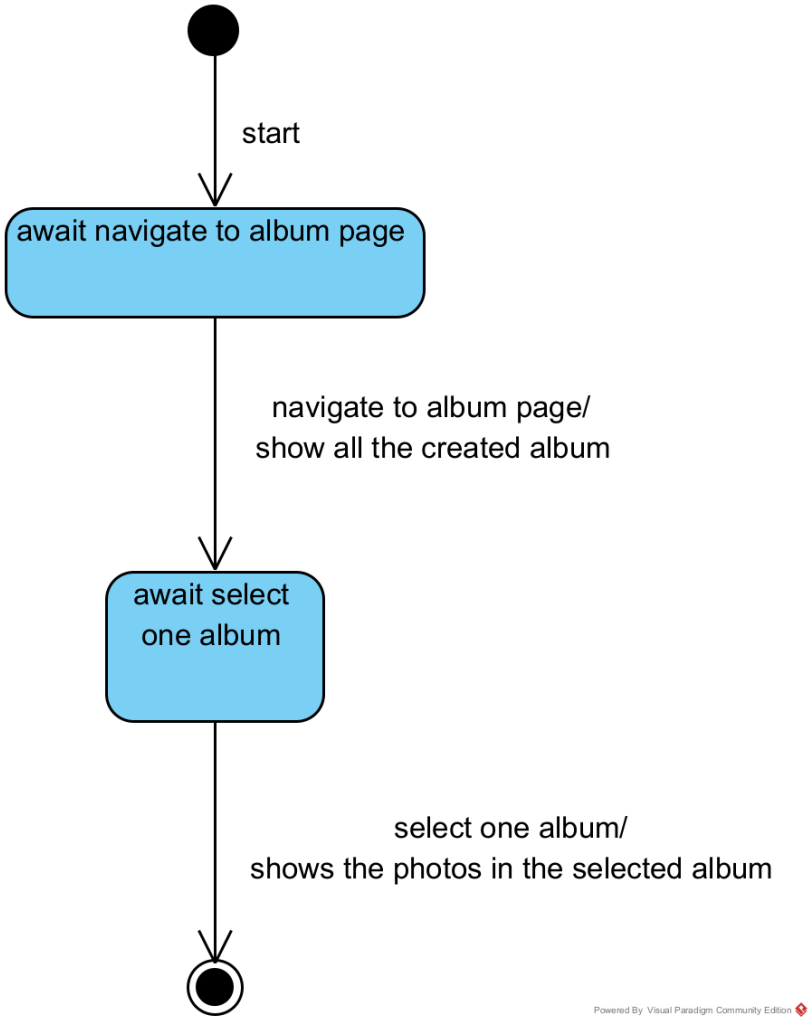
State Machine Diagram: Video Call



Sequence Diagram: View Album



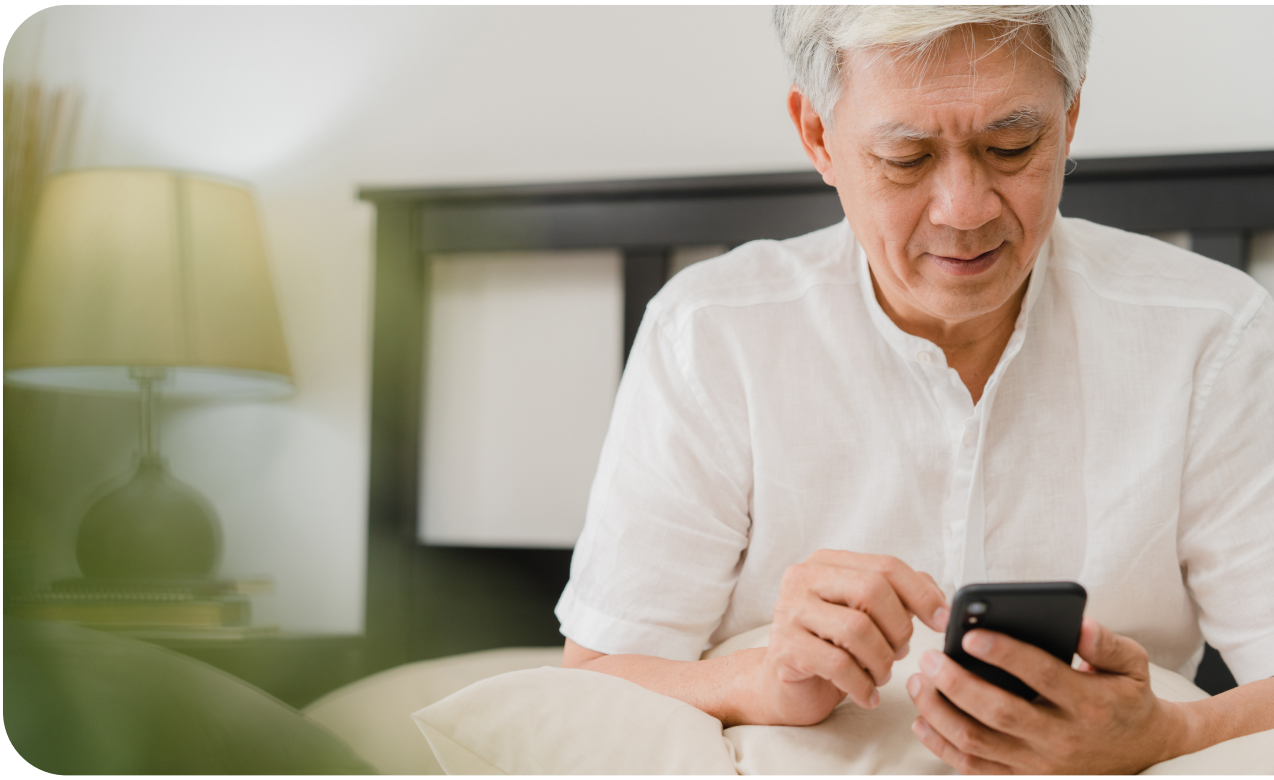
State Machine Diagram: View Album



Data Design

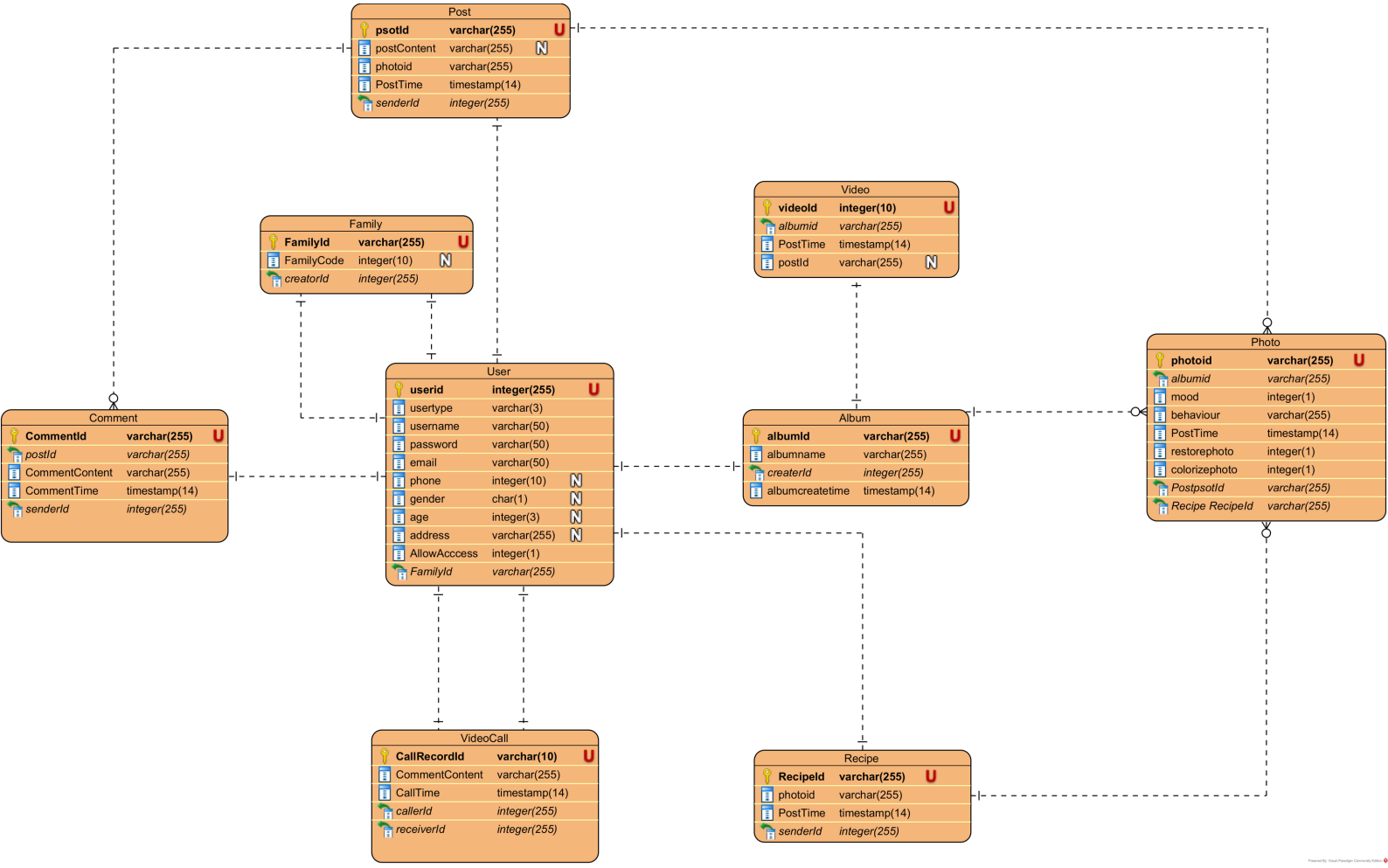
The project first defined the tradition user data for system. User data is typically local data that individuals need to complete their specific tasks. This data is to be kept in the /home file system or in file systems that are created specifically for user data. [26]

In this section, an Entity Relationship Diagram is used to illustrate the relation between data/entities, followed by data dictionaries that have been created for this project.



[26] IBM. (N.D.). WHAT IS COMPUTER VISION? IBM - UNITED STATES. HTTPS://WWW.IBM.COM/HK-EN/TOPICS/COMPUTER-VISION

Entity Relationship Diagram



Data Dictionaries

1. POST TABLE

Post Table						
Element or value display name	**Description**	**Data type**	**Character length**	**Acceptable Values**	**Required? (Function required)**	**Accepts null value?**
postId	The unique Id of each post	varchar	255	"post" + digits + "_" followed by userID	Y	N
postContent	The Content of each post	varchar	255	Don't have any constraint	N	Y
photoid	Unique identifier for the user's uploaded photo	varchar	255	"pic"+digits +"_" followed by userID	Y	N
PostTime	The published time of the post	date	14	YYYY-MM-DD hh:mm:ss	Y	N
senderId	The sender of post	integer	255	digits	Y	N

Data Dictionaries

2. COMMENT TABLE

Comment Table						
Element or value display name	**Description**	**Data type**	**Character length**	**Acceptable Values**	**Required? (Function required)**	**Accepts null value?**
CommentId	The unique Id of each comment	varchar	255	postId + "_" + digits + "_" followed by userID	Y	N
postId	The unique Id of each post	varchar	255	"post" + digits + "_" followed by userID	Y	N
CommentContent	The Content of each comment	varchar	255	Don't have any constraint	Y	N
CommentTime	The published time of the comment	timestamp	14	YYYY-MM-DD hh:mm:ss	Y	N
senderId	The sender of comment	integer	255	digits	Y	N

Data Dictionaries

3. VIDEOCALL TABLE

VideoCall Table						
Element or value display name	**Description**	**Data type**	**Character length**	**Acceptable Values**	**Required? (Function required)**	**Accepts null value?**
CallRecordId	The unique Id of each Video Call Record	varchar	255	"CallRecord" + "_" + digits + "_" followed by userID	Y	N
CommentContent	The Content of each comment	varchar	255	Don't have any constraint	N	Y
CallTime	The published time of the phone call	timestamp	14	YYYY-MM-DD hh:mm:ss	Y	N
callerId	Who launch the video call	integer	255	digits	Y	N
receiverId	Who receive the video call	integer	255	digits	Y	N

Data Dictionaries

4. ALBUM TABLE

Album Table						
Element or value display name	**Description**	**Data type**	**Character length**	**Acceptable Values**	**Required? (Function required)**	**Accepts null value?**
albumId	Id of the album	varchar	255	"album" + digits + "_" followed by userID	Y	N
albumname	Name of the album, which created by the user	varchar	255	digits A-Z a-z	Y	N
createrId	Who create the album	integer	255	digits	Y	N
albumcreatetime	Time of creating the album	timestamp	14	YYYY-MM-DD hh:mm:ss	Y	N

Data Dictionaries

5. PHOTO TABLE

Photo Table						
Element or value display name	**Description**	**Data type**	**Character length**	**Acceptable Values**	**Required? (Function required)**	**Accepts null value?**
photoid	Unique identifier for the user's uploaded photo	varchar	255	"pic"+digits +"_" followed by userID	Y	N
albumid	id of the album, which created by the user	varchar	255	digits A-Z a-z	Y	N
mood	the photo represents which **mood**	integer	1	-1 - 1	Y	N
behaviour	the photo represents which behaviour	varchar	255	"sport" "eating"….	Y	N
PostTime	The published time of the photo	timestamp	14	YYYY-MM-DD hh:mm:ss	Y	N
restorephoto	The file which restored by AI technology	integer	1	0 mean "False" 1 mean "True"	Y	N
colorizephoto	The file which colorized by AI technology	integer	1	0 mean "False" 1 mean "True"	Y	N

Data Dictionaries

6. VIDEO TABLE

Video Table						
Element or value display name	**Description**	**Data type**	**Character length**	**Acceptable Values**	**Required? (Function required)**	**Accepts null value?**
videoId	Unique identifier for the user's uploaded photo	varchar	255	"video"+digits +"_" followed by userID	Y	N
albumid	id of the album, which created by the user	varchar	255	digits A-Z a-z	Y	N
PostTime	The published time of the photo	timestamp	14	YYYY-MM-DD hh:mm:ss	Y	N
postId	The unique Id of each post	varchar	255	"post" + digits + "_" followed by userID	Y	N

Data Dictionaries

7. RECIPE TABLE

Recipe Table						
Element or value display name	**Description**	**Data type**	**Character length**	**Acceptable Values**	**Required? (Function required)**	**Accepts null value?**
RecipeId	Unique identifier for the user's uploaded photo	varchar	255	"Recipe"+digits +"_" followed by userID	Y	N
photoid	Unique identifier for the user's uploaded photo	varchar	255	"pic"+digits +"_" followed by userID	Y	N
PostTime	The published time of the photo	timestamp	14	YYYY-MM-DD hh:mm:ss	Y	N
senderId	The sender of post	integer	255	digits	Y	N
photoid	Unique identifier for the user's uploaded photo	varchar	255	"pic"+digits +"_" followed by userID	Y	N
PostTime	The published time of the post	date	14	YYYY-MM-DD hh:mm:ss	Y	N
senderId	The sender of post	integer	255	digits	Y	N

Data Dictionaries

8. USER TABLE

User Table						
Element or value display name	**Description**	**Data type**	**Character length**	**Acceptable Values**	**Required?**	**Accepts null value?**
userid	Unique identifier	integer	255	digits	Y	N
usertype	Identifier different type of user – "COM" for common user, "NGO" for NGO members, data can be added for expansion	varchar	3	"COM" "NGO"	Y	N
username	Login name for sign in	varchar	50	1-9 A-Z a-z	Y	N
password	String of characters that allows access to system	varchar	50	at least 8 characters at least one lowercase letter, one uppercase letter, one number	Y	N
email	Email for registration	varchar	50	formal email	Y	N
phone	User's phone number	integer	11	digits (start with 852 for Hong Kong Tel)	N	Y
gender	Either of two sexes (male and female)	char	1	"M" or "F"	N	Y
age	The length of user has lived	integer	3	0-200	N	Y
address	Particulars of place where user lives	varchar	255	digits, A-Z	N	Y
AllowAcccess	The permission of allow other members to remote your device	integer	1	0-1	Y	N

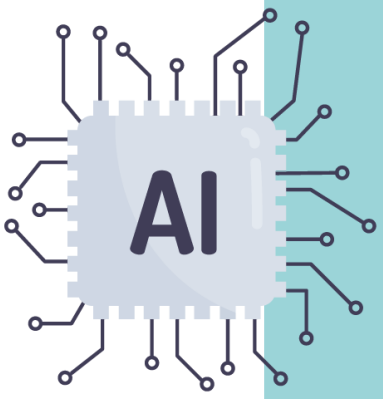
Data Dictionaries

9. FAMILY TABLE

Family Table						
Element or value display name	**Description**	**Data type**	**Character length**	**Acceptable Values**	**Required? (Function required)**	**Accepts null value?**
FamilyId	Unique identifier for the Family Group	varchar	255	"Family"+digits +"_" followed by creatorId	Y	N
FamilyCode	The code of leader invite his/her family member	varchar	255	no constraints	N	F
creatorId	The sender of post	integer	255	digits	Y	N

Role of User

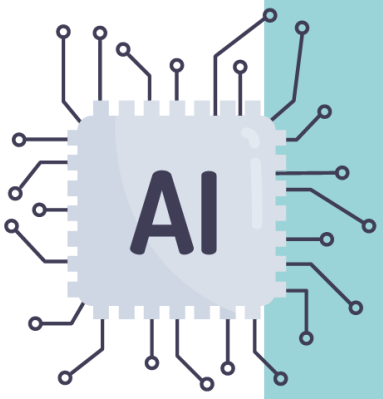
1.ELDERLY



- Primary user (main target audience) of the application.
- User can create an account with the system. User then selects to upload the photo or uses the video call function.
- The user also can create album and write caption of photo.
- User can use the photo restoration / colorization function.

