MOBILE APPLICATION FOR INTERACTIVE DIGITAL BUSINESS CARD

By

Chan You Ming

A PROPOSAL

SUBMITTED TO

Universiti Tunku Abdul Rahman

in partial fulfillment of the requirements

for the degree of

BACHELOR OF COMPUTER SCIENCE (HONS)

Faculty of Information and Communication Technology

(Kampar Campus)

MAY 2018

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DECLARATION OF ORIGINALITY

I declare that this report entitled "**MOBILE APPLICATION FOR INTERACTIVE DIGITAL BUSINESS CARD**" is my own work except as cited in the references. The report has not been accepted for any degree and is not being submitted concurrently in candidature for any degree or other award.

Signature : _____

Name : _____

Date : _____

ACKNOWLEDGEMENTS

I would like to express my deep gratitude to Mr. Tan Teik Boon, my Final Year Project supervisor, for his patient guidance, enthusiastic encouragement and useful recommendations and suggestions of this research work. Other than that, I would also like to thank my fellow friends who had been guided me whenever I faced difficulties in this project.

Finally, I wish to thanks my parents for their support and encouragement throughout my study.

ABSTRACT

The widespread use of printed business card results in a large amount of paper waste produced annually. In this information age, almost every people around the world own at least a digital device. In order to solve the problem, the printed business card should be digitalized. Although there are several digital business card application available in the market, it does not reduce the use of hardcopy business card effectively. This project is intended to develop a mobile application for the interactive digital business card. The interactive feature of this mobile application included the dynamic content of digital business card, geo-based awareness of business card contacts' company location with the map function, scanning function to scan and save hardcopy business cards and QR code generator for a personal business card for easy exchange. Firebase is a cloud-hosted real-time database used to sync data and perform dynamic content. Next, Google MAP API is used to produce the geo-based awareness of business card contacts' company location with map function in this project. On the other hand, Google Mobile Vision API which provides optical character recognition (OCR) technology is used to implement the scanning function to scan hardcopy business cards and save the information extracted using text recognition. Lastly, the ZXing API will be used for decoding and generating of barcodes such as QR code for the digital business card. The project is initialized in Mar 2018 and completed in Aug 2018. The time use for the completion of the whole project is less than 6 months. All the objective of the project had been achieved. As a conclusion, the mobile application for the interactive digital business card is introduced to promote the 'paperless office'.

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LIST OF ABBREVIATIONS

QR code	Quick Response code
ORC	Optical Recognition Character
API	Application Program Interface
GUI	Graphical User Interface
PDF	Portable Document Format
BCR	Business Card Reader
IDBC App	Interactive Digital Business Card Application
JPEG	Joint Photographic Experts Group
SMS	Short Message Service
MS Excel	Microsoft Excel
IDE	Integrated Development Environment
PVT. LTD.	Private Limited Company
WiFi	Wireless Fidelity
ISBN	International Standard Book Number
AAMVA	American Association of Motor Vehicle Administrators
ID	Identification
ASCII	American Standard Code for Information Interchange
SDLC	System Development Life Cycle
ERD	Entity-Relationship Diagram
FYP	Final Year Project
VCF/ vCard	Virtual Contact File

CHAPTER 1: INTRODUCTION

1.1 Motivation and Problem Statement

1.1.1 Problem Statement

One of the biggest problems with using the printed business card is the production of a huge amount of paper waste. Even in the digital world which is flooded with smartphones, personal computers, laptops, and tablets, peoples are still practicing the use of hardcopy business card. Based on Kim Pinnelli (October 26th, 2017), there are 27 million business cards are printed daily. In other words, there are approximate of 10 billion business cards printed annually.

However, Elissa Dunn Scott (26th October 2016) come out with a statistic stating that 88% of business card distributed out get thrown away within a week. That's mean, 8.8 billion over 10 billion of business card will become a rubbish in a week. It was such a waste and we must try our efforts to stop it.

According to Statistic Brain (4th May 2017), the reasons given for throwing out business card included the customers feel like they don't need the service provided by card giver (63%), don't want to do business or deal with specific card giver (24%), added business card information into digital contact list (9%) and other reason (4%).