Role of User

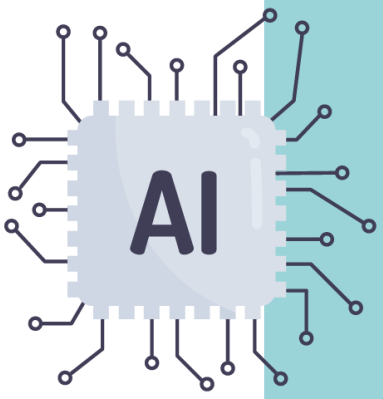
2.FAMILY MEMBER OF USER



- Secondary user of the system. They are linked with the elderly member as family member.
- The user can use all the function same as the elderly.
- Pop up notifications if the sentiment of elderly member in negative sentiment.
- Family member can activate the Drop-in call function to instantly connect with the elderly user.

Role of User

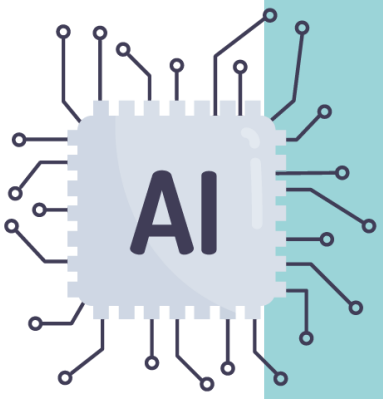
3.STAFFS IN NGO



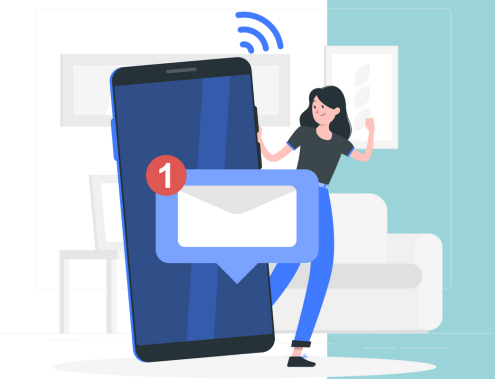
- The sub-target of the application. User can generate statistical report from the system. For instance, the sentiment status of users in community, and activity preference of a month.
- The data provided by the system would be helpful for staffs in NGO to organize events strategically.
- The user can login the desktop platform of ELVIS to activate Face Synthesis function when having a video calling.

Role of User

4.SYSTEM ADMINISTRATOR



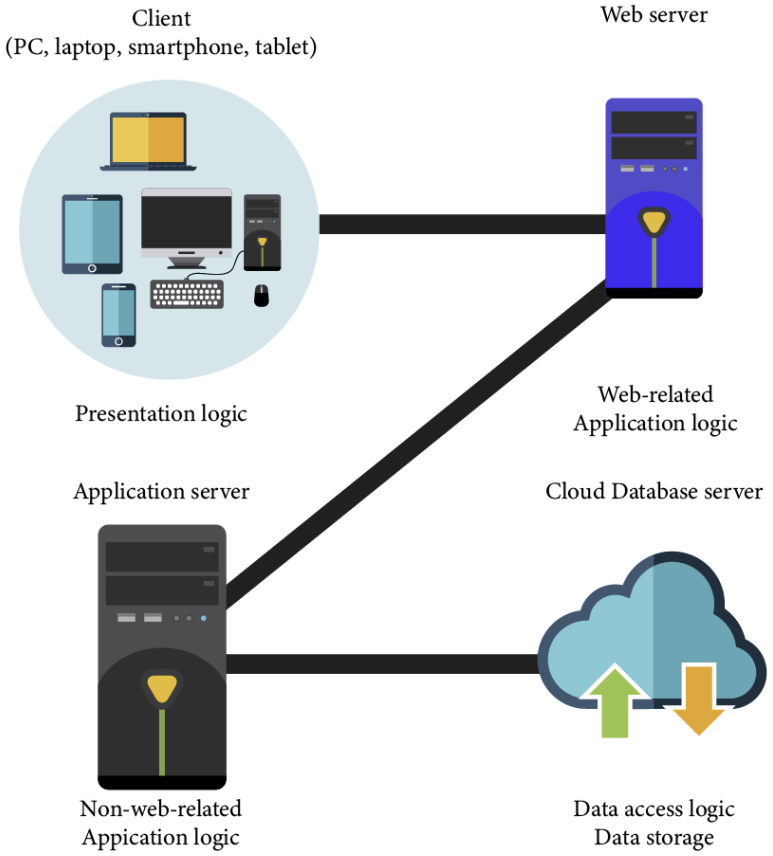
- The operation staff of the system.
- Junior operators have permission to update the data in database and manage user access.
- Senior operators have permission to integrate new applications, such as Skill Sharing or further updates.



SYSTEM ARCHITECTURE

FOUR-TIERED CLIENT-SERVER ARCHITECTURE

A Four-Tiered Client-Server Architecture shall be employed in the proposed system. By separating the processing that occurs, there shall be a better balance to the load on different servers. It is proposed that there will be one Application Server processing the application logic, one Web server for web-related application logic and one Database Server to store customers data and other information. Most application logic and data shall be hosted by the server. The Client, on the other hand, integrates with the presentation layer and accesses the server for application-specific tasks and processing.



Facilities and hardware needed

CLOUD SERVER

A cloud server is required for the storage of use. It is expected that a 10TB Hard Drive Space is required to store the data. Except storage the data, the team also needs to build a backup server, which will be used for recovering the data in case of failure.

SERVER (OWN)

Own servers are used to process user data and operations such as the AI functionalities. Therefore, higher processing speed and higher efficiency is expected. To achieve this goal, the own server must have at least 32 processors and 100GB of memory.

Finally, if the own server cannot maintain the processing speed during peak traffic, then the service will become slow or completely crash. Therefore, there is a high demand for own servers.

Facilities and hardware needed

PCS FOR DEVELOPMENT (DESKTOP, LAPTOP)

As these PCs are required for developing the AI functionalities, high process speed of the PC is expected. Also, multiple development tools (such Adobe XD, TensorFlow) are required. Therefore, there is also a need to install larger SSD to for the tools. Therefore, it is expected that these PCs need to have at least 8 process and 16GB memory to maintain the process speed. 1TB SSD is required to ensure that there was enough space install the application.

PC WITH HIGH-END DISPLAY CARD FOR AI TRAINING

It is the same as the development PC, but the biggest difference of this PC is the quality of the graphics card. Compared with a development PC, a high-quality graphics card can greatly reduce AI training time. Otherwise, because there will be bottleneck and the whole process will be prolonged. In addition, the use of high-quality GPUs can reduce the burden on other devices (CPU, ram). Because the GPU can optimize the target task, so that the PC can process the same task faster and free up the CPU for other tasks.

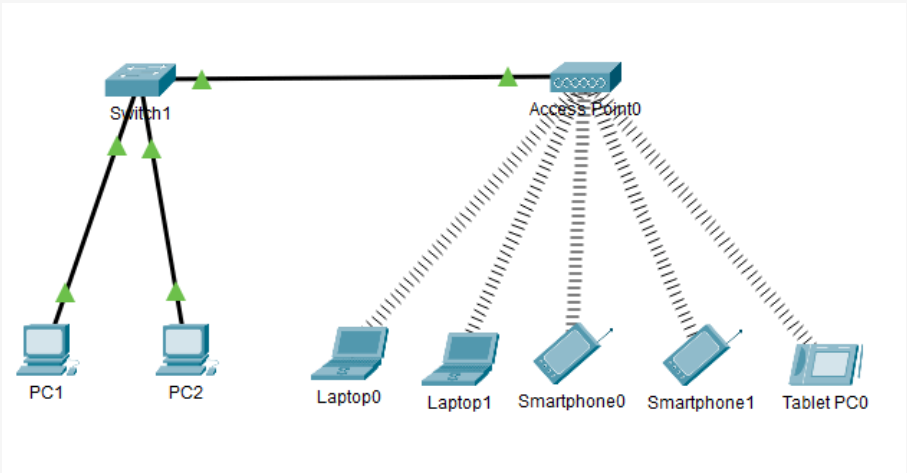
Facilities and hardware needed

ROUTER

The router will be used to connect to the Internet. If there is no router to connect to the Internet and the server, it will prevent the server from cooperating and communicating with other devices. In addition to the router that allows the server to connect to the Internet, the router will also create a local area network for project team's internal communications. Finally, the router can also provide security for ELVIS servers. The router will have firewall and content filtering functions, all of which can reduce the percentage of malware and the number of server failures faced.

SWITCH

Regarding the switch, it is used to create an Ethernet. Using a switch to create an Ethernet has the following advantages. First, the switch can connect a large number (> 30) of devices to create an Ethernet. Compared to a router, a router only allows less than 10 devices to connect. Second, the switch can control the access area of each device. The switch can also monitor usage. For example, if the administrator notices abnormal usage in the log, further investigations will be required.



Facilities and hardware needed

TESTING DEVICES

Regarding the test equipment, when the application is fully developed, equipment will be used to test the application.

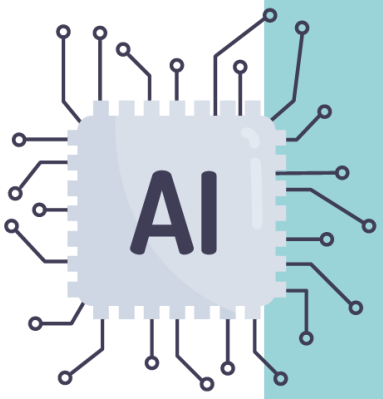
The equipment will include:

- IOS mobile phone/tablet
- Android mobile phone/tablet
- PC

In this section, the project team will test the application for the following issues:

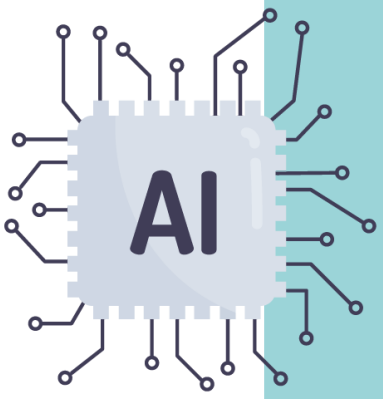
- Did the application crash during testing?
- Is there any error message during the test?
- Is the interface displayed properly?
- Can this function be used properly?

Hardware of solution



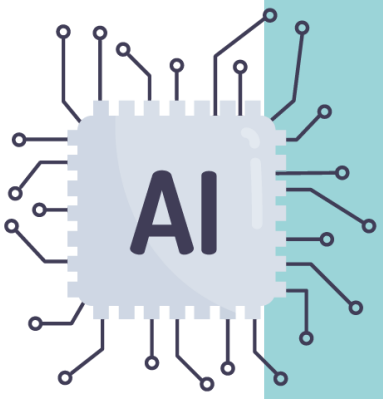
Hardware	Specification	Purpose
I9-11900 PC	**Motherboard:** GIGABYTE GA-Z590 AORUS ULTRA Z590, DDR-4, LGA 1200, Intel 2.5Gb Lan, USB3.2 Gen2, WIFI ax ATX M/B BOA005723 **CPU:** Intel 8 Cores 16 Threads Core i9-11900 Rocket Lake (2.5GHz,16MB Cache, LGA 1200,14nm) CPU BOX CPU001458 **RAM:** ADATA 16GB Kit AX4U320088G16A-DCBK20 3200MHz XPG GAMMIX D20 DDR4 (2x8GB) RAM006071 **HDD:** Toshiba DT01ACA100 1TB SATA3 6Gb/s /32MB HDD HDD001985 Power Supply: GIGABYTE AORUS P850W 850W 80Plus GOLD Full Modular (GP-AP850GM) POW001961 **Metal Case:** be quiet! BGW35 PURE BASE 500 Window White MID-Tower Case, 2 preinstalled Pure Wings 2 140mm fans CAS003735 **SSD:** Samsung 500GB 980 SSD M.2 2280 MZ-V8V500BW PCIe 3.0 x4, NVMe 1.3 SSD SSD001980 **Display Card:** ASUS TUF-RTX3060-O12G-V2-GAMING RTX3060 12GB GDDR6 OC Editon (DI-E3L60Y1) VGA005707	1. **Training AI model:** ASUS RTX-3060 offers a stable environment for AI model training 2. **Programming:** ADATARAM support programmer doing multitasking tasks 3. **Storing source data:** 1TB storage for saving the source data of the application such as icons, images, codes.

Hardware of solution



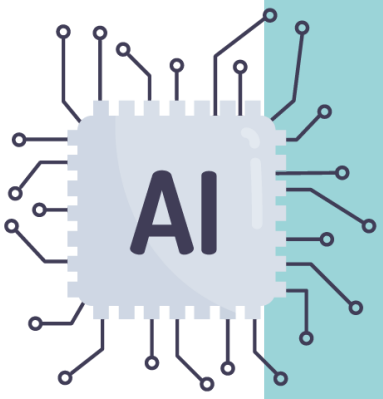
Hardware	Specification	Purpose
Lenovo X13G2	**CPU:** 11th Generation Intel® Core™ i5-1135G7 Processor (4 Cores / 8 Threads, 2.40 GHz, up to 4.20 GHz with Turbo Boost, 8 MB Cache) **RAM:** 8GB Soldered LPDDR4X 4266MHz **SSD:** 256 GB M.2 2280 SSD NVME TLC OP **Display Card:** Integrated intel Iris Xe Graphics **Wireless:** Wi-Fi 6 AX201 11AX(2x2) Bluetooth 5.0	1. **Present application:** Portable device is needed for presentation 2. **Process Simple AI Model:** Demonstrate the AI function of the application
Samsung Galaxy S21	**CPU:** Octa-core (1x2.9 GHz Cortex-X1 & 3x2.80 GHz Cortex-A78 & 4x2.2 GHz Cortex-A55) **GPU:** Mali-G78 MP14 - International **Memory:** 128GB 8GB RAM, 256GB 8GB RAM **Platform:** Android 11, One UI 3.1	1. **Test application:** Project team tests the application on android platform

Hardware of solution

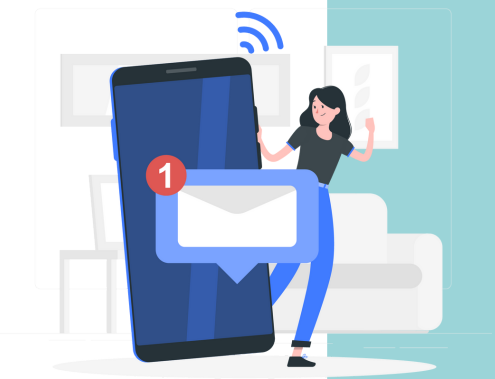


Hardware	Specification	Purpose
Uninterruptible power supply	**Input capacity:** 240W **Input voltage range:** 24 VDC±10% **Input maximum current:** 11.7A **Rated output voltage:** 10A **Switching time:** Uninterrupted **Output voltage:** 24 V±5% **Backup time (25°C, initial characteristics):** 6 min. (240 W) **Dimensions (W × D × H mm):** 148 x 100 x100	1. **Prevent damage from power loss and common electric occurrences:** Ensure that during power outage, network device continues to run.

Hardware of solution



Hardware	Specification	Purpose
AX3000 Dual Band Gigabit Wi-Fi 6 Router	**Standards:** Wi-Fi 6 IEEE 802.11ax/ac/n/a 5 GHz **WIFI Speeds:** 5 GHz: 2402 Mbps (802.11ax, HE160) **Processor:** Dual-Core CPU **Ethernet Ports:** 1x Gigabit WAN Port 4x Gigabit LAN Ports	1. **Connect to internet:** Connect computers and other devices to the Internet
HD Webcam C310	**Feature:** Widescreen HD 720P Video Calls 30 Frames Per Second Built-in Noise Reducing Mic Adjusts To The Lighting Condition Firmly Fixed	1. **Video Call function testing:** Video Capturing for the video call function

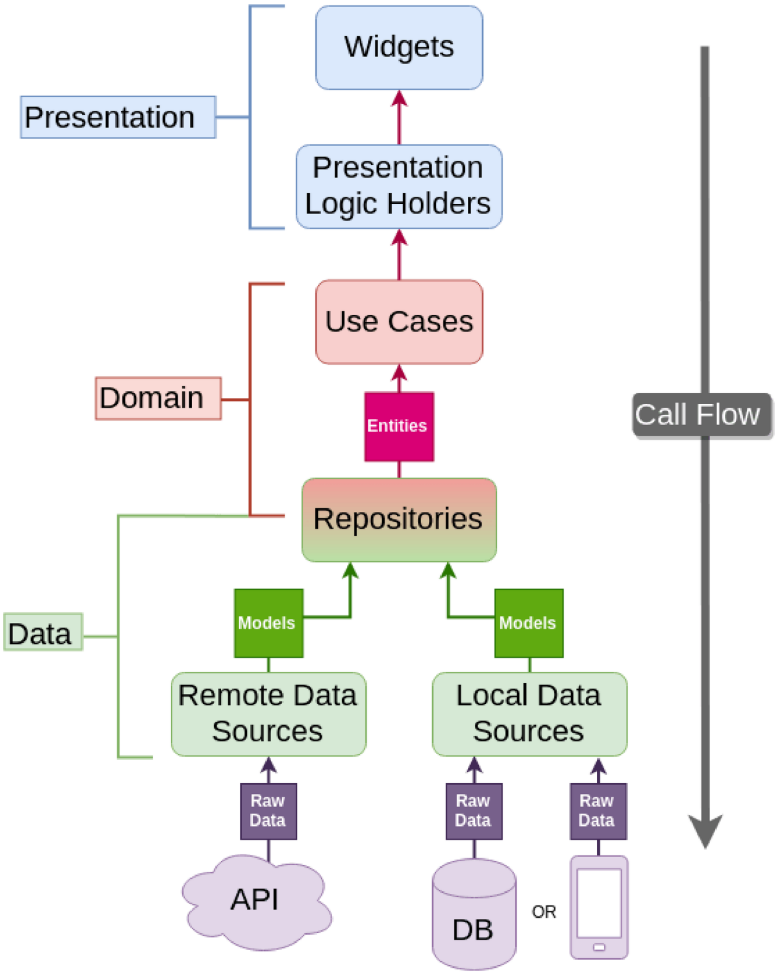


IMPLEMENTATION LANGUAGE, SOFTWARE & ALGORITHMS

DART (LANGUAGE) / FLUTTER (FRAMEWORK)

- This project primarily uses the programming language Dart with support of the Flutter framework to materialize cross platform development (Smartphones: iOS, Android; and desktop: Web).

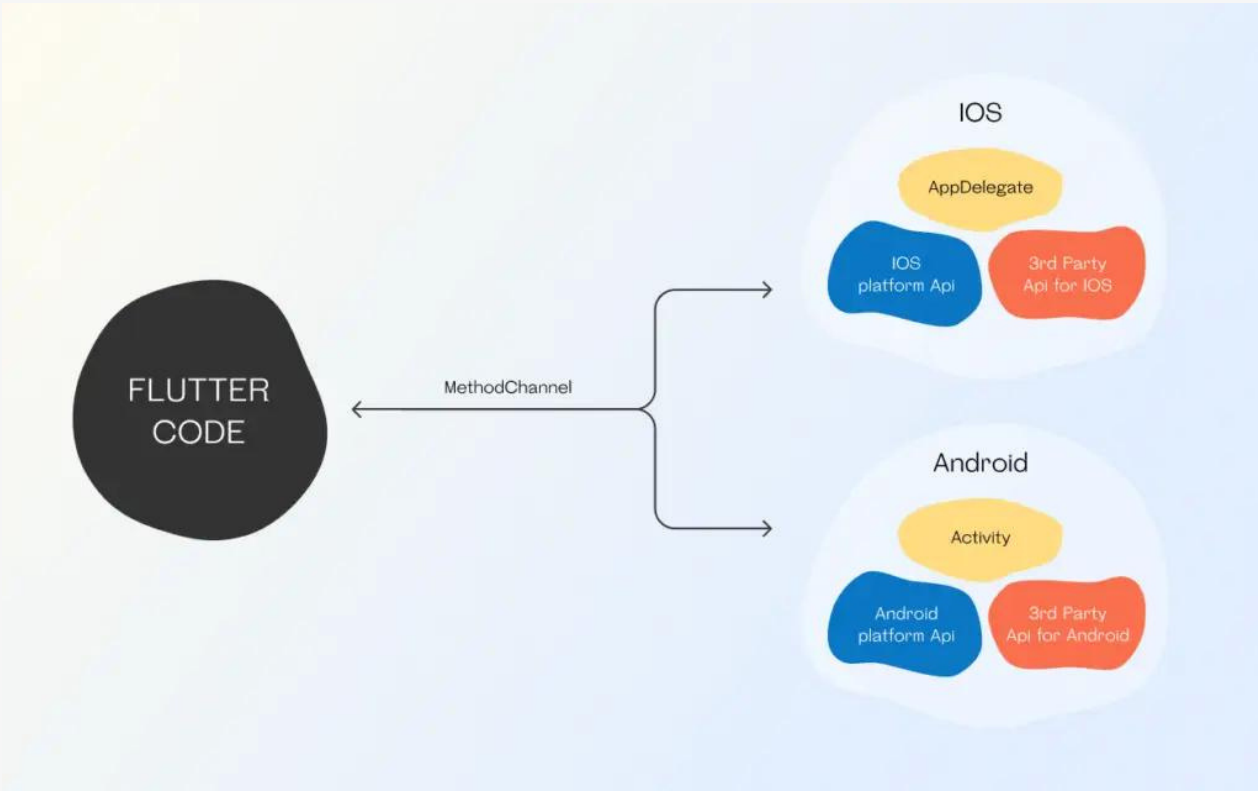
- Dart is a relative new programming language (comparing to C# or Java, for instance), while Flutter is an open-source UI software development kit for Dart with an aim to enhance the functionality of Dart language.



IMPLEMENTATION LANGUAGE, SOFTWARE & ALGORITHMS

ANDROID STUDIO FOR ANDROID/IOS DEVELOPMENT WITH DART

- All members of the project team are trained with the use of Android Studio.
- Dart and Flutter is also officially supported through installing relevant SDK for the IDE.



IMPLEMENTATION LANGUAGE, SOFTWARE & ALGORITHMS

VISUAL STUDIO CODE FOR WEB DEVELOPMENT

- The team shall use VS code for web development.
- The project team was trained with Brackets, but it is discontinued starting from Sept 2021.
- Brackets users are encouraged to switch from Brackets to VS code with certain plugins installed to inherit the functionality of Brackets (e.g. Live Preview and CSS editing functionality).
- Therefore, the lightweight editor by Microsoft became first choice of the team. Flutter editability is also made possible by installing extensions.
- Therefore, VS code shall also be used for minor editing when necessary.

IMPLEMENTATION LANGUAGE, SOFTWARE & ALGORITHMS

XCODE FOR IOS DEVELOPMENT (SECONDARY)

- While Android Studio has been chosen as the main IDE, Xcode shall be used as a secondary development tool for this project, for two reasons.

- Firstly, the primary language to be used in this project is Dart, rather than Objective-C or swift. As such, it is not necessary to use Xcode extensively in this project.

- Secondly, not all members of the team own a Mac which is the required device to install Xcode.

- In this light, Android Studio is preferred over the native environment to enable capability of code editing for all members.

- For sure, it is acknowledged that Xcode might be required on some occasions as it is the native environment for iOS development.

- Therefore, team members with Mac devices shall have Xcode installed as a secondary tool to handle such occasion.

IMPLEMENTATION LANGUAGE, SOFTWARE & ALGORITHMS

TENSORFLOW FOR AI TRAINING

- TensorFlow is an open-source platform for machine learning and artificial intelligence.
- Thanks to the open-source nature of TensorFlow, the project team could use the application for free, and thus lower the maintenance cost.
- In this project, TensorFlow shall be used to build the AI-enabled suggestion function system.
- TensorFlow supports programming language Python for model training.
- Fundamental knowledge on Python has previously been acquired by the project team and further workshops and seminar on data science as well as machine learning has been arranged to further enhance the ability to write python programs.
- As a result, AI training could be performed at ease.

IMPLEMENTATION LANGUAGE, SOFTWARE & ALGORITHMS

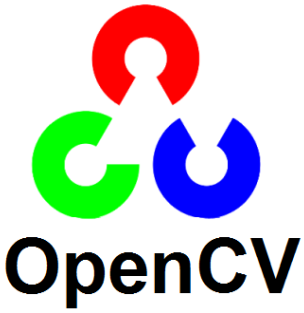
YOLO X DARKNET

- You only Look one, or more commonly known as YoLo, is a real-time object detection system developed upon the open-source neural network framework Darknet.
- It is expected that the proposed system shall use both YoLo and Darknet to made possible the real-time detection for object detection and sentimental analysis.
- Regarding the YOLO algorithm, which is used to detect objects in the proposed project, the main purpose of which is to detect photo objects and analyse the operations or activities that the customers are doing as shown in the image.
- For example, when AI detects a human in the sea in the photo, the AI model may analyse and conclude that the individual is swimming.
- In addition, face detection could also be performed when using this algorithm, to detect whether the user is happy or sad, i.e., having a sentimental analysis of the photo, and classifying the photos in groups for further actions.
- For instance, caretakers shall be able to view which elderly looked sad in the photo and could contact him/her when deemed necessary. Including the use darknet could also enable the project team to easily enhance the functionality of the proposed system, thanks to its open-source nature and thus a huge library ready to be used.

IMPLEMENTATION LANGUAGE, SOFTWARE & ALGORITHMS

OPENCV

- OpenCV is a computer vision library for image recognition, computer vision and model recognition.
- In this project, OpenCV shall be used to make the AR field functionality possible. It is expected that some graphics (e.g., direction or guidance) could be drawn live on the screen during a video call, which is one of the examples of using AR in our project.
- In addition, the application is a cross-platform one: Windows, MacOS and Linux are also supported.
- Last but not least, OpenCV is free even when using the business area, so the production cost of the proposed system could be lowered.



IMPLEMENTATION LANGUAGE, SOFTWARE & ALGORITHMS

VISUAL PARADIGM

- Visual paradigm is a handy tool to model information system and manage development processes, building upon industry standards such as Unified Modelling Language (UML).
- It is particularly useful for the project team as its built-in function offers code engineering design.
- For example, with the help of visual paradigm, model can be generated automatically with program code (such SQL, C#).
- In this project, there shall be various components that required to be illustrated in charts or diagrams.
- Examples: UML modelling design, database structure and operation process etc.

IMPLEMENTATION LANGUAGE, SOFTWARE & ALGORITHMS

ADOBE SOFTWARE

Adobe XD

- Developed by Adobe, XD is a professional user experience (UX) design tool for web apps and mobile apps.

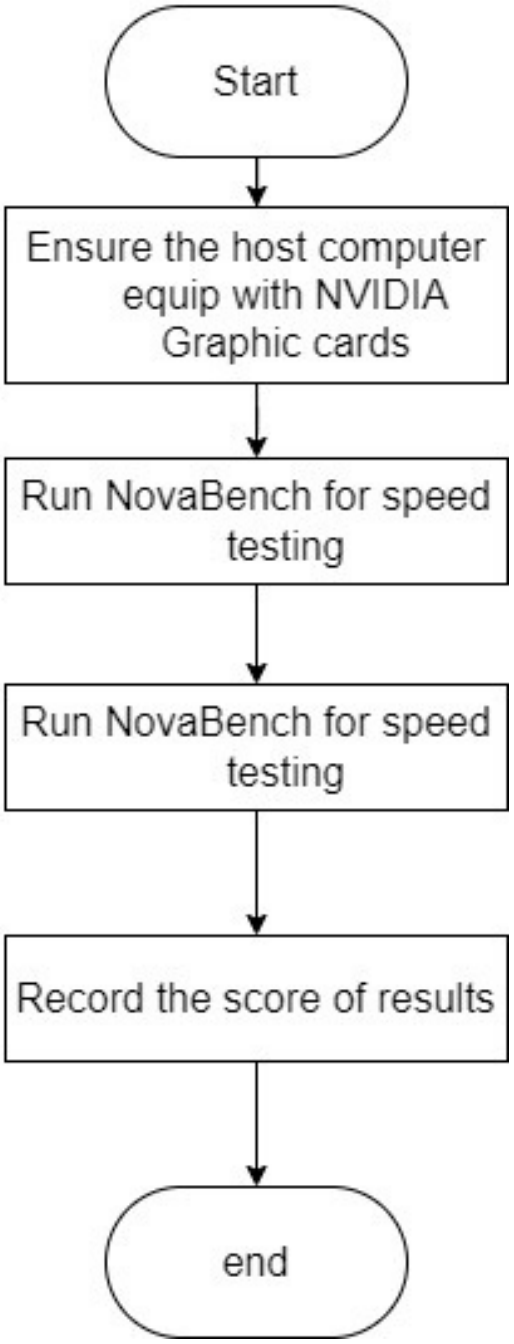
- It is expected that XD will be used in the early stage of the development cycle in order to create UI/UX design of the ELVIS app rapidly.

Other Adobe Software

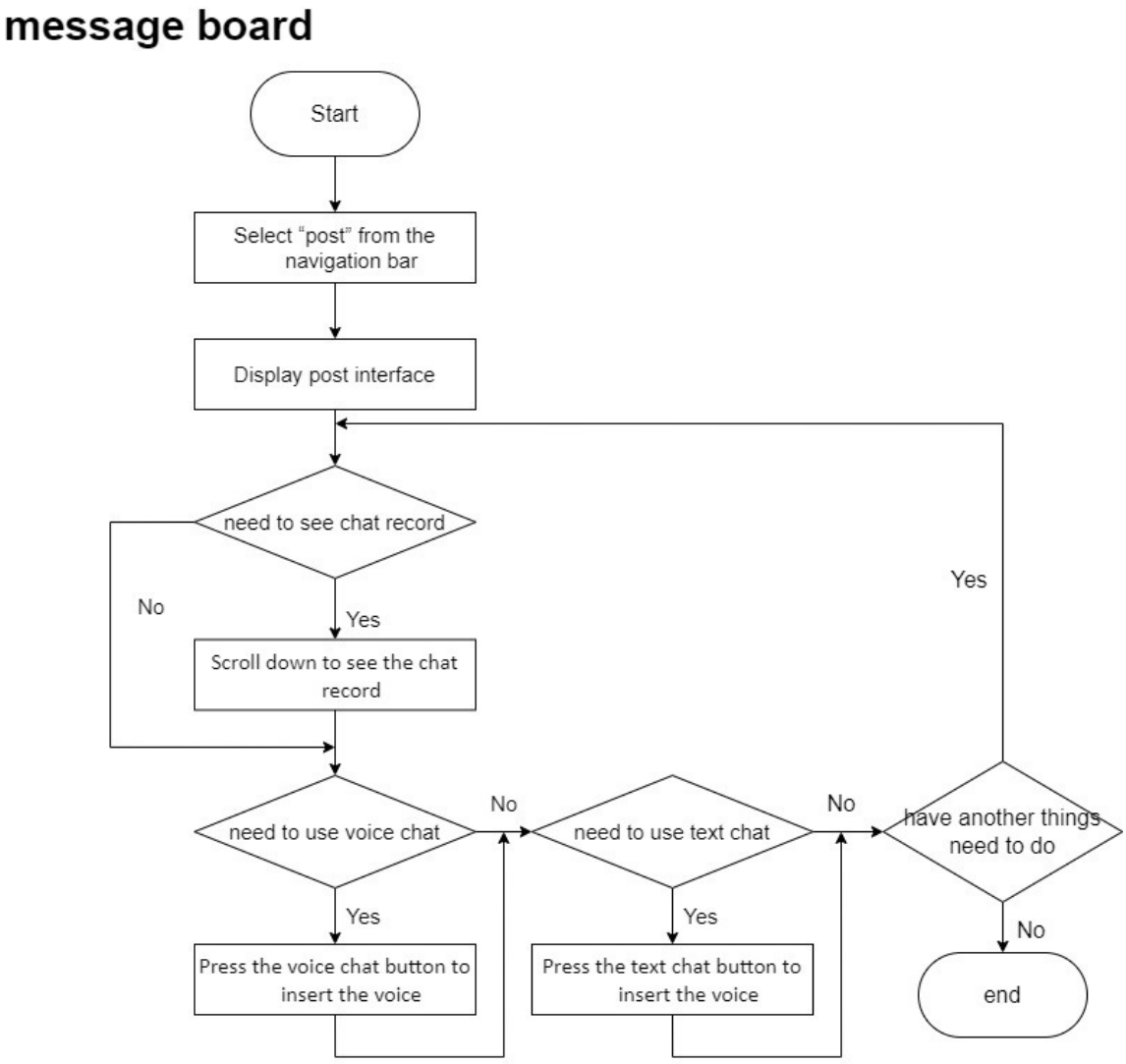
- Other adobe software shall also be used throughout the development cycle.
- It is expected that Illustrator shall be used at the very beginning of the development cycle to create a general idea of the overall brand image of the system.
- Photoshop, together with illustrator, is expected to be very useful during the stage of prototyping as various images (such as icons) shall be designed, redesigned, and eventually be implemented in the actual system.
- At later stage of the production cycle, InDesign and InCopy shall be used to produce text-based promotional materials while Premiere Pro and After Effect be used for moving image production.
- Adobe Creative Cloud Licenses have been acquired through the sponsorship of the Innovation and Technology Co-creation Centre (ITCC).