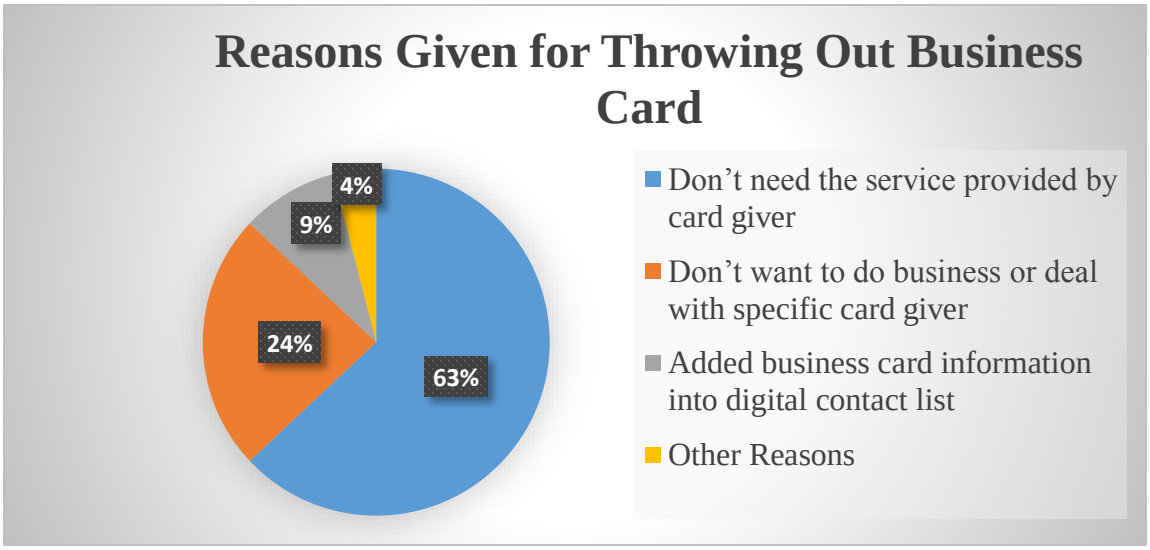


Figure 1-1 Reason given for throwing out business card

Other than that, the information contained in the printed business card is not dynamic. Due to the characteristic of the printed business card, the content or the information in the business card is unable to be dynamically updated. For example, if the owner of the business card changed his contact information, we will be not able to contact him via the contact information given on his business card. Other than that, if there is any change in our job such as changed to a new company, we need to replace our business card with a new one and remove all the previous one. But with the digital business card application, we can make the changes within a few minutes by clicking and designing a digital business card using our smartphone than waiting for a period for the printing shop to print out the new business card.

Besides, the printed business card is not as reproducible as the digital business card. If we used up all our printed business cards, we need to order the business card and wait for the slow printing process of the printing shop. However, with the use of digital business card application, it can always be reproduced within a second by sending it through email or by scanning the QR code generated for the digital business card.

Last but not least, the disadvantages of the printed business card is it required a space to store it. When we receive more and more business cards, we will be running out of space to store all of them. This forces us to choose and keep a few and throw the others. Thus, we need to spend some of our time in maintaining and storing the printed business card which is delivered to us. But with the digital business card application, we can store the business card in the memory storage of our digital device, some application even provides the cloud storage for the users.

1.1.2 Motivation

Nowadays, there are many digital business cards mobile application exist in the market. However, there are still many peoples prefer to use the printed business card compared to the digital business card.

In 1978, a British-American information scientist named Frederick Wilfrid Lancaster, envisioned the concept of ‘paperless office’ in his book ‘Towards Paperless

Information System'. However, after 40 years passed, the concept of 'paperless office' is still not being practicing by everyone. The most direct evidence is that the use of the printed business card.

The motivation of this project is to promote the concept of 'paperless office'. In other words, this project is motivated to greatly reduce or eliminate totally the usage of paper in the office environment. To realize the concept of 'paperless office', we must first eliminate the use of the printed business cards. Thus, this project aims to create a more interactive mobile application for the digital business card.

1.2 Project Scope

This project develops an interactive mobile application that can help in manage and store the business card efficiently.

- To develop a more interactive mobile application for the digital business card.
- To develop a database that maintains the user business card information.

1.3 Project Objectives

The objective of developing a mobile application for interactive digital business card included:

- To develop a database that maintains users' digital business cards information.
    - To reduce the use of the printed business card.
    - To centralize the data so that everyone gets the latest information.
- To develop a more interactive mobile application for the digital business card.
    - To design a user-friendly interface
    - To provide a geo-based awareness of business card contacts' company location with map function mobile application to users

  - To provide a digital business card mobile application with QR code generator for the user's personal business card for easy exchange
  - To provide a free of charge digital business card mobile application to users
  - To provide a digital business card mobile application with dynamic content
  - To provide a digital business card mobile application with indexes to group the business card contacts
  - To provide a digital business card mobile application with scanning and OCR function to scan and save hardcopy business cards
  - To provide a digital business card mobile application with chat function.
  - To initiate and promote the practice of "paperless office"
- To test and evaluate the application

1.4 Impact, Significance and Contribution

At the completion of this project, a mobile application for interactive digital business card will be created. This mobile application will be available for all peoples without any charges. The users of the mobile application will have a greater experience in practicing the use of digital business card compare to the others.

According to the Malaysian Green Technology Corporation (24 August 2015), paper waste accounts for over 50% of all office waste. To stop this situation, we must practice the concept of 'paperless office'. This project will be the first step for everyone to start practicing the concept of 'paperless office'. With this, we can greatly reduce the office waste.

By having this mobile application, the users will be able to manage their digital business card easier. The features of this mobile application will help the users to have more interaction with their business partners or friends.

1.5 Background Information

Business card is an essential marketing tool across industries. It is playing an important role in introducing personal business by providing some concrete details such as our identity (who we are), our services (what we can do for our customers), our company location (where we're located) and our contact information (how our customers can contact us). Is there any better way to introduce ourselves or our business than by handing out business cards? The answer would probably be: No.

Optical Characters Recognition (OCR) is a technology that enables the users to extract texts from all kinds of documents included portable document format (PDF) and images/photos of the documents captured by a digital camera, then convert them into a searchable and editable data. The benefit of using OCR application is time-saving when converting the hardcopy documents into softcopy files. For example, if we want to digitalize a magazine article, we could spend hours to retype all the contents into the digital devices. However, by using the OCR application and a scanner or a digital camera, we could do it in just a few seconds.

In this project, we will be developing the application with the OCR technology provided by the Google Mobile Vision API. Currently, the Google Mobile Vision API is included with the Face API, Barcode Scanner API and Text Recognition API. We will be using the Barcode Scanner API and Text Recognition API for this assignment.

Barcode Scanner API is used to detect real-time barcodes in any orientation. The barcode type we will be using in this project is the Quick Response Code (QR code). In this project, the QR code of the digital business card will be generated by the user to be shared with the others by scanning the generated QR code.