Procedural design: Post

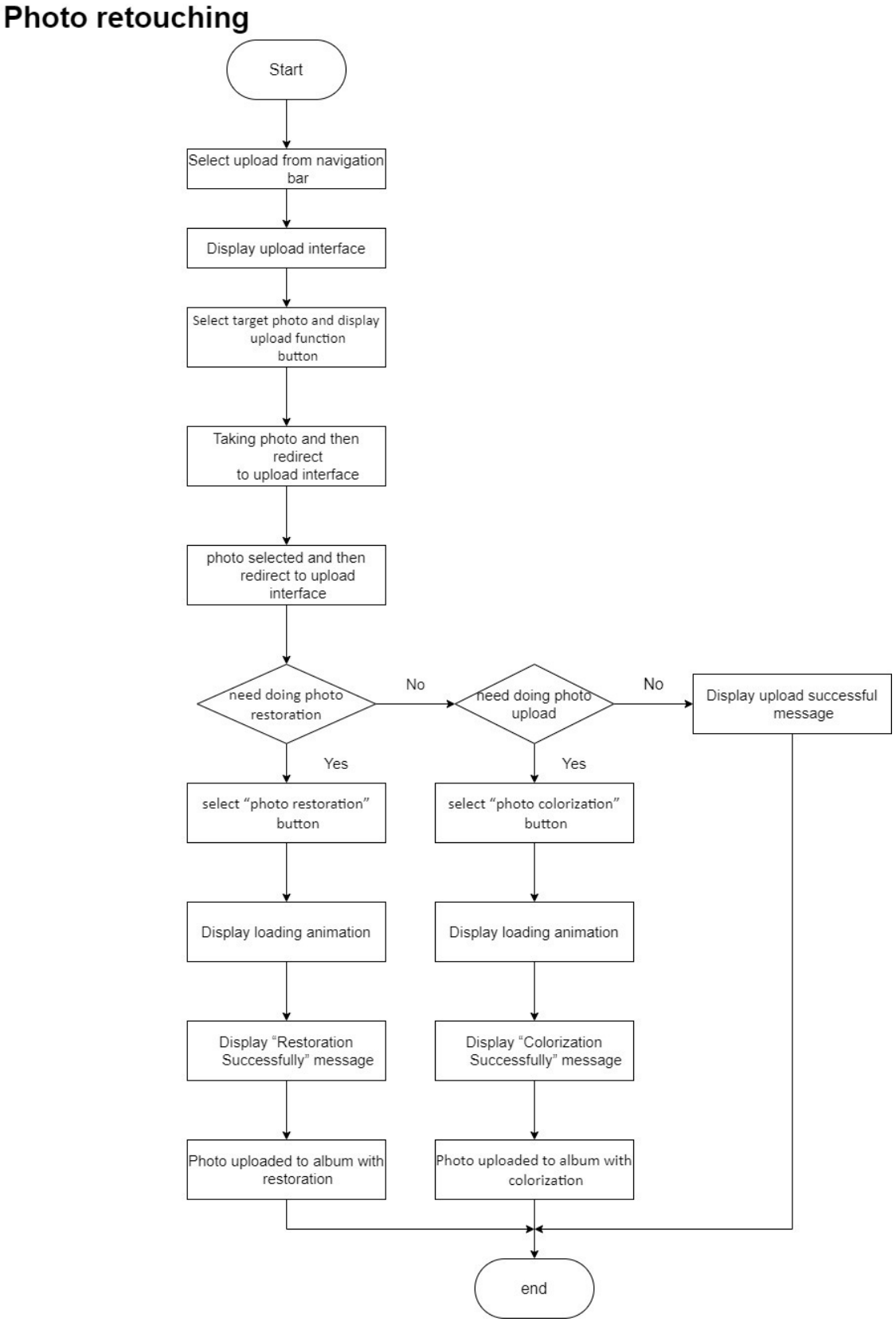
Face synthesis



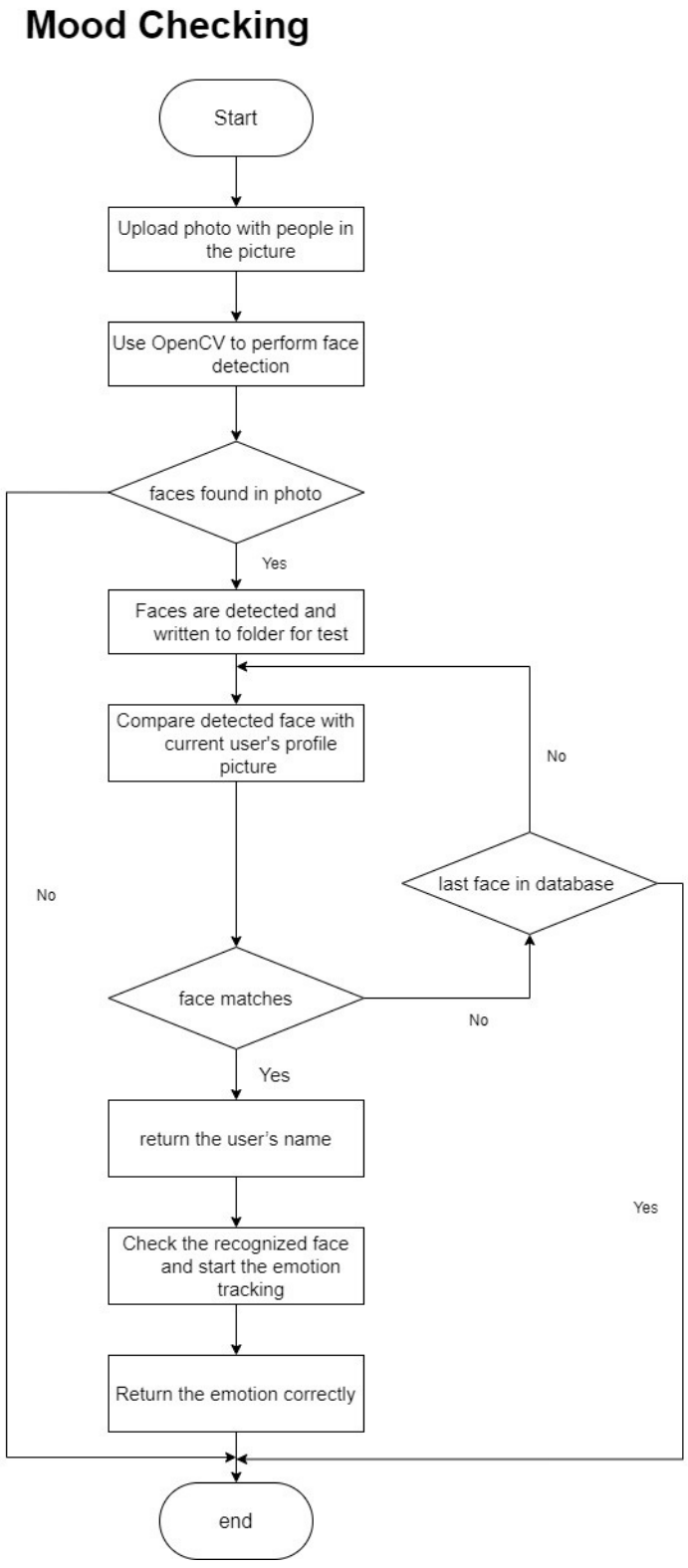
Procedural design: message board



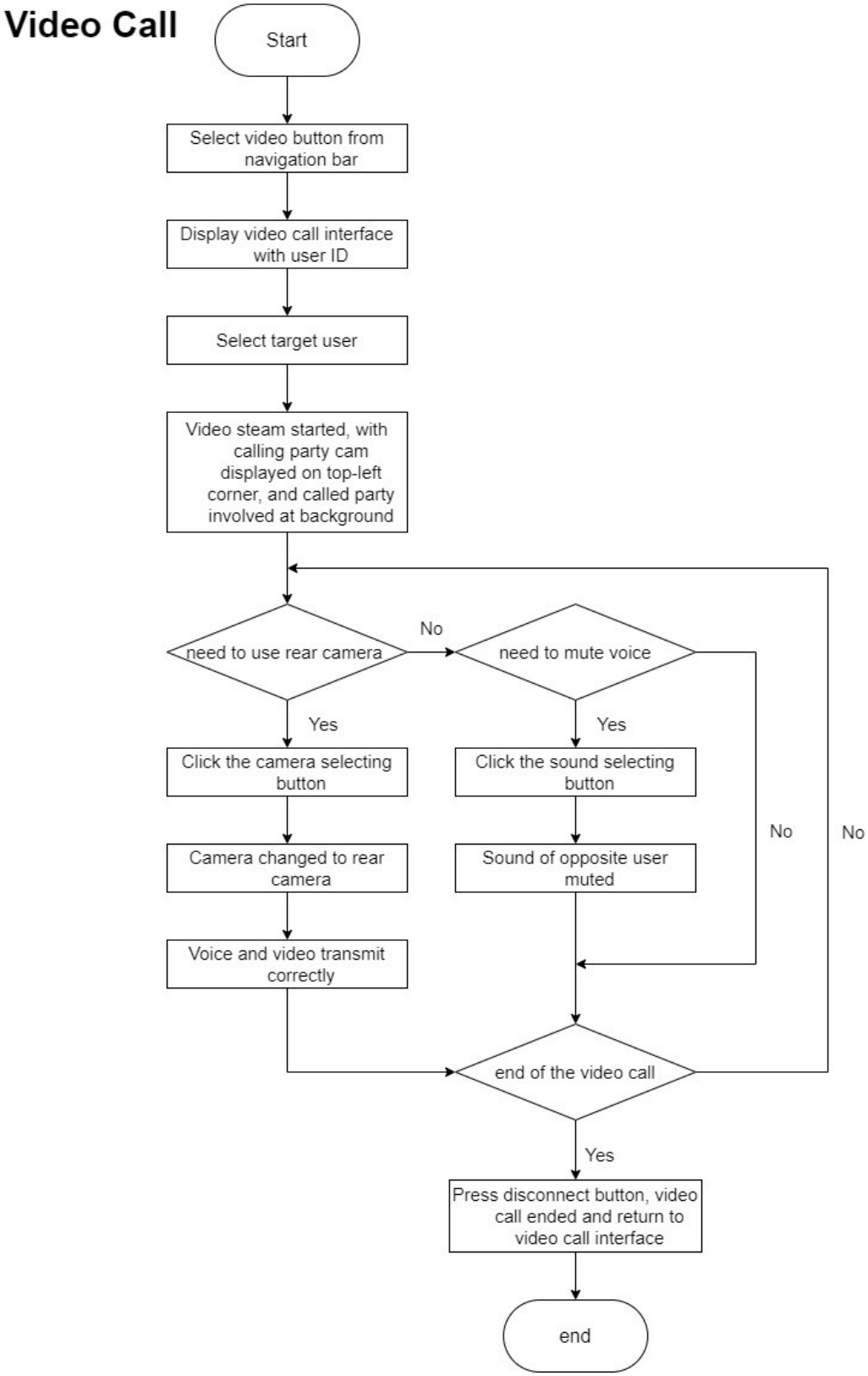
Procedural design: Photo retouching



Procedural design: Mood Checking

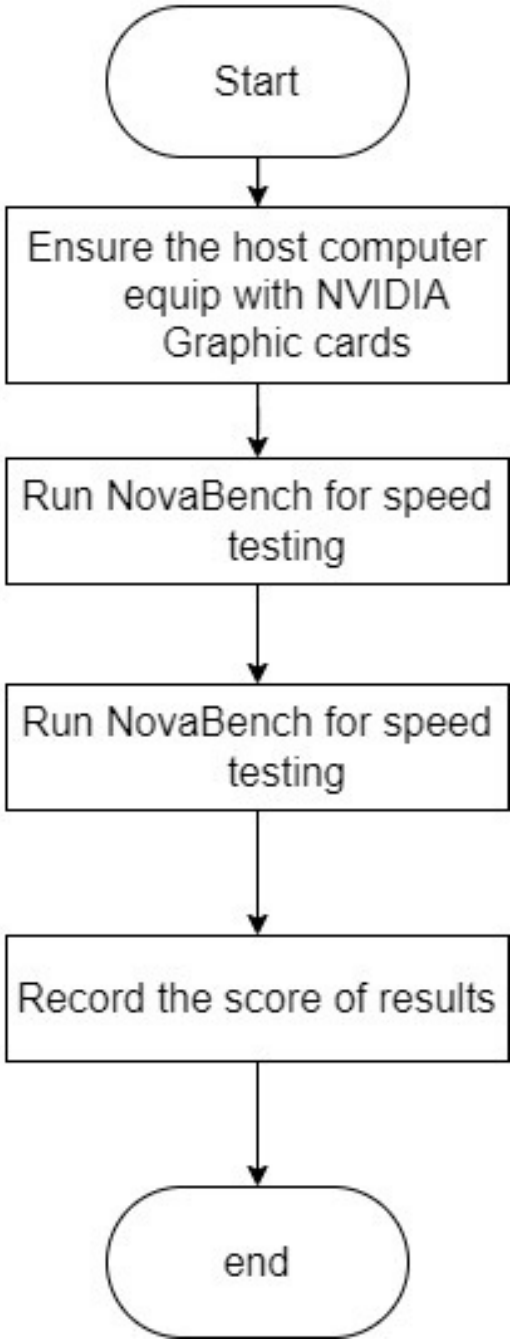


Procedural design: Video Call



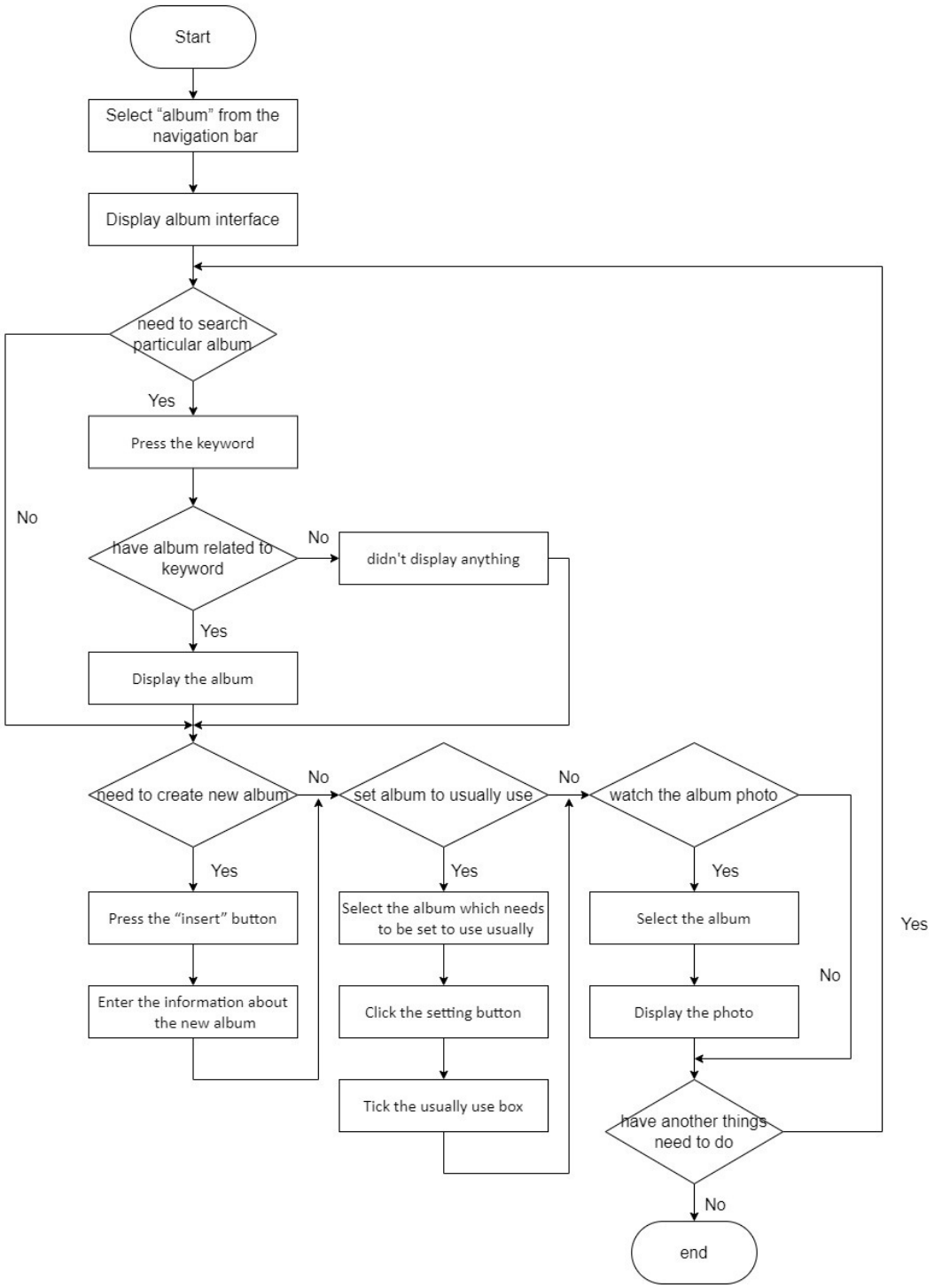
Procedural design: Face synthesis

Face synthesis



Procedural design: Album

Album



User Interface Design

In this section, the user interface design concepts of the current prototype will be introduced.

As ELVIS aims to be used largely by elderly, there are several barriers and/or points to note in designing the mobile interface.

According to Lau et al. (2013), existing smartphone applications such as social media, making telephone calls, taking photographs and complicated menu could be hard to use for the elderly.[27] This is mostly due to the fact the the size of the words and figures are too small for elderly to read.

Therefore, the project team makes reference to existing mobile application designed for elderly (e.g. HKTV mall elderly version) and the suggestion made by Lau et al. (2013) to come up with the current design of the application.

[27] LAU, C., YEE, H., NG, T. & FONG, B. (2020). THE ADOPTION OF SMARTPHONE AND SOCIAL MEDIA AMONG ELDERLY (CAHMR WORKING PAPER SERIES NO. 1, ISSUE 2, 2020). HONG KONG: THE HONG KONG POLYTECHNIC UNIVERSITY, COLLEGE OF PROFESSIONAL AND CONTINUING EDUCATION, SCHOOL OF PROFESSIONAL EDUCATION AND EXECUTIVE DEVELOPMENT, CENTRE FOR AGEING AND HEALTHCARE MANAGEMENT RESEARCH. RETRIEVED AUG 8, 2020 FROM HTTP://WEBLIB.CPCE-POLYU.EDU.HK/APPS/WPS/ASSETS/PDF/CW20200201.PDF

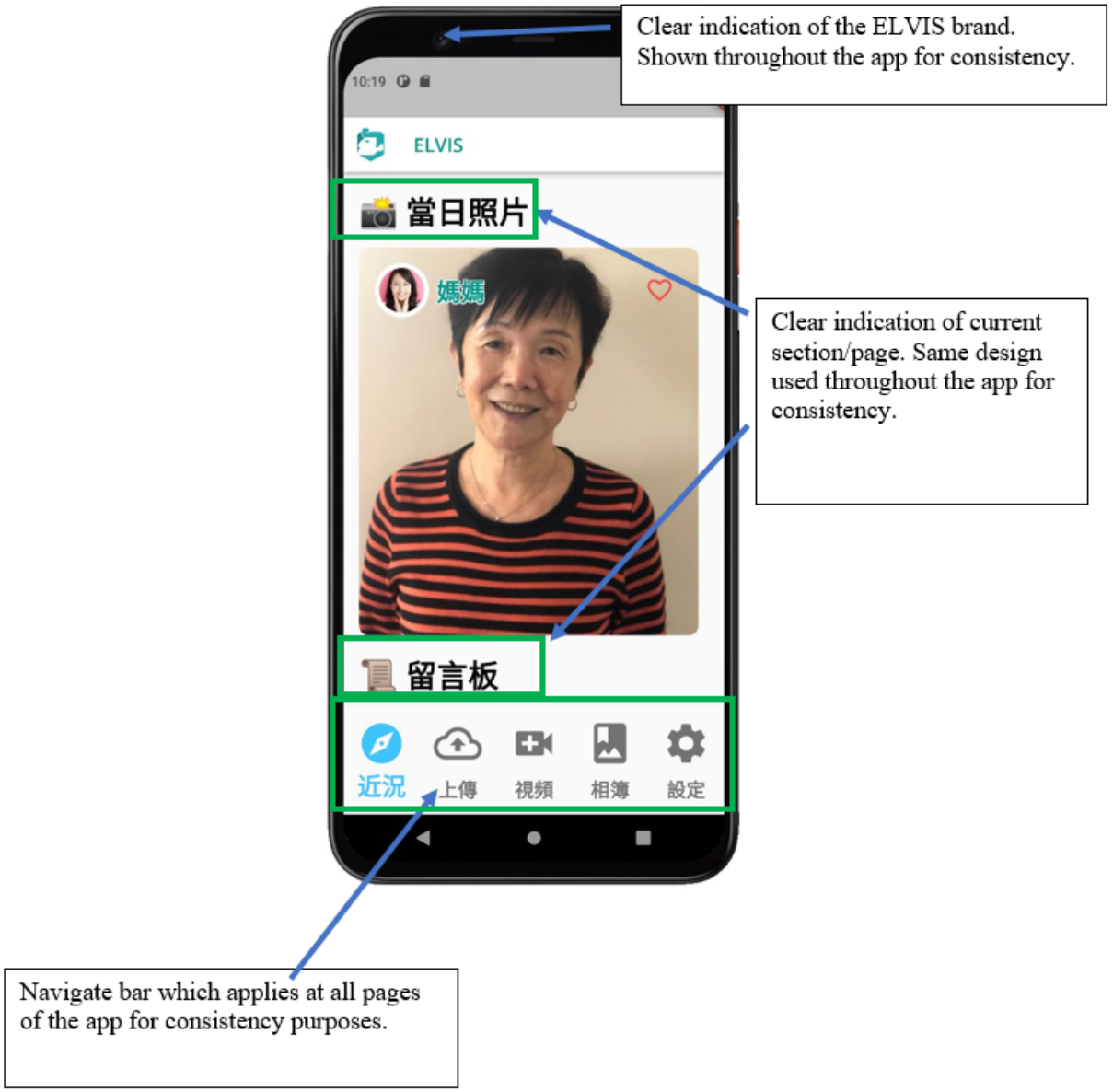
User Interface Design

The project team eventually comes up with the following idea to enhance usability and user experience:

(1) Use of Consistent Design,
(2) Use of Large Icon as button,
(3) Use of Emoji,
(4) Use of Contrasting Colours and
(5) Use of Animations.

User Interface Design: Use of Consistent Design

- Consistency of visual design and organization have also been applied to ELVIS.
- The application uses a consistent color tone across all functions to avoid confusion.



User Interface Design: Use of Large Icon as button

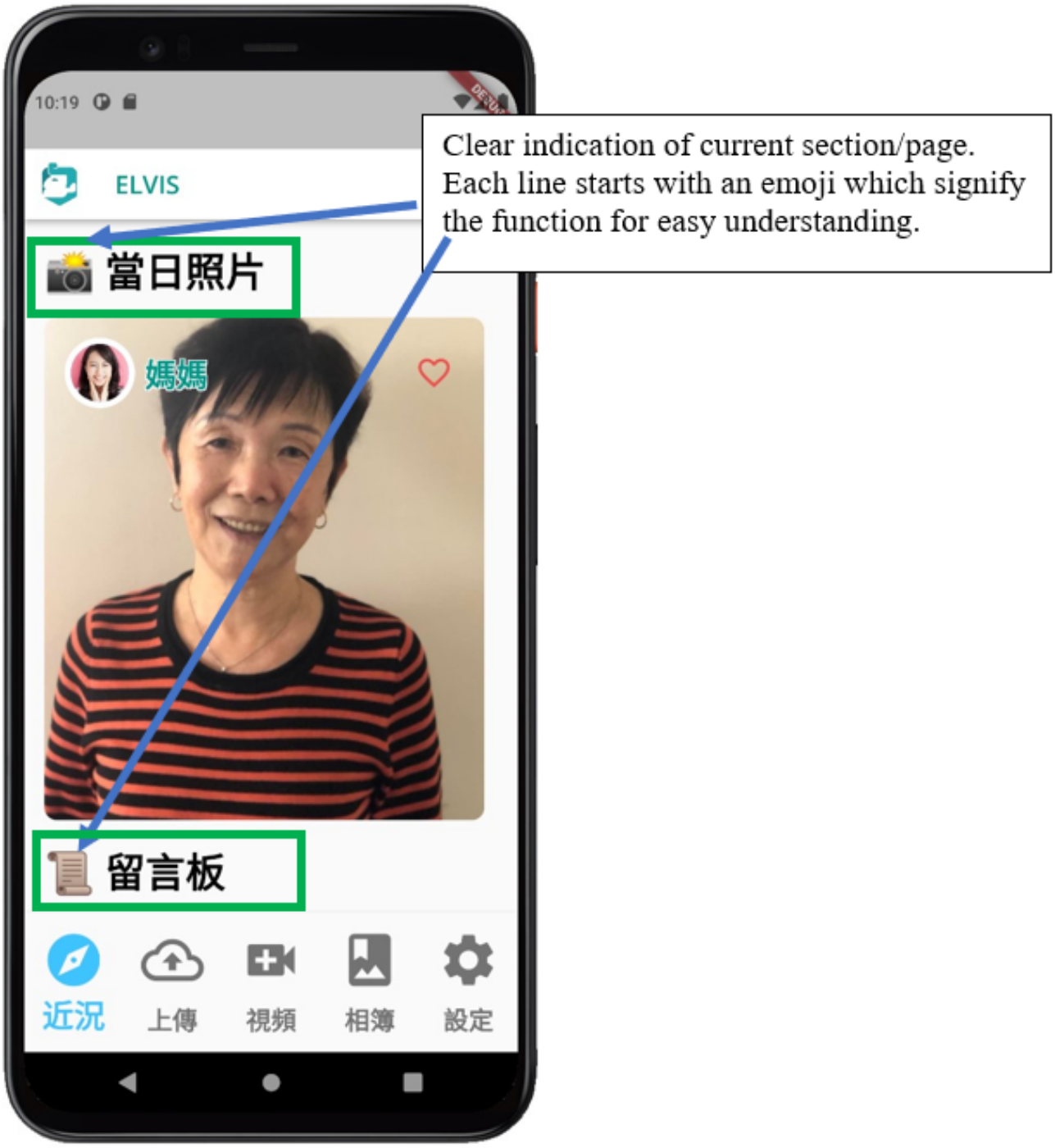
- All the functions are designed with a task-oriented organization.
- The user can select the function in the function list and as a result, the user can select the function efficiently, and that operating efficiency is improved.

User Interface Design: Use of Large Icon as button

- All the functions are designed with a task-oriented organization.
- The user can select the function in the function list and as a result, the user can select the function efficiently, and that operating efficiency is improved.

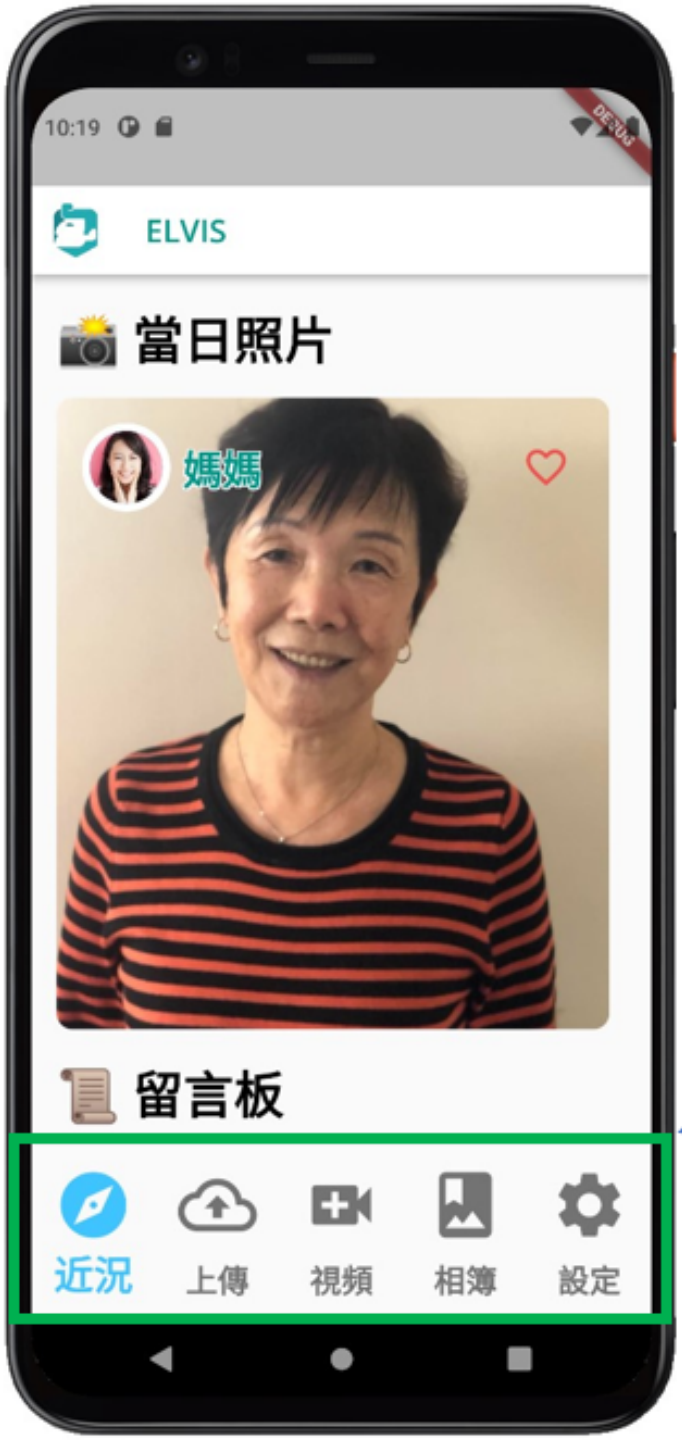
*User Interface Design: Use of Emoji as metaphors

- By using emojis which signify the function, it is hoped that the elderly can easily relate a difficult or more abstract concept to a familiar one



User Interface Design: Use of Contrasting Colours

- It is believed that the use of contrasting colour code can emphasize the logical organization of information



The light blue colour signifies currently chosen function. Change upon navigation.

User Interface Design: Use of Animations

- By using animation which signifies the function, it is hoped that the elderly can easily relate a difficult or more abstract concept to a familiar one

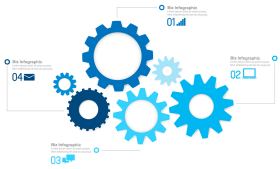
The image in the card is animated, so the elderly can identify their respective function by simply looking at the animations.

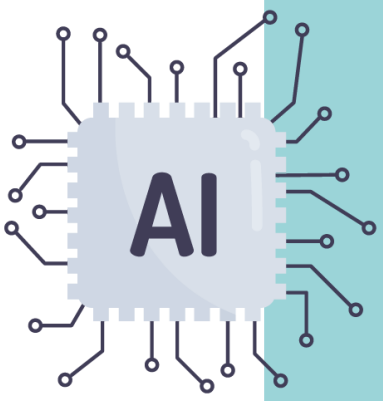
Feasibility Study

In this section, a preliminary analysis on the relevant factors of the projects, namely **technical**, **organizational**, and **economical** factors, will be considered to ascertain the likelihood of completing the project successfully.

Technical Feasibility

1.RISK REGARDING FAMILIARITY WITH THE TECHNOLOGY IS LOW:

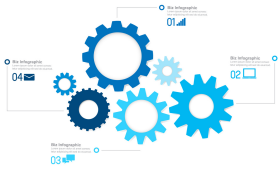




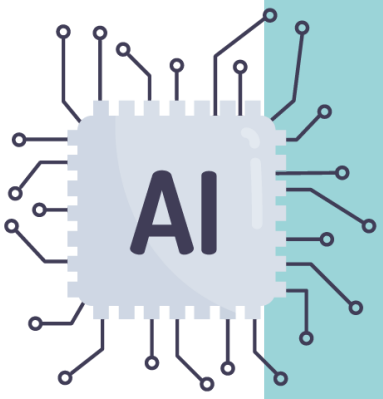
- Members of the project team have considerable experience in web and mobile application development.
- Members have practical experience on AI technologies.
- Dart has been chosen as the main programming language for project. The language is developed is developed by Google and thus is easily compatible with the firebase service, also from Google, to be used in the implementation of the system.
- The language written in C-style syntax, which the project team has prior knowledge on. It's believed that the project team could handle the language in s short time.

Technical Feasibility

2.RISK REGARDING ELDERLY'S FAMILIARITY WITH SOCIAL MEDIA APPLICATION IS LOW:



- Government statistics showed that elderly or people aged 45 above have caught up rapidly in their media participation, with a rate rising from 50% in 2014 to 78% in 2018.[28]



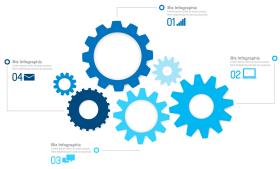
- Another research, by Lingnan University, showed that one of the main obstacles for elderly to use latest technology is that there is no one teaching them how should they be used. Therefore, user guides in video format and live chat during service hours will be provided.[29]

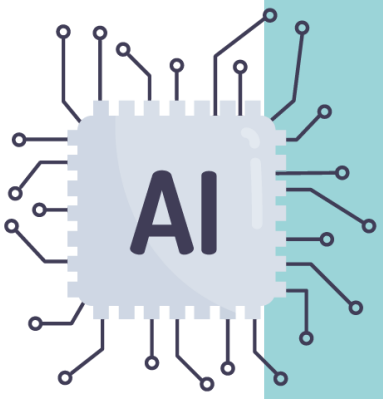
[28] RESEARCH OFFICE, HONG KONG LEGISLATIVE COUNCIL. (2018). "SOCIAL MEDIA USAGE IN HONG KONG". RETRIEVED IN 14 NOV 21.

[29] HTTPS://WWW.LN.EDU.HK/APIAS/GERONTECHNOLOGY/EN/ABOUT.HTML

Technical Feasibility

3.THE PROJECT SIZE IS CONSIDERED LOW-MEDIUM RISK:





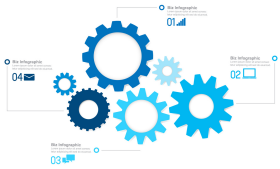
- The project forms part of the city-wide Smart District Project co-organized by Hong Kong General Chamber of Commerce (HKGCC), Hong Kong Productivity Council (HKPC) and the Vocational Training Council, therefore the scale of the project might seem to be large at first glance.

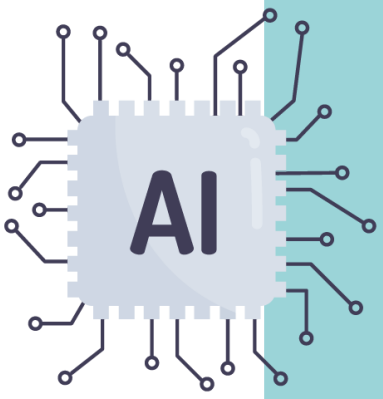
- However, support from supervisors and tutors at schools, and mentors from the industry is sufficient. HKGCC and HKPC will also be involved in the process of linking up the project with industry partner.

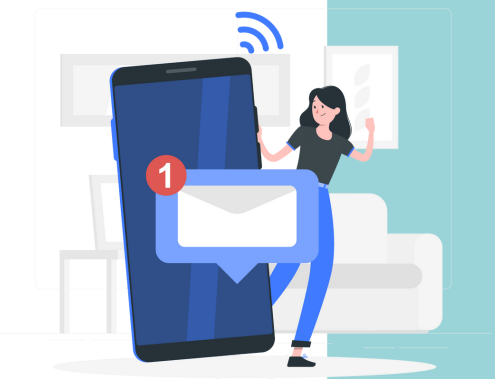
- Although the project time frame is firm. It takes about 9 months to complete the project and future upgrade for the coming extension.

Technical Feasibility

4.THE SETTING UP OF IT INFRASTRUCTURE IS MEDIUM.



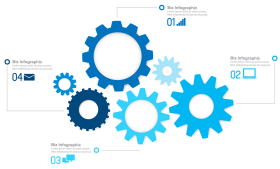


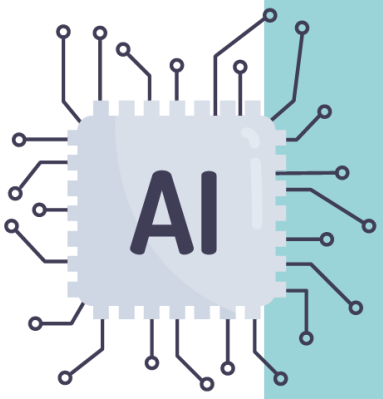


- There is no existing system which used to be integrated.
- Project team has freedom to develop their own infrastructure.
- Open-source software will be used for development.
- Project Team members have expertise in software development but lack of experience in infrastructure.
- The ITCC should be able to provide support for the installation of new system.