The Text Recognition API is able to recognize text in any Latin-based language such as English, German, French, and so on. This API will allow the application to get the text in segments which can be blocks, lines, and words. The concepts of block, line and word are shown in the diagram below.

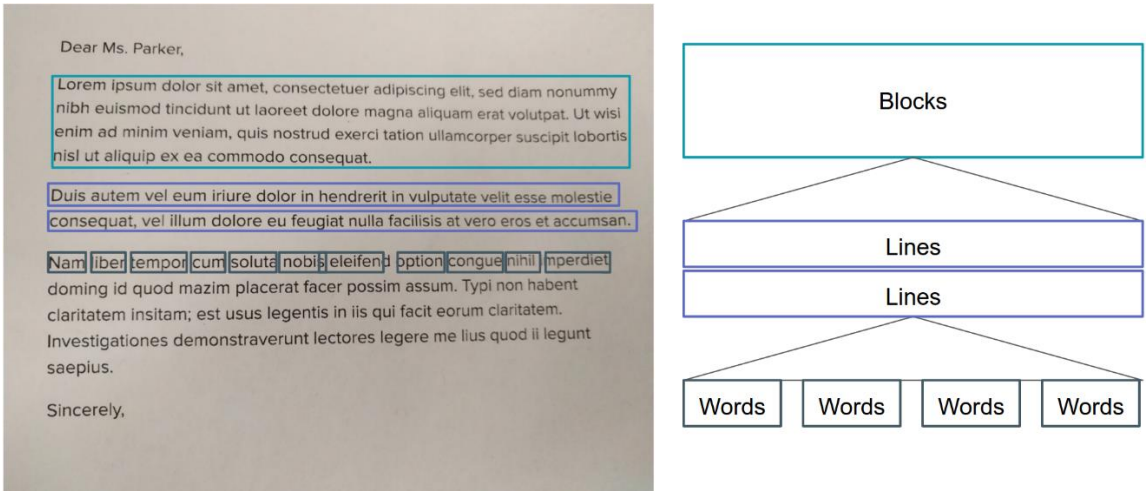


Figure 1-2 Concept of blocks, lines and words

Google Map API enables developers to embed Google Maps into web pages or mobile application to retrieve data from Google Maps. The data retrieved is allowed for either extensive customization or just simple usage.

The ‘paperless office’ is a concept envisioned by Frederick Wilfrid Lancaster in 1978 in his book ‘Towards Paperless Information System’. The aim of this concept is to cut off the use of hardcopy documents in the business office to reduce the paper waste and reduce the production of the hardcopy papers.

CHAPTER 2: LITERATURE REVIEW

2.1 Literature Review on Existing Solution

2.1.1 Literature Review on CamCard Free

Figure 2-1 CamCard Free application logo

CamCard Free is a mobile application to manage and exchange business card. CamCard Free is currently one of the top developer's applications on Google Play store with 10 million downloads and has an average rating of 4.4 given by approximate 102, 000 users.

Key Features:

- Scan and store business cards (Only up to 200 cards in free version)
- Exchange e-cards with people nearby
- Add notes and reminders to contacts
- Get contact updates dynamically
- Navigate to contact address in Map
- Manage contacts from all over the world with 17 recognition languages
- Access contact information across multiple devices