Organizational Feasibility

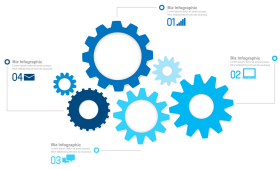
1.FROM AN ORGANIZATIONAL PERSPECTIVE, THIS PROJECT HAS LOW RISK:

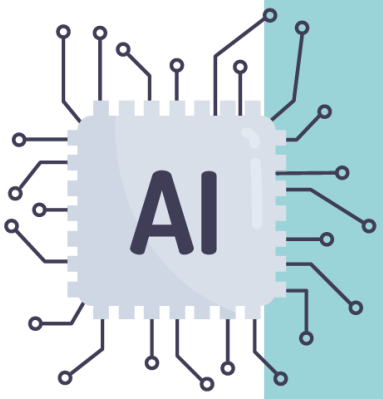




- The project is selected as one of the projects in the collaborative Smart District Project.
- The project will be referred to community organization and industry partners. Project is expected to be welcomed by the NGO and the community groups in district.
- The extension of skill sharing can be developed as the sharing economy for district. It may involve a way of co-purchasing services, in which an elderly provides a services / skill to the other users for profit.

Economic Feasibility





- As suggested previously, there will be one elderly out of every three persons in Hong Kong by 2038. There is a need to cater their requirements in smartphone apps.
- However, existing social media is mostly design for youngster and thus not suitable for the elderly. Thus, elderly mobile app is one of the niche markets
- On the other hand, researchers from HKPU reveal that the complex functions of existing social media affect the perceived ease of use of smartphone. As a result, elder's motivation in using smartphones is affected. [30]
- Therefore, it is understood that ELVIS must be an extremely user-friendly app in order to attract elderly for using it.

[30] LAU, C., YEE, H., NG, T. & FONG, B. (2020). THE ADOPTION OF SMARTPHONE AND SOCIAL MEDIA AMONG ELDERLY (CAHMR WORKING PAPER SERIES NO. 1, ISSUE 2, 2020). HONG KONG: THE HONG KONG POLYTECHNIC UNIVERSITY, COLLEGE OF PROFESSIONAL AND CONTINUING EDUCATION, SCHOOL OF PROFESSIONAL EDUCATION AND EXECUTIVE DEVELOPMENT, CENTRE FOR AGEING AND HEALTHCARE MANAGEMENT RESEARCH. RETRIEVED MAR 30, 2022 FROM HTTP://WEBLIB.CPCE- POLYU.EDU.HK/APPS/WPS/ASSETS/PDF/CW20200201.PDF

Business Plan

EXECUTIVE SUMMARY

ELVIS is a start-up organization whose vision is to create an evolutionary social media software elderly, powered by Artificial Intelligence, and other emerging technologies. The software product has been designed and created by a group of Software Engineering students, to meet the needs of this special customer segment. The software will be constructive by enabling easy social interaction and will be fun to use, encouraging the elderly, their family members, their friends, and their caretakers to use it as often as possible.

Business Plan

THE MARKET

ELVIS has identified three distinct market segments that will be interested in the software product. These segments are the most likely consumers of the software. The segments are as follows:

- Elderly – Given the obstacles imposed by COVID-19 and the current wave of emigration in Hong Kong, there is needs in developing an easy-to-use social media software targeting elderly and their family members. Various AI-powered functions of ELVIS are unique and should stand out in the current market.
- Family Members – The family members who cannot visit their parents due to physical barriers are often the target customer who have a good financial status. It is expected that they will be interested in ELVIS software as they provided the family members an advanced communication platform to get connected.
- Caretakers – Due to physical barriers, day-to-day operation of caretakers as a service provider to the elderly is constantly interrupted. It is expected that they will be interested in ELVIS software as they could carry out these operations via the ELVIS app with the support of Artificial Intelligence.

Business Plan

THE PRODUCT

Barnhart & Peñaloza (2013) found that elderly is sometimes reluctant to contact their grown children, for various reasons.[31] Therefore, to attract them to use ELVIS, the functions featured in the App are designed with an aim to enhance communication on the Internet with the elderly and the family, powered by Artificial Intelligence.

The first component of the software is AI-powered photo album that could enhance old photos. It is not uncommon that old photos taken by elderly in the past were damaged due to improper storage of the photo correctly. The AI-enabled photo repair function of ELVIS could repair the photos from scratching, enhancing the resolution of old photos and even colorize these photos.
The second component is the AI-powered photo sharing function that provides the user with activity/emotion tracking, interact bot and receipt generation functionality. After posting a photo, the artificial intelligence of ELVIS will start analyzing the photo uploaded, and then track user's activity and emotion.

[31] AARP. (2015). Building a Better Tracker. https://www.aarp.org/content/dam/aarp/home-and-family/personal-technology/2015-07/innovation-50-project-catalyst-tracker-study-AARP.pdf

Business Plan

COMPETITIVE EDGE

There are several social media platforms on the market but none of them targeted elderly. ELVIS will leverage their competitive edge by incorporating the concept of memories into the software product, a means of creating interest and joy while using the software. This interest and joy will increase the amount of time that the elderly and their family use the software, thereby increasing the effectiveness of the program. ELVIS is convinced that when elderly enjoy what they are doing they are likely to use the product instead of having to be forced to use it.

Business Plan

1.1 MISSION

1.2 KEY TO SUCCESS

1.3 VISIONS

1.1

To develop easy-to-use social media software for elderly and their family members. ELVIS will provide AI-powered functionalities that allow the individuals and make them more capable of communicate with family members even if there are physical barriers. ELVIS exist to make products that the market demands and have a positive impact on society.

1.2

- Develop social media software that is constructive and fun.
- Implement a strong marketing campaign to develop awareness of the software and its benefits within the elderly centers, NGOs, district councils, and among family members.
- Design strict financial controls for the organization to prevent over budgeting.

Business Plan

1.1 MISSION

1.2 KEY TO SUCCESS

1.3 VISIONS

1.3

- Increase number of users by triple of that in first year within first three years.
- Assist more than 10,000 different elderlies in two years
- Collaborate with 100 different elderly homes in two years

Business Plan

ABOUT THE TEAM

The team is founded by 4 Student Software Engineers and is led by Manni CHEUNG.

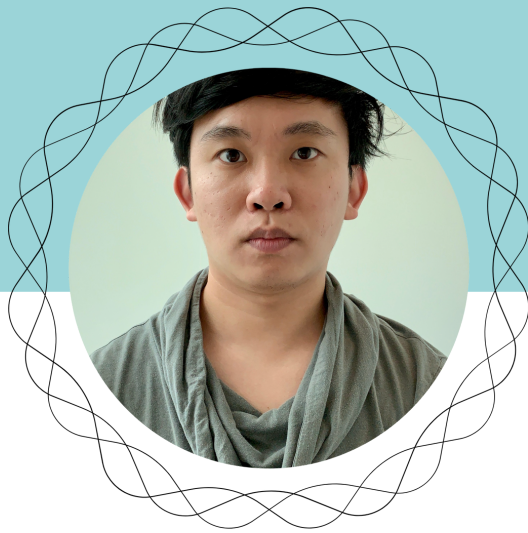
Team Members :
Name: Manni
Position: Leader/Product Master

Characteristic:

- Documentation
- Languages: Flutter, Java, Python, HTML, JavaScript
- Skills: Adobe Creative Suite

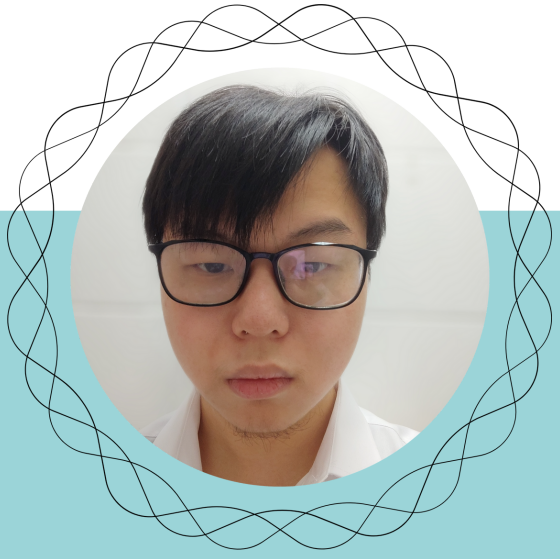
Specialty:
Project Management

International Role:
Microsoft Learn Student Ambassador



Business Plan

ABOUT THE TEAM



Name:Jacky
Position: Designer

Characteristic:

- Responsible, energetic
- Languages: Java, HTML, CSS, JavaScript, PHP
- Skills: Sigma

Specialty:
UI design
Participate in Cathay Hackathon 2021

Business Plan

ABOUT THE TEAM

Name:Sam
Position: Programmer
Characteristic:

- Innovative, Systematic
- Skill: Java, C#, Python, HTML, JavaScript, PHP
- AI Technologies

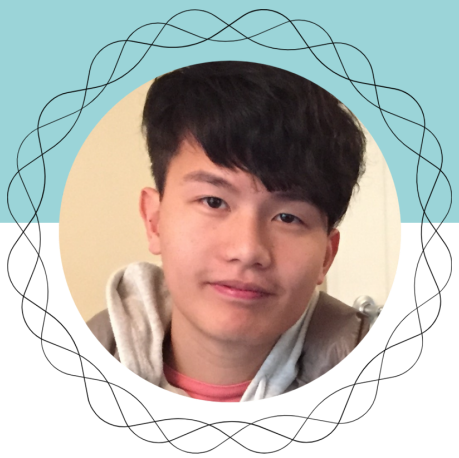
Specialty:
Innovation & Technology Ambassador
(ITCC student Ambassador-2021)
Microsoft x VTC Future Skills Ambassador Program
participate in “Smart District Project” and “iOS campaign”

Name:Stan
Position: Programmer
Characteristic:

- Creative, Efficiency
- Skill: OOP, Java, C#, Python, HTML, JavaScript

Specialty:

- Program analysis



Business Plan

START-UP SUMMARY

ELVIS is a start-up organization. The following assets and professional services will be needed for the formation and start of operations.

- Computer programmers (a team of 3 persons) that could rapidly develop the prototype.
- ELVIS is interested in launching the product quickly therefore the team will employ multiple programmers to speed the process up.
- Eight computer workstations, including one server and seven of the stations will have Microsoft Office, one of them will have QuickBooks Pro (Accounting Software). Three networked laser printers.
- A broadband Internet connection.
- Office cubicle furniture for seven employees.
- Copier and fax machine.
- Database/AI/Cloud Server
- Backup devices.
- Network equipment
- Security (e.g., Server room with access control, CCTV system, fire alarm, etc.)

Business Plan

FUNDRAISING

Fundraising is essential for start-ups. The following key fundraising opportunities have been identified. ELVIS will pursue the following start-up fund and crowdfunding:

Potential Start-up funds	*Amount*
Seed Fund or Jumpstarter Programme	
Alibaba JUMPSTARTER IdeaPOP	$60,000
Cyberport Greater Bay Area Young Entrepreneurship Programme	$100,000
Social Innovative Programme (社創基金)	$300,000
Technology Voucher Programme (TVP)	$100,000
Sustainable Development Fund	$440,000
Crowdfunding	
Indiegogo, Kickstarter	$150,000

Business Plan

DEVELOPMENT COST

Development cost is one-off cost that requires for building the system, which includes notional monthly salary of the project team, hardware cost as well as software cost.

Development cost	Cost Per Unit	No. of Unit	Notional Cost	Actual Estimated Cost
Salary (Monthly)				
Project Manager*	$30,000	12	$360,000	0
Programmer x2*	$15,000	24	$360,000	0
UI/UX Designer*	$17,000	12	$204,000	0
IT consultant	$20,000	12	$240,000	$240,000
Hardware				
I9-11900 (PC)		2	$24,000	$24,000
Lenovo X13G2 (Laptop)		1	$9,574	$9,574
Samsung Galaxy S21 (Phone)		1	$5,199	$5,199
Uninterruptible power supply		1	$20,000	$20,000
Development Software				
Adobe Creative Suite	$228	12	$2,736	$2,736
Visual Paradigm Pro	$5,600	1	$5,600	$5,600
			Total	$307,109

* The cost for these items is notional as these positions shall be picked up by the project team.

Business Plan

OPERATIONAL COST

Operational cost is the monthly cost required to keep the system in operation. In terms of personnel, it is believed that a security specialist is required, as none of the team members is specialized in network security. Other operational cost includes monthly subscription of hardware and software as well as rent and utilities.

Operational Cost	Cost Per Unit	No. of Unit	Actual Estimated Cost
Salary (Monthly)			
Security Specialist	$25,000	12	$300,000
Operation Software			
Firewall	$2,800	24	$67,200
Antivirus software	$300	12	$3,600
Operation Hardware			
Firebase server	$5,300	12	$63,600
Cloud Server (for AI)	$1,000	12	$12,000
Backup Server	$333	1	$333
CCTV Camera	$396	1	$396
Wi-Fi 6 Router	$700	1	$700
Other Expenses:			
Workplace	$20,000	12	$240,000
Electricity	$5,000	12	$60,000
Network (Broadband service)	$1,200	12	$14,400
		Subtotal	$762,229

Business Plan

MARKET ANALYSIS

Purpose of the market research

ELVIS is a brand-new social media application for a group of close family and friends to share their photos and videos on the Internet. Through artificial intelligence technology, ELVIS creates the best environment to store the memories between people and their loved ones. In addition, the main idea of this application is to break the barriers of each individual and increase their interaction. The project team is new to this market, so market research is required. There are three major objectives of this market research. First, Identifying the prospect of the industry and understanding the current market. Secondly, identifying the target users and potential users. Finally, the project team want to understand the competition of the market. The project team hopes the finding can decrease business risks and explore the potential of the application in the future.

Business Plan

MARKET ANALYSIS

Social media market in Hong Kong

The social media users had a significant increase recently in the city of Hong Kong in 2021. There was total 6.4 million social media users who were active in social media platforms. The number of social media users rose by 110 thousand during 2020 and 2021. Surprisingly, the figure shows there are 86.6% of the total population in Hong Kong who became a social media user. The rising of social media users may relate to the number of increasing in internet users in Hong Kong. Between 2020 and 2021, internet users grew by 128 thousand.

Concerning the market share in Hong Kong, Facebook was the favourite social media platform of Hong Kong people. As of January 2020, this global social media giant has 82% of internet users aged 16 to 64 who reported that using the platform last month, which is significantly ahead of other competitors such as WHATSAPP and YouTube. Since the city's anti-government protests in 2020, Twitter, an American social news and discussion website, has received more and more attention.

Business Plan

TARGET USER AND POTENTIAL USERS

Background

The main target user would be the elderly. In the social media market, there is no social media applications mainly for the elderly. For instance, Facebook, the favourite social media app in Hong Kong, targets the age range from 25 – 34 years old. The project team aims to design an age-friendly platform so that even the elderly can use the application easily. In the experience of UI and UX, the project team specially designed clearer and larger icons and words. In addition, project teams avoid complicated operation in the application. All functions should be completed in 3 steps. Besides the UI and UX experience, the project team also designed some features to help the elderly use social media. For example, the application has caption assistance. This helps the elderly think of their descriptions of the new post. As a result, ELVIS Presley is unique in the current market as it mainly focuses on elderly. Also, it reduces the technical requirements of using social media.

Business Plan

TARGET USER AND POTENTIAL USERS

Target user — elderly

Hong Kong's "silver economy" that taps elderly spending is worth HK$50 billion a year and growing but too few businesses are wooing this market. Companies such as travel agencies and banks are now developing products for the elderly, but not enough companies are willing to bet on the rapidly expanding silver hair market. According to market research, Hong Kong people over the age of 65 will spend about 50,000 to 70 Hong Kong dollars a year in addition to their daily living needs and rent. With around a million Hongkongers over the age of 65, the market valued at around HK$50 billion was only set to grow. Considering that the number of elderly will double to 29% of the population in the next ten years. The need for products and services for the specific needs of older people is only growing, but the supply is unable to keep up - both qualitatively and quantitatively.

Business Plan

TARGET USER AND POTENTIAL USERS

Potential user — teenager

Teenagers can become potential users of the application, because teenagers always use social media as the main user groups. According to the research, there is no specific pattern for teenagers to use some social media, but teenagers like to use various social media. Although teenagers do not have biggest consuming power among age group, teenager market is very important because their purchase power will grow by their age.

Business Plan

SWOT ANALYSIS

Business Plan

MARKETING STRATEGY

TO PROMOTE ELVIS, THE FOLLOWING WILL BE ORGANIZED.

1) Official Website

The ELVIS will develop an official website that will be used as both a marketing and sales tool. On the site interested parties can receive more information regarding the project team and the ELVIS app. Once the beta version of the software is ready interested customers can download a trial version of the software for their evaluation. The website will also provide people with company contact information to allow them to ask any questions that they may have.

The website will be marketed using simple yet effective means. The first method is inclusion of the URL address and QR code in all promotional activities. This will be especially important because it will allow all interested parties to view screen shots of the software and download a trial version of the product.

Development will occur concurrently with the development of the software. At the early stage of the development cycle, the ELVIS team will be responsible will for the design and development of the website. In the later stage of the project, the team shall employ one computer science student intern, or a full-time web developer if possible.

Business Plan

MARKETING STRATEGY

2) Tradition Crafts Market

There are numerous forms of traditional craftsmanship: tools, clothing, and jewelry. As an event for connecting elderly and youngster in community, they can enjoy handmade objects that are imbued with accumulated knowledge and cultural values of the craftspeople. It can also stimulate the economy of community. The organization of market can be referenced by the system data provided.