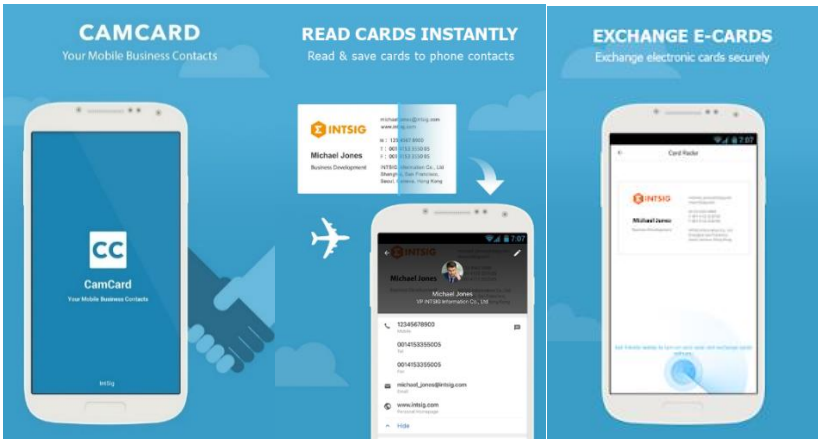


Figure 2-2 CamCard features

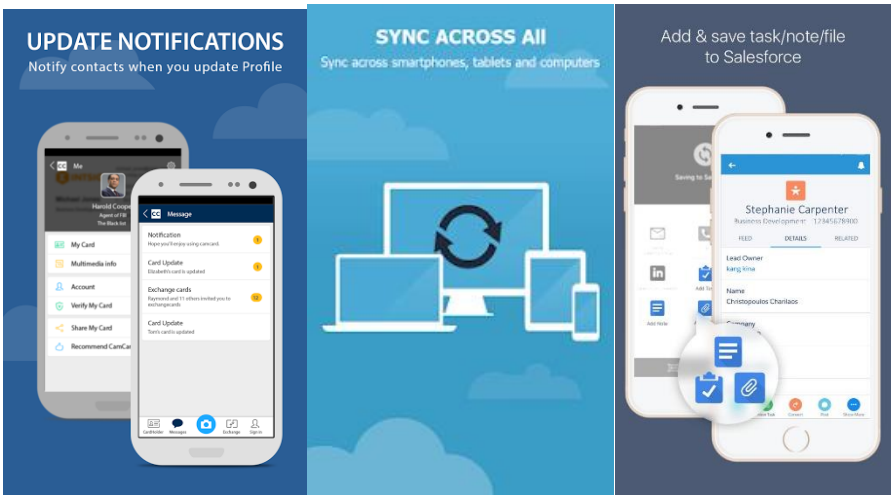


Figure 2-3 CamCard features

Strengths of CamCard Free

- Reasonable accuracy on the text recognition result.
- Clean and intuitive interface.
- Fast OCR processing speed.
- Instant messaging service services allow users to communicate with their contacts.
- Card radar service which allows the user to search for nearby CamCard users and exchange business card with them.
- Contact information is accessible on multiple devices by using mobile application (for mobile phone and tablet) and web application (for laptop and personal computer).
- Allow business card exchange with QR code.
- Provide indexes/group to differentiate the type of business card contacts.
- Dynamically update contacts.

Weakness of CamCard Free

- Although it provides a feature to navigate to contact address in Map, it does not provide geo-based awareness of contact company location with map function.
- There has a limit of 200 cards for the scan card and OCR service for the CamCard Free version. However, the CamCard Premium have unlimited card scanning services but the user is required to pay subscription fees.
- Does not have built-in Map function and .Chat function.

2.1.2 Literature Review on Knowee

Figure 2-4 Knowee application logo

Knowee is a powerful manager for traditional business cards with lots of helpful modern functionality. Currently, Knowee has 1 thousand downloads and an average rating of 4.1 given by 22 users.

Key Features:

- Scan and store business cards
- Send e-cards via email or via the application
- Email Signature create tool for business card
- Get contact updates dynamically
- Create QR code for the personal business card
- Email Signature create tool for business card