Times: Twice a year
Period: Two weeks on Saturday, Sunday
Target: 30 stalls

Project expected income:

$500 / stall per day
30 stalls, two days per week:
30 x $500 x 2
Income: $60,000

one year's twice:
Income: $120,000

Business Plan

MARKETING STRATEGY

3) Senior Technology Expo

An exhibition is an important part of promotion. There are several innovative technology exhibitions in Hong Kong. For instance, the annual "Gerontech and Innovation Expo cum Summit" hosted by HKSAR Government and the Hong Kong Council of Social Service, or the "International ICT Expo" organized by Hong Kong Trade Development Council. By participating in exhibitions, it is expected that ELVIS have:

1. Opportunity to reach audience, specify the elderly with distinct interest in the market.
2. Opportunity to create awareness and develops relationship with other companies in related market.
3. Opportunity to study the features and benefits of the products by other companies. It is possible to meet the competitors and learn more for future expansion.

Times: Twice a year
Entry fee: around $20,000 per standard booth.

Expenses: $40,000 per year

Business Plan

SUSTAINABLE DEVELOPMENT

AI Technology: improved accuracy

Artificial Intelligences makes it possible for computer to learn from experience[32]. By analyzing more and deeper data, AI can predict with increasing accuracy and suitable for long-term sustainable development. For example, social media such as Google, the interactions between user and system are all based on deep learning. And these products keep getting more accurate the more you use them. In the medical field, AI techniques from deep learning and object recognition can now be used to pinpoint cancer on medical images with improved accuracy.

ELVIS is also the application developed with several AI techniques. For instance, the AI tracking of activity/sentiment, can be achieved with improvement of accuracy. The evolution of system is seeable.

[32] SAS. (n.d.). Artificial intelligence – What it is and why it matters. https://www.sas.com/en_in/insights/analytics/what-is-artificial-intelligence.html

Business Plan

SUSTAINABLE DEVELOPMENT

Recommendation Marketing

Recommendation marketing includes harnessing what people are saying about a particular business.[33] Recommendations are based on positive customer experiences that are shared with others in a wide variety of ways. Word of mouth is the most powerful way customers share their experience with a business.

Related to this marketing strategy, the company can apply similar plan for future development:

1. ELVIS can seek for sponsorship from and/or partnership with other companies of senior technology (or exchange with advisements in application).
2. Company can encourage the main users (Elderly) to recommend ELVIS to their friends.
3. In return for recommendation, the companies offer coupon of senior technology for remuneration.

[33] ClickWorker. (n.d.). Recommandation marketing ⇒ content marketing glossary. AI Training Data and other Data Management Services. https://www.clickworker.com/content-marketing-glossary/recommendation-marketing/

Business Plan

POSSIBILITY FOR PARTNERSHIP AND COLLABORATION

1) Hotel

Hotel provides great customer service can increase revenue, but also it helps brand development and customer retention, and the development team believe that Elvis app can increase the quality of customer service for the hotel. Because many hotel guests are far away from home, they may miss their family because of the long distancing. Elvis can fill the gap between hotel guests and their family so that they can easily contact each other.

The content sharing and video call functions in Elvis app is best fit for long distance family. Family member can share their live trivia. Also, family member can understand other family members recent activities by receiving AI notification. More than that, user can immediately have interaction on the app like commenting others content and meeting on video call.

Business Plan

POSSIBILITY FOR PARTNERSHIP AND COLLABORATION

2) Photo Product Company

At present, many photo product companies encourage customers to digitize old photos. These companies provide technology and services to help consumers convert photos, but there is no concrete platform to store these memories. Elvis app can provide a platform to not only store digital photos, but also share them with family easily.

Smart photo album in Elvis app can store photos neatly. Users can group the photos in different photo albums and customize the details of the photo album. All family members of Elvis can watch these images. In addition, it is free to use some advanced function in the smart album, such as repairing and coloring old photos and adding some interesting filters to photos.

Test Plan

- The following test plan are formulated for testing the ELVIS system. As ELVIS is currently at its prototyping phase, the first two plans, namely Unit Test and Integration Test have been carried out. The system test and acceptance shall be performed after the application is finalized. The test result will be discussed in the next section.

	Mobile App Interface	System Management
Unit test	Black-box tests	Black-box tests
Integration test	User interface tests Use scenario tests	System interface tests Use scenario tests
System test	Requirements tests Performance tests Usability tests	Requirements tests Performance tests
Acceptance test	Alpha test	Alpha test

Unit test: Black-box testing

- Black-box testing, also known as functional testing, is a software testing method in which the functionalities of software applications are tested without having knowledge of the internal code structure. ELVIS aims to become a user-friendly mobile application, so the complexity of using the application should be low. Thus, testing at this stage has been targeting the usability of the elderly. Therefore black-box tests are conducted.
- In terms of testing techniques, Scenario-Based Testing has been used. The scenarios are useful to connect to documented software requirements, especially requirements modeled with use cases. [34]

[34] FLORIDA INSTITUTE OF TECHNOLOGY. (N.D.). CITESEERX. HTTPS://CITESEERX.IST.PSU.EDU/VIEWDOC/DOWNLOAD?DOI=10.1.1.384.7932&REP=REP1&TYPE=PDF

Test Plan

Integration tests

The integration test phase included the following tests: User Interface tests, Use scenario testing, System interface testing:

For normal integration testing, tests have been conducted for each interface function by conducting user interface testing. Through moving through navigation bar and every menu item in the interface in top-down manner, the user interface test is important testing for the user-friendliness to elderly. Thus, test will be done by moving through each use scenario to ensure the function works correctly. The system exchanges data through mobile itself, cloud(firebase) and AI algorithm, it is critical for testing the exchange of data among systems.

System tests

The system test phase shall include the following tests Requirements tests, Usability tests, Performance tests:

To ensures that changes made as a result of integration testing did not create new errors, requirements testing would be involved to test against whether original requirements are met. It's also important to perform usability tests in this test phase to discover how convenient the system is to use. The tests can be done by analysis with experience in how users think and in good interface design. For the infrastructure design (cloud service with several AI technologies), ELVIS also needs to examine the ability to perform under high loads.

Acceptance tests: Alpha testing

The ELVIS application has currently been implemented as prototype. Therefore, alpha testing would be conducted by users to ensure that they accept the system. When the system reaches its 3rd milestone and has been finalized, beta testing which uses real data would be involved.

Test Result:
Upload Functionality

Test Case #	Test Case Description	Test Steps	Test Data	Expected Result	Actual Result	Pass/Fail
1.1	Verify upload functionality with selecting photo from album	1. Press the "Upload" button from the navigation bar 2. Display upload interface 3. Choose "Preserving Memory" function and display upload function button 4. Photo selected and then redirect to upload interface 5. Press upload button and upload automatically 6. Display upload successful message	-	Upload succeed	As expected	Pass

Test Result:
Video Call Functionality

Test Case #	Test Case Description	Test Steps	Test Data	Expected Result	Actual Result	Pass/Fail
2.1	Verify video call functionality	1. Press the "Video Call" button from navigation bar 2. Display video call interface with user images 3. Select target user 4. Video stream started, with moving images captured by the front-facing camera displayed on top-left corner, and moving images from the call recipient at background 5. Voice and video transmit correctly 6. Press "Disconnect" button, video call ended and return to video call interface	-	Video Call succeed	As expected	Pass

Test Case #	Test Case Description	Test Steps	Test Data	Expected Result	Actual Result	Pass/Fail
2.2	Verify video call functionality with font-facing camera and rear-facing camera	1. Press the "Video Call" button from navigation bar 2. Display video call interface with user images 3. Select target user 4. Video stream started, with moving images captured by the front-facing camera displayed on top-left corner, and moving images from the call recipient at background 5. Click the camera change button 6. Camera changed to rear-facing 7. Voice and video transmit correctly 8. Press "Disconnect" button, video call ended and return to video call interface	-	Camera changing succeed	As expected	Pass

Test Result:
Video Call Functionality

Test Case #	Test Case Description	Test Steps	Test Data	Expected Result	Actual Result	Pass/Fail
2.3	Verify of voice-muting video call functionality	1. Press the "Video Call" button from navigation bar 2. Display video call interface with user images 3. Select target user 4. Video stream started, with moving images captured by the front-facing camera displayed on top-left corner, and moving images from the call recipient at background 5. Click the "Mute" button 6. User muted 7. Click the "Mute" button again 8. User unmuted 9. Voice and Video transmit correctly 10. Press disconnect button, video call ended and return to video call interface	-	Voice-muting succeed	As expected	Pass

Test Result:

Album Functionality

Test Case #	Test Case Description	Test Steps	Test Data	Expected Result	Actual Result	Pass/Fail
3.1	Use valid search criterion to search album	1. Press the "Album" button from the navigation bar 2. Display album interface 3. Key in the keyword "Recent Post" 4. Display the "Recent Post" album	Data: e.g. (" Recent Post") Assume there was an album called "Recent Post"	Return "Recent Post" album	As expected	Pass
3.2	Use Invalid search criterion to search album	1. Press the "Album" button from the navigation bar 2. Display album interface 3. Key in the keyword "Party" 4. Return empty album list	Data: e.g.("Party") Assume there was no album call party	Return empty album list	As expected	Pass

Test Case #	Test Case Description	Test Steps	Test Data	Expected Result	Actual Result	Pass/Fail
3.3	Add a new album	1. Press the "Album" button from the navigation bar 2. Display album interface 3. Press the "Insert" button 4. Enter name of the new album	Album name: "party"	Insert a new album succeed	As expected	Pass
3.4	Setting the album to frequent album	1. Press the "Album" button from the navigation bar 2. Display album interface 3. Select the album which needs to be set to frequent album 4. Click the "Setting" button 5. Tick the "Frequent Album" box	Frequent album: true	Setting the target album to "Frequent Album" succeed	As expected	Pass
3.5	Browse photos inside the album	1. Press the "Album" button from the navigation bar 2. Display album interface 3. Select the album 4. Display the photo	-	Display the photo inside the album succeed	As expected	Pass

Test Result:
Post Functionality

Test Case #	Test Case Description	Test Steps	Test Data	Expected Result	Actual Result	Pass/Fail
4.1	Display family post	1. Press the "Recent Post" button from the navigation bar 2. Display "Recent Post" interface	-	Display "Recent Post" interface correctly	As expected	Pass
4.2	Explore more post	1. Press the "Recent Post" button from the navigation bar 2. Display post interface 3. Scroll to the left to explore more post	-	Explore more post succeed	As expected	Pass

Test Result:

Message Board Functionality

Test Case #	Test Case Description	Test Steps	Test Data	Expected Result	Actual Result	Pass/Fail
5.1	Display the chat record	1. Press the "Recent Post" button from the navigation bar 2. Display "Recent Post" interface 3. Scroll down to see the chat record in "Message Board"	-	Display the chat record successfully	As expected	Pass
5.2	Use voice chat function	1. Press the "Recent Post" button from the navigation bar 2. Display "Recent Post" interface 3. Scroll down to see the chat record in "Message Board" 4. Press the voice chat button to insert the voice	Family member voice chat message	Insert voice chat succeed	As expected	Pass
5.3	Use the text chat function	1. Press the "Recent Post" button from the navigation bar 2. Display "Recent Post" interface 3. Scroll down to see the chat record in "Message Board" 4. Press the text chat button to insert the text	Family member text chat message	Insert text chat succeed	As expected	Pass

Test Result:

AI Functionality

Test Case #	Test Case Description	Test Steps	Test Data	Expected Result	Actual Result	Pass/Fail
6.1	Verify AI functionality with photo restoration	1. Press the "Upload" button from the navigation bar 2. Display upload interface 3. Choose "Photo Restoration" function and display upload function button 4. Select upload from album (Test Case #1.1) 5. After photos uploaded to server, "Photo Restoration" starts 6. Display loading animation 7. Display "Restoration Successfully" message 8. Photo uploaded to album with restoration	50 damaged photos	Accuracy: over 70% Photo can be restored and uploaded to album (with image resolution enhancement)	As expected 38 photos restored successfully Accuracy: over 76%	Pass

Test Result:

AI Functionality

Test Case #	Test Case Description	Test Steps	Test Data	Expected Result	Actual Result	Pass/Fail
6.2	Verify AI functionality with photo colorization	1. Press the "Upload" button from the navigation bar 2. Display upload interface 3. Choose "Photo Colorization" function and display upload function button 4. Select upload from album (Test Case #1.1) 5. After photos uploaded to server, "Photo Colorization" starts 6. Display loading animation 7. Display "Restoration Successfully" message 8. Photo uploaded to album with Colorization	50 black and white photos	Accuracy: over 70% Photo can be colorized and uploaded to album (with image resolution enhancement)	As expected 35 photos colorized successfully Accuracy: over 78%	Pass

Test Result:
AI Functionality

Test Case #	Test Case Description	Test Steps	Test Data	Expected Result	Actual Result	Pass/Fail
6.3	Verify AI functionality with face detection	1. Upload photo with people in the picture 2. Use OpenCV to perform face detection 3. Faces are detected and written to folder for test	50 photos	Accuracy: over 70% Faces can be detected and saved to test folder for upcoming process	As expected Accuracy: over 96% 48 pictures detected successfully, 2 pictures with non-face objects recognized	Pass
6.4	Verify AI functionality with face recognition	1. Face Detection (Test Case #3.3) 2. Compare detected face with uploaded user profile photo 3. If faces found in profile (known person in server), return the user's name	30 profile pictures	Accuracy: over 70% Faces can be recognized and return the name of known person	As expected Accuracy: over 80% 24 profile pictures recognized successfully, 6 pictures return 'unknown'	Pass

Test Result:
AI Functionality

Test Case #	Test Case Description	Test Steps	Test Data	Expected Result	Actual Result	Pass/Fail
6.5	Verify AI functionality with emotion tracking	1. Face Detection (Test Case #3.3) 2. Face Recognition (Test Case #3.4) 3. Check the recognized face and start the emotion tracking 4. Select upload from album (Test Case #1.1) 5. Display loading animation 6. Photo uploaded to album with details of emotion 7. Notification message pushed	30 human pictures	Accuracy: over 70% Emotion can be tracked and return the string of emotion	As expected Accuracy: over 73% 22 emotions tracked successfully, 4 pictures return ''neutral', 2 pictures return emotions incorrectly	Pass
6.6	Verify AI functionality with human activity	1. Press the "Upload" button from the navigation bar 2. Display upload interface 3. Choose "Photo Restoration" function and display upload function button 4. Select upload from album (Test Case #1.1) 5. Display loading animation 6. Photo uploaded to album with details of activities 7. Notification message pushed	35 human activity pictures	Accuracy: over 70% Activity can be tracked and return the string of activity	As expected Accuracy: over 91% 32 activities tracked successfully, 3 pictures return activities incorrectly	Pass

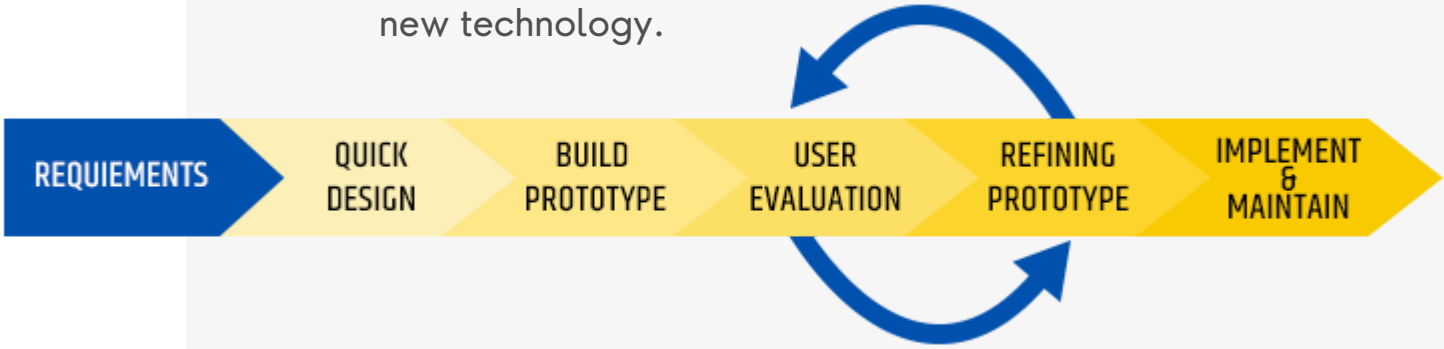
Test Result:

AI Functionality

Test Case #	Test Case Description	Test Steps	Test Data	Expected Result	Actual Result	Pass/Fail
6.7	Verify AI functionality with face synthesis	1. Test Steps 2. Ensure the host computer equip with NVIDIA Graphic cards 3. Run NovaBench for speed testing 4. Run ELVIS and Deepfake on the same time 5. Record the score of results	Two different platform for test: 1)NVIDIA Graphic GTX1650 2)Mobile NVIDIA Graphic RTX3060	Perform Deepfake effect within 1min	GTX1650 scored 128 marks in Graphics test used 1:18 to activate the Deepfake function RTX3060 scored 478 marks in Graphics test used 0:48 to activate the Deepfake function	GTX1650: Fail RTX3060 : Pass

Project Plan

Throwaway prototyping shall be adopted in this project. It is expected that the team could gain more confidence in building a social media system with throwaway prototyping. With this methodology, the project team could have more opportunities to grasp new technology.



In addition, more feedback from elders could be retrieved via throwaway prototyping. More feedback from older people is desired because older people might eschew modern technology and could be afraid of using complex technology. Therefore, it is necessary to adjust the UI and UX in accordance with the feedback from elder. Through the feedback, it is hoped that we could also understand whether our functions fulfil their needs.