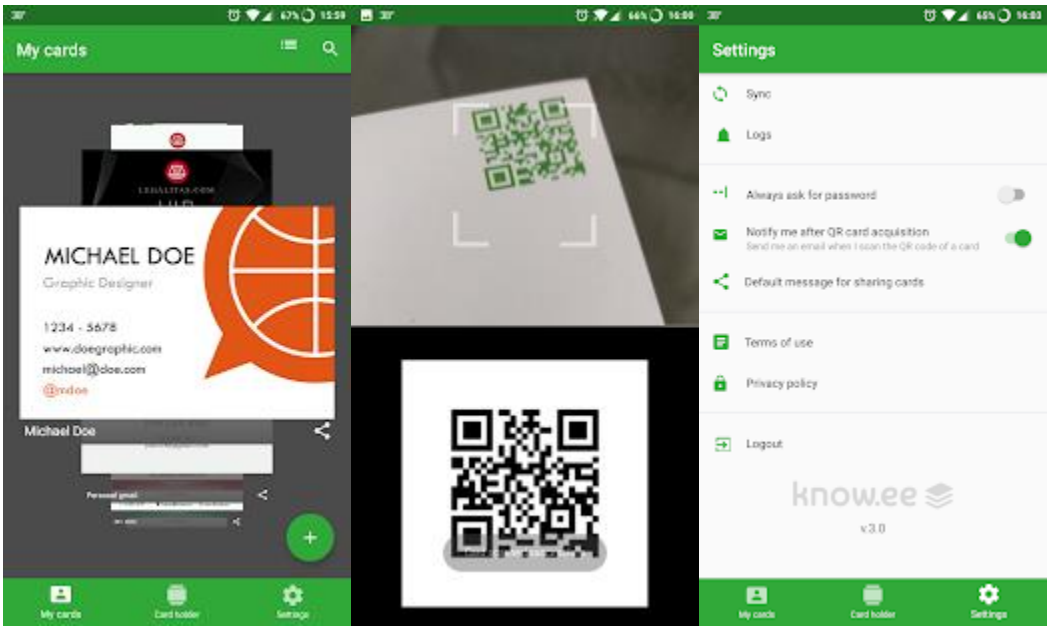


Figure 2-5 Knowee features

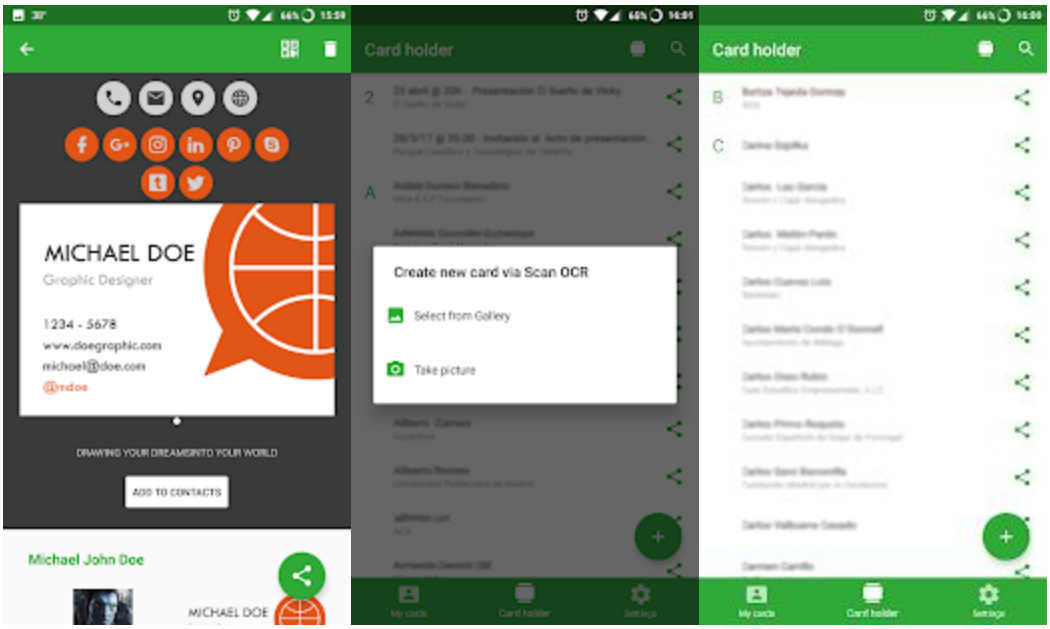


Figure 2-6 Knowee features

Strengths of Knowee

- Reasonable accuracy on the text recognition result.
- Clean and intuitive interface.
- Relatively fast OCR processing speed.
- Contact information is accessible on multiple devices by using mobile application (for mobile phone and tablet) and web application (for laptop and personal computer).
- Unlimited scanning cards and OCR services.
- Allow business card exchange with QR code.
- Dynamically update contacts.

Weaknesses of Knowee

- Does not provide geo-based awareness of contact company location with map function.
- Does not provide dynamic update.
- Does not provide indexes/group to differentiate the type of business card contacts.
- Does not have built-in Map function.
- Does not have Chat function.

2.1.3 Literature Review on ABBYY BCR Free Edition

Figure 2-7 ABBYY BCR application logo

ABBYY Business Card Reader (BCR) is a mobile application that can scan and manage all our business cards and contacts in a flash. It is one of the Mobile Star Award Winner of SHINNING STAR in the 'Contact Manager App' category. ABBYY currently reached 500 thousand downloads and have an average rating of 3.9 given by approximately 4400 users.

Key Features

- Implemented the famous ABBYY Mobile OCR technology which provide unsurpassed data recognition and speed
- Users able to updated and accessible to their business cards database from all devices such as mobile phones, tablets and computers on ABBYYBCR.COM
- Users are able to perform business card search, sorting and grouping of contacts with the BCR's own storage, Card Holder.
- Allow users to keep their personal business card in a different language for different business occasions.
- Quickly verify the recognition results of scanned business card.
- Export to MS Excel to enable users to manage their business cards database on a laptop or personal computer.
- One tap to search for the address of user business contact in Maps.
- Recognize business cards in 25 languages
- Detect a maximum of 3 languages simultaneously from multilingual cards

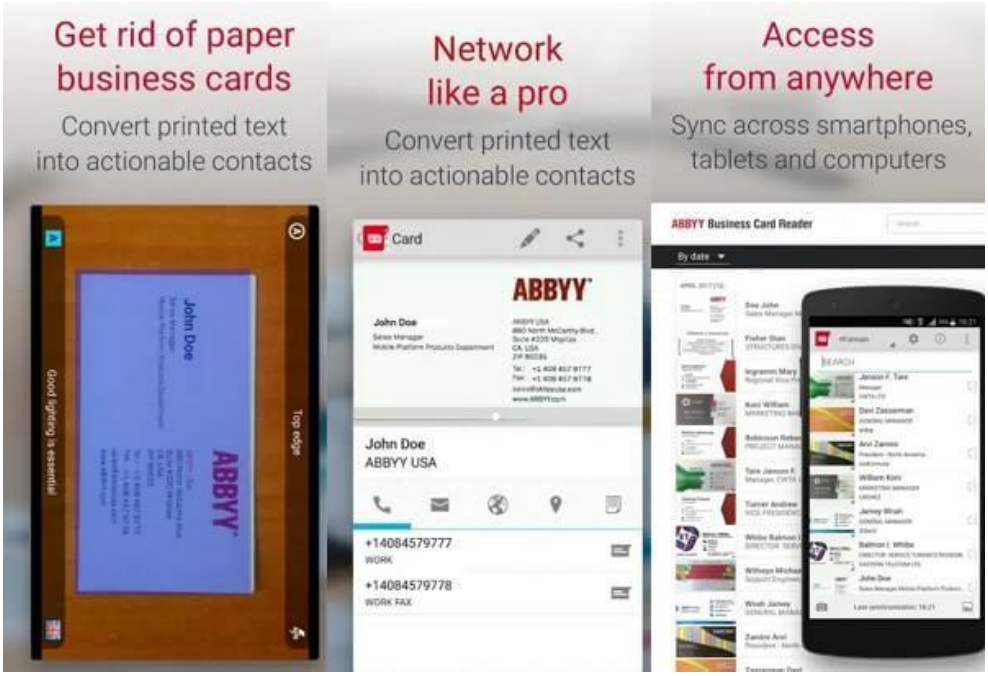


Figure 2-8 ABBYY BCR features

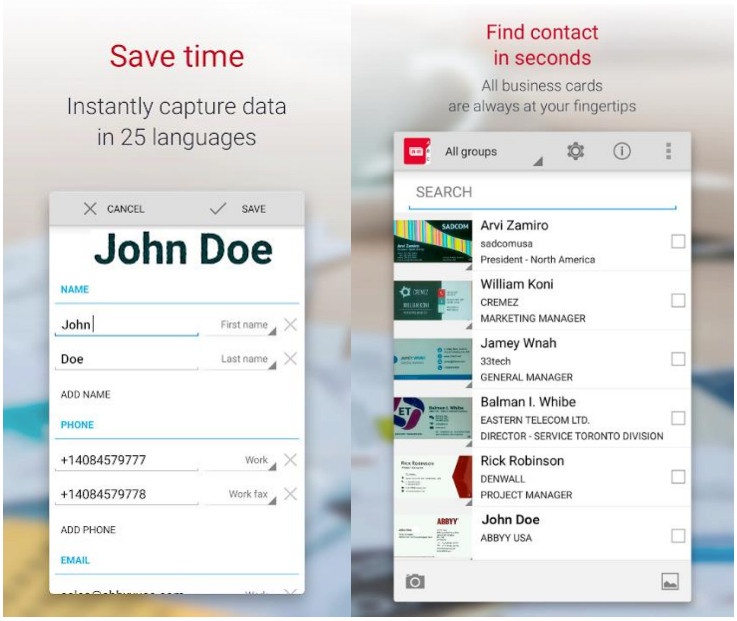


Figure 2-9 ABBYY BCR features

Strengths of ABBYY Business Card Reader

- Reasonable accuracy on the text recognition result.
- Auto-detection when capturing an image of the business card using the mobile phone camera.

- Fast OCR processing speed.
- Users able to updated and accessible to their business cards database from all devices such as mobile phones, tablets and computers on ABBYYBCR.COM
- Users are able to perform business card search, sorting and grouping of contacts with the BCR's own storage, Card Holder.
- Dynamically update contacts.
- Detect a maximum of 3 languages simultaneously from multilingual cards

Weaknesses of ABBYY Business Card Reader

- Does not provide geo-based awareness of contact company location with the map function.
- There has a limit of 10 cards for the scan card and OCR service for the free version of this mobile application. However, the ABBYY Business Card Reader have unlimited card scanning services but the user is required to pay subscription fees.
- Contain advertisement in the application.
- Complex user interface.
- Does not allow business card exchange with QR code.
- Does not have built-in Map function.
- Does not have Chat function.

2.1.4 Literature Review on BCard

Figure 2-10 BCard application logo

BCard is a mobile application developed by ATMAS Softwares PVT. LTD. This mobile application current has 50 thousand downloads and an average rating of 4.3 given by 772 users.

Key Feature

- Scan and Store business card with just one click.
- BCard provides a multiple-platform login for the user to access this application data from any platform or browser.
- The contacts are auto synced to user's Google account.
- User existing contacts can be imported to BCard from the user database in Excel format and contacts on BCard can be exported to Excel.

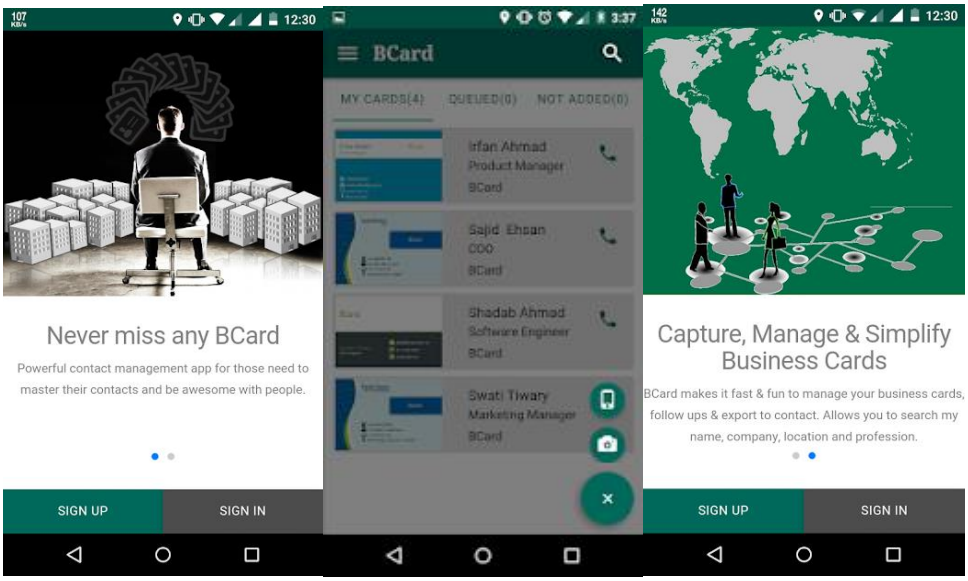


Figure 2-11 BCard features

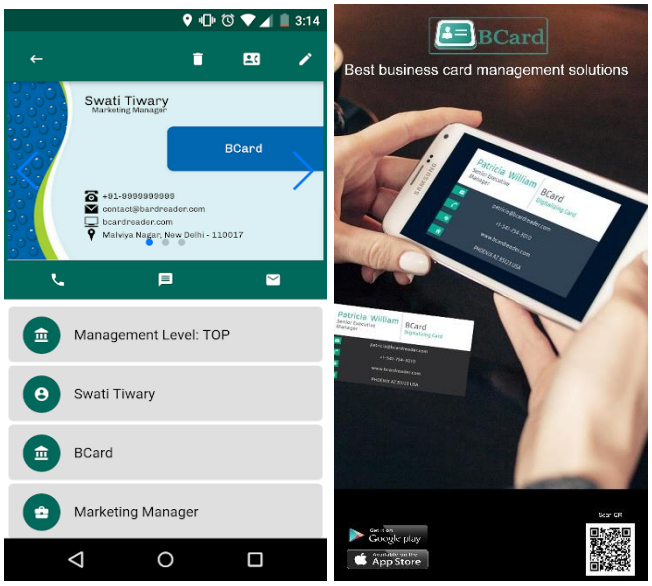


Figure 2-12 BCard features

Strength of BCard

- Reasonable accuracy on the text recognition result.
- Provide multiple-platform login for the user to access this application data from any platform or browser.
- Dynamically update contacts.