The project team hopes that the system reliability should be high because unreliable software disappoints the target user, the elders. They will get frustrated when they see something they do not understand such as bugs and errors. As a result, the user quits the application. Throwaway prototyping can enforce the reliability of the application. Analysis, design, and implementation phases would be in a loop until the project team satisfies the outcome.

Project Timeline

Jul – Aug: Ideation

At the beginning of the project, top priority is to determine the scope and theme of the project. The project team generates ideas through sessions such as brainstorming, mind mapping, sketching and design thinking. To screen a best alternative, project team will consider the impact of the pandemic, unresolved community problems, feasibility of solution and other factors, to determine the best solution that the team can implement in the project.

Aug – Sept: Planning

During the planning phase, the proposed system shall be assessed by the 5W1H method.

For example:
Why: Why a system should be built?
Who: Who is the user?
Where: Where to use the system?
When: What is the timeline of the project
What: What is the objective? What will be delivered at the end?
How: How to build it?

After a brief analysis, the team would conduct research, including preliminary research and secondary research, to collect the requirements and demands of target user. In addition, the project team should evaluate the feasibility of the project in economic, operational, and technical areas. The feasibility analysis can also provide the project team with useful risk analysis. Project charter, work plan and staffing for the whole SDLC would be completed at this stage.

Sept – Oct: Analysis

In the analysis phase, it is critical to determine the requirement of the system. The team would refer to the insight gained during the planning phase to decide functional requirements. For non-functional requirements, it is believed that all basic non-functional requirements will be covered in the document such as performance, reliability, availability, and security. Project proposal will be delivered at this stage.

Project Timeline

Oct – Nov: Design

In the design phases, the team will discuss how to build the system in depth. The system specification will be created in the phase. This document includes architecture design, hardware and software specification, interface design, physical process model, program design specification, physical data model and data storage design. The whole structure of the system will be formed.

Nov – Jan: Implementation & Testing

In the implementation phase, the team shall start coding and constructing the system. Every member of the project will be assigned programming tasks according to their programming skills and knowledge. All the members should finish their tasks according to the schedule. Before launching the software, the project team should create a test plan, and each member should complete the test case according to the test plan. Test plan should include performance testing, security testing, requirement testing, usability testing and interface testing. Initial Report will be delivered at this stage.

Jan– mid Jan: Prototype I

The prototype will be delivered to our target user. The team should design a questionnaire on the Protoype in order to get the comments from the target user. These comments help us to identify unnecessary elements and throw them away. In addition, the first prototype will be submitted to our supervisors, giving them a complete idea of the project.

Mid Jan – Feb: Analysis, Design

After prototype 1, the system requirements will be adjusted based on target user's comments. Project team will make the final decisions on the system requirements. Also, System specifications and architecture will be confirmed for final system. Interim Report will be created for Interim Report Presentation and Demonstration.

Project Timeline

Feb – Apr: Implementation II & Testing II

Repeat the tasks in the first implementation and testing phase which have been mentioned above. In addition, the project team will perform document testing and create a system support for all users who will use it later. Progress report will be prepared at this stage.

Apr – mid May: Prototype II/ Final system

Final report and system should be completed for the Final Report Presentation and Demonstration.

Project plan

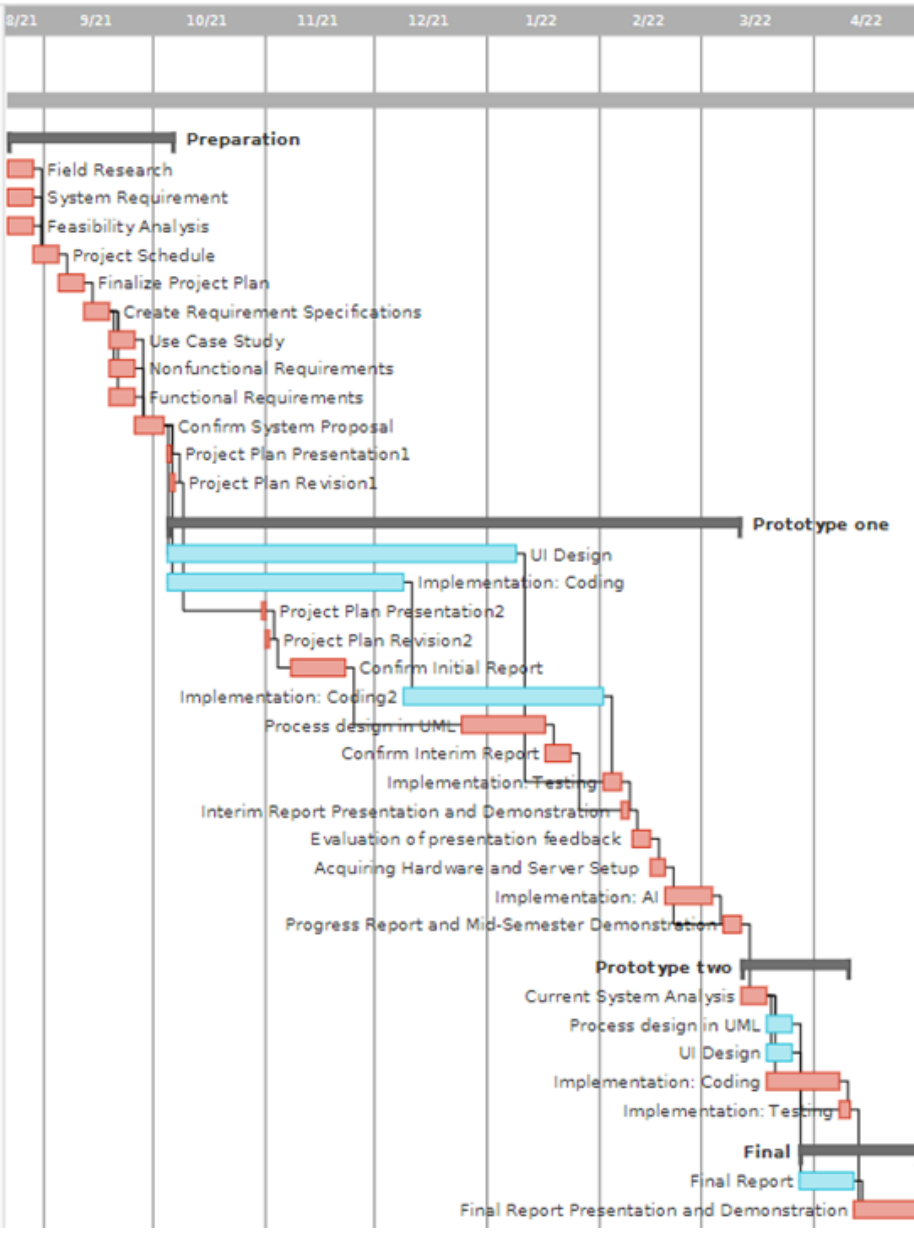
1. project schedule

ID	Name / Title	Type	Start Date	End Date
1	ELVIS	project	22-08-21	04-05-22
1.1	Preparation	group	22-08-21	06-10-21
1.1.1	Field Research	task	22-08-21	28-08-21
1.1.2	System Requirement	task	22-08-21	28-08-21
1.1.3	Feasibility Analysis	task	22-08-21	28-08-21
1.1.4	Project Schedule	task	29-08-21	04-09-21
1.1.5	Finalize Project Plan	task	05-09-21	11-09-21
1.1.6	Create Requirement Specifications	task	12-09-21	18-09-21
1.1.7	Use Case Study	task	19-09-21	25-09-21
1.1.8	Non-functional Requirements	task	19-09-21	25-09-21
1.1.9	Functional Requirements	task	19-09-21	25-09-21
1.1.10	Confirm System Proposal	task	26-09-21	03-10-21
1.1.11	Project Plan Presentation1	task	05-10-21	05-10-21
1.1.12	Project Plan Revision1	task	06-10-21	06-10-21
1.2	Prototype one	group	05-10-21	11-03-22
1.2.1	UI Design	task	05-10-21	08-01-22
1.2.2	Implementation: Coding	task	05-10-21	08-12-21
1.2.3	Project Plan Presentation2	task	31-10-21	31-10-21
1.2.4	Project Plan Revision2	task	01-11-21	01-11-21
1.2.5	Confirm Initial Report	task	08-11-21	22-11-21
1.2.6	Implementation: Coding2	task	09-12-21	01-02-22
1.2.7	Process design in UML	task	25-12-21	16-01-22
1.2.8	Confirm Interim Report	task	17-01-22	23-01-22
1.2.9	Implementation: Testing (Unit Test)	task	02-02-22	06-02-22
1.2.10	Interim Report Presentation, Demonstration and Evaluation	task	07-02-22	10-02-22
1.2.11	Server Setup and Acquiring Hardware	task	09-02-22	12-02-22
1.2.12	Implementation: AI	task	09-02-22	06-03-22
1.2.13	Progress Report and Mid-Semester Demonstration	task	07-03-22	11-03-22
1.3	Prototype two	group	12-03-22	10-04-22
1.3.1	Current System Analysis	task	12-03-22	18-03-22
1.3.2	Process design in UML	task	19-03-22	25-03-22
1.3.3	UI Design	task	19-03-22	25-03-22
1.3.4	Implementation: Coding 3	task	19-03-22	08-04-22
1.3.5	Implementation: Testing (Integration Test)	task	08-04-22	10-04-22
1.4	Final	group	28-03-22	04-05-22
1.4.1	Final Report	task	28-03-22	11-04-22
1.4.2	Final Report Presentation and Demonstration	task	11-04-22	29-04-22

Project plan

2. Gantt Chart

ELVIS	start	end
Preparation	**08/22/21**	**10/06/21**
Field Research	08/22	08/28
System Requirement	08/22	08/28
Feasibility Analysis	08/22	08/28
Project Schedule	08/29	09/04
Finalize Project Plan	09/05	09/11
Create Requirement Specifications	09/12	09/18
Use Case Study	09/19	09/25
Nonfunctional Requirements	09/19	09/25
Functional Requirements	09/19	09/25
Confirm System Proposal	09/26	10/03
Project Plan Presentation1	10/05	10/05
Project Plan Revision1	10/06	10/06
Prototype one	**10/05/21**	**03/11/22**
UI Design	10/05	01/08
Implementation: Coding	10/05	12/08
Project Plan Presentation2	10/31	10/31
Project Plan Revision2	11/01	11/01
Confirm Initial Report	11/08	11/22
Implementation: Coding2	12/09	02/01
Process design in UML	12/25	01/16
Confirm Interim Report	01/17	01/23
Implementation: Testing	02/02	02/06
Interim Report Presentation and De...	02/07	02/08
Evaluation of presentation feedback	02/10	02/14
Acquiring Hardware and Server Setup...	02/15	02/18
Implementation: AI	02/19	03/03
Progress Report and Mid-Semester D...	03/07	03/11
Prototype two	**03/12/22**	**04/10/22**
Current System Analysis	03/12	03/18
Process design in UML	03/19	03/25
UI Design	03/19	03/25
Implementation: Coding	03/19	04/07
Implementation: Testing	04/08	04/10
Final	**03/28/22**	**04/29/22**
Final Report	03/28	04/11
Final Report Presentation and Demo...	04/12	04/29



Main Deliverables

Upon completion of the project, it is expected that there shall be two set of deliverables, namely

(i) the system, and
(ii) a set of documentations.

In the following section, the two deliverables shall be outlined one by one.

Main Deliverables

i) the system: backend

The project team shall build the system with a four-tier architecture, which includes one Application Server processing the application logic, one Web server for web-related application logic and one Database Server to store customers data and other information. Most application logic and data shall be hosted by the server. The Client, on the other hand, integrates with the presentation layer and accesses the server for application-specific tasks and processing.

ii) the ELIVS app

The ELVIS app shall be the major deliverables for this project. It is expected that the app itself is a cross-platform one, i.e., the app compatible with the two major OS in the smartphone market, iOS and Android, as well as with Web environment. Users could use the application no matter which device is in his/her hand, be it an iPhone, an iPad, an Android smartphone, or a desktop computer with modern browsers installed. The app shall be tested across all these environments before deploying the end users.

Main Deliverables

iii) Documentation: Test plan

As suggested in the previous sub-section, the app shall be thoroughly tested before going to the market. Therefore, a test plan as details as possible shall be produced for the project team to follow while caring system test. This document should address all functions that are implemented during development of the system.

iv) Documentation: User manual

As the system might be maintained by peoples from outside of the project team, a user manual shall be designed for IT technician/support staff to assist them user while the system is in operation. Although members of the IT supporting team are expected to have received training before operating the system, some may face technical issue in particular when the system employs several emerging technologies, in addition to the fact that the system is implemented with a relative new programming language that not all IT specialists are familiar with. Therefore, producing a user manual for these users is essential.

Main Deliverables

v) Documentation: User guide

The user guide shall be of a more generic nature, to be offered to end users of the system, such as caretakers, family members of elderly and even the elderly himself/herself. It is expected that text-based guide might not be useful for users such as the elderly. Therefore, the project team shall produce user guide in video format, preferably by having relatively short video for each function, in addition to the traditional text-based one.

Future extensions of the proposed solution

For future extension, there are two directions that the project team wish to extend, which are the functions of software and hardware. There are two main functions will be added in the software for future extension now.

Extension 1: Skill sharing
According to activity theory and studies on retirement, seniors share skills with others may help the elderly increase the opportunities for interpersonal communication, and maintain a positive attitude, which is conducive to one's mental health. Therefore, the project team decided to create a platform for elderly share their skills in future extension. The proposed functions are listed below

- The skill-sharing elderly can select his skill category in list.
- The system will allow user to enter detailed description of the skills.
- Other users can search elderly by skill category. For instance, bread baking, Chinese-cooking, gardening, carving sculpture, music instruments, Cantonese opera, chess…
- Other users can put a “like” on the skill-sharing post.
- The skill-sharing elderly can check the total number of “likes”.
- The system can display the location and information of skill-sharing elderly.
- The user can simply click on the video button in the interface and contact the elderly by video call.

Future extensions of the proposed solution

Extension 2: User customize their own album

Customization is a common feature in many applications. To cater the needs of different elderly, for instance different levels of eyesight, the future ELVIS app is expected to have a function that allows them to customize the album. Users can personalize their photo album according to their taste to meet their own needs. In addition, users can share the photo albums they designed with the community. As the application community grows stronger, the community attracts more users to participate in ELVIS.

- Customize text, patterns, and backgrounds of the album
- Save your own album design
- Add background to the album
- Change album size
- Share to community

Extension 3: Provide photo scanner service

The old photos kept by elderly are usually hard copy, not digital photo, so it may be a challenge for the elderly to scan their hard copy photo. The project group wants to provide a service to solve this problem. This service would collect old photos from the elderly, and staff would turn printed photos into digital and upload the digital photos to their photo album.

Conclusion and Critical Evaluation

In this project, the project team attempts to use GernoTech to support the elderly in the districts by producing an intelligent social media platform called ELVIS - ELdery Video and Image Sharing. ELVIS is a memory-driven social media for the elderly to connect with their beloved ones, enhancing family unity and intergenerational understandings. As the vision statement – Preserving Memories, Connecting Generations - suggests, it is believed that memories could serve as powerful tools that connect different generations.

Indeed, the pandemic has inevitably and fundamentally altered how individuals live, work, and learn. Older people are primarily influenced by the fact that they could not embrace these changes and thus are mainly available only when there is support from others who can manage the devices. In a sense, Hong Kong's recent wave of emigration has imposed another challenge on the elderly in Hong Kong. Local NGOs reported that they had been receiving calls from the elderly whose sons and daughters had emigrated to other places and thus left them behind and let them live alone in Hong Kong. The emotional status of these "left behind" elderly people requires immediate attention.

Conclusion and Critical Evaluation

The project team produced ELVIS with three main objectives for this proposed project: (1) to develop a system for assisting the elderly in communication, (2) to develop a platform for the elderly to share their daily life, and (3) to develop a platform to help caretakers to understand the elderly. These objectives are expected to be achieved by three significant functions of ELVIS: (1) AI Photo retouch, (2) AI Photo Sharing with the mood checking function, and (3) Advanced Video Call. With these functions, it is hoped that senior citizens would have more social and meaningful interactions with their family members or caretakers and stay in touch with their family and society, wherever they are.

The project team fulfilled most of the requirements stated in the proposal, with one exception, which will be discussed in detail in the next section. Overall, all team members were able to utilize what was learned during their studies at the Hong Kong Institute of Vocational Education (Tsing Yi), together with additional self-learned knowledge and technical requirements on emerging technologies such as Artificial Intelligence and Machine Learning.

Changes to design and justification of changes

It is unfortunate that the original plan of having the system to assist caretakers and staff at elderly home (i.e., the third milestone of the original plan) was postponed and thus left unfinished as the development of the system is largely affected by the 4th and the 5th of the pandemic.

Because of the pandemic, elderly home in Hong Kong is virtually isolated from the rest of the city due to social distancing measures and lockdown. The project team was not able to conduct research at the said location, nor to negotiate with elderly home and NGOs for collaboration.

It is hoped that in the future the ELVIS application could continue to grow as the project team believes that the application itself and the system as a whole indeed have the potential to fill the gap between mental/cognitive condition of elderly and the use of Artificial Intelligence.

The project team firmly believes that there is a market niche, and this belief is supported by the industry as the project team has been connected with a tech company which focuses on the use of Gernotechology in helping elderly in various occasion under the Yeung Kin Man Industrial Incubation Scheme. If condition allows, the project team intends to continue the development of ELVIS in the near future.

About the time management, the project team has been using the longest time to implement the application, so the deadline of the coding has been daily

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