Weakness of BCard

- Very slow OCR processing speed.
- Does not provide geo-based awareness of contact company location with map function.
- There has a limit of 10 cards for the scan card and OCR service for the free version of this mobile application. However, the Bcard offer in-app purchases for 50 cards, 100 cards and 500 cards with different prices.
- Does not allow business card exchange with QR code.
- Does not provide indexes/group to differentiate the type of business card contacts
- Does not have built-in Map function.
- Does not have Chat function.

2.2 Critical Remarks of Previous Works

Features	CamCard Free	Knowee	ABBYY BCR Free	BCard	Proposed method
Clean and intuitive user interface	✓	✓			✓
Scan and store business cards	✓	✓	✓	✓	✓
Auto-detection of a business card using the mobile phone camera.			✓		
Fast OCR processing speed	✓	✓	✓		✓
Unlimited scanning service without charges or fees		✓			✓
Detect and exchange e-cards with the nearby application user	✓				
Create QR code for a personal business card for easy sharing	✓	✓			✓
Add notes to contacts	✓		✓		✓
Get contact updates dynamically	✓				✓
Navigate to contact address in Map	✓	✓	✓	✓	✓
Built-in Map function					✓
Geo-based awareness of contact company location with the map function.					✓
Manage contacts from all over the world with multiple recognition languages	✓	✓	✓	✓	✓
Access contact information across multiple devices	✓	✓	✓	✓	
Indexes/Group to group business card contacts	✓		✓		✓
Built-in Chat function					✓

Table 2-1 Comparison of the previous solutions and the proposed method

2.3 Literature Review on Business Card

A standard hardcopy business card is 2 by 3 inch rectangles of card stock containing the contact information of the card owner.

The standard information that the business card should contain:

- Individual's name
- Business name/ company name
- A way to contact the person. It could be a phone number, email address, mailing address, fax, webpage or company address. One does not need to include all of them but must contain either one of them so that others can contact the individual easily.

The importance of business card:

- Swapping contact information.
- As an effective direct marketing tool.
- Act as the first impression of our brand.

2.4 Literature Review on Barcode

A barcode is defined as a machine-readable code in the form of numbers and parallel lines of varying widths, printed on and identifying a product. (Paul Trujillo, 2015)

However, the barcode is definitely so much more than the description. Generally, barcode encrypted the data and basic information of the product with lines and patterns to be read easily by a scanning device such as camera.

Generally, there are only 2 kinds of barcodes which are 1D and 2D. The Table 2-2 below shows the variation of barcodes and the usage of the barcode. In this assignment, the type of barcode that we are going to use is the Quick Response (QR) code.

Image	Name	Type	Details	Industry
	Uniform Product Code (UPC)	1D	Used for sales checkout in retail store. Mainly use in the United States, but also in the United Kingdom, Australia, New Zealand and other countries.	Retail
	International Article Number (EAN)	1D	Retail stores for sales checkout; inventory, etc. Primarily use in Europe.	Retail
	Code 39 (Code 3 of 9)	1D	Used for inventory, tracking shipments and identification. Often found in the automotive industry and the US department of Defense.	Automotive and Defense
	Code 128	1D	Code 128 is more compact than Code 39 so normally it is used in preference to Code 39.	Supply Chain
	Interleaved 2 of 5 (ITF)	1D	Used in the warehouse, packaging and shipping industries	Warehouse, Packaging and Shipping
	Code 93	1D	Improvement and complements of Code 39.	Retail, Manufacturing and Logistic
	Codabar	1D	Used in libraries, photo labs and the United State blood banks. Other than that, it is also used by Federal Express.	Logistic, Healthcare and Education
	GS1 Databar	1D	Used by small objects in the healthcare industry and retail outlets. Formerly known as Reduced Space Symbology.	Retail and Healthcare

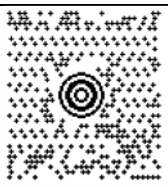
	Modified Plessy (MSI Plessy)	1D	Used for inventory management in retail environments, such as labeling supermarket shelves.	Retail
	POSTNET	1D	Used to encode zip codes on U.S. mail.	Mailing
	Bookland	1D	Used on the book covers. It is generated based on ISBN numbers.	Publication
	QR Code	2D	Used in advertising, entertainment and retail. Easily read by smartphones.	Retail, Entertainment and Advertising
	Data Matrix	2D	Able to encode 50 characters in an extremely small size. Used in electronic components and healthcare industry. Ideal for marking small item.	Electronics, Retail, Healthcare and Government
	PDF417	2D	Able to store large amounts of text and data by compressing. Used to print postage and airline boarding passes.	Logistics and Government
	Maxicode	2D	Used by the United Parcel Service. MaxiCode symbols can encode two messages; a primary and secondary message.	Logistic and Supply Chain
	AZTEC	2D	Used by transportation industry particularly for tickets and airline boarding passes.	Transportation

Table 2-2 List of barcodes

2.5 Literature Review on Application Programming Interface (API)

2.5.1 Literature Review on Google Mobile Vision API

Google Mobile Vision API is an interesting framework developed by Google. This framework is implemented to detect objects or extract data from photos and video captured by the camera.

Key Features:

- Face API
    - Face API provides the process of automatically locating human faces in photos and video. Once a face is detected, landmarks such as eyes and nose will be searched. With Face API, the developer can developing application with the functions for face recognition, face tracking, landmark (for example, left eyes, right eyes, and nose) searching and also facial characteristic classification.
- Barcode API
    - Barcode API detects barcodes on the mobile device in real-time and in any orientation. Currently, there are 2 types of barcode which are 1D barcodes and 2D barcodes. With this API, developers can scan the barcodes and retrieve the information contained in the barcode. Other than that, this API also enabled the developer to parse the 2D barcodes such as QR codes into the supported formats (URL, Contact information (VCARD, etc.), calendar event, email, phone, SMS, ISBN, WiFi, Geo-location such as latitude and longitude, and also AAMVA driver license/ID.
- Text Recognition API
    - Text Recognition API provides the service to detect text in photo and video. It harnesses the Optical Character Recognition technology which enables the software/system to recognize and understand the text information contained in the photo.

Optical Character Recognition (OCR) is a process that can retrieve text information contained in photos or images and converts the information into digital text format.

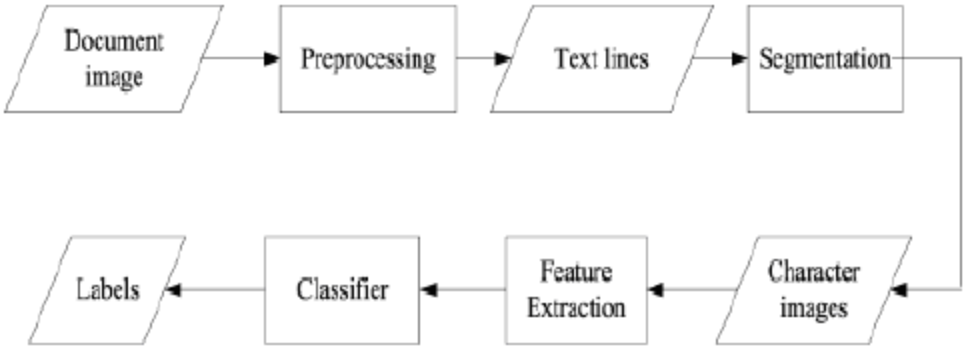


Figure 2-13 OCR system flow diagram

The Figure 2-13 above shows the flow diagram of a OCR system. First, the document image is captured. Then the document image is preprocessed by retrieving every single text in the form of character-by-character. After that, the characters in the image are translated into character codes such as ASCII value and stored into text lines. Next, the text lines undergo the segmentation process. The segmentation process first breaks the blocks of text into lines of text and then further break the lines of text into words. After that, each word break into characters. At the end of the segmentation process, character images are produced. The Figure 2-14 below shows the segmentation process of the text.

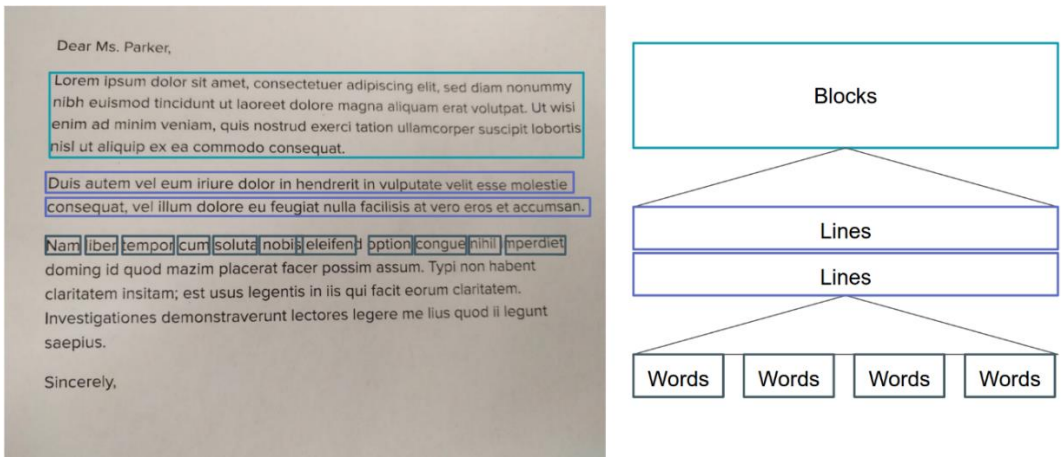


Figure 2-14 Segmentation of text

After that, the character images will then undergo feature extraction process and classifier process to produce the labels. The labels are the final outcome of the OCR system. In short, with the implementation of OCR technology in the mobile application, it enables the digitalization of paper documents in just a few seconds.

Strengths of Google Mobile Vision API

- Save time and resources to reproduce hardcopy documents into digital documents
- Enable digital transformation and move toward the paperless office with a solution that can convert photos of hardcopy documents into full text-searchable digital documents.

Weaknesses of Google Mobile Vision API

- Text recognition is not 100% accurate. The API sometimes might had differentiating between “5” and “S”, “8” and “B”, “1” and “|”, “M” and “W, N”, “A” and “4”, “C” and “G”, “D” and “O”,
- The image taken by the mobile camera is expected to be good quality. If the quality of the image taken is bad, the accuracy of the text recognition will be seriously affected.
- The Google Mobile Vision API is unable to detect any non-Latin based language such as Chinese language, Japanese language, Korean language and so on.

2.5.2 Literature Review on ZXing API

ZXing (“zebra crossing”) is an image processing library to generate and scan barcode. It is written in Java programming language. ZXing supports the operations to read and write in the 1D product, 1D industrial, and 2D barcodes. ZXing API is able to be integrated into Book Search and Google Product.

Strengths of ZXing API

- Support Wi-Fi QR codes. The Wi-Fi QR codes can be generated on https://zxing.appspot.com/generator/
- Auto-use of camera flash. ZXing API can turn on the flashlight automatically from the camera settings.
- Can generate QR codes for bookmarks, clipboard data, applications and contacts.
- ZXing API is an open source API. This promotes the versatility of the developer to develop the functions for the ZXing API either for self-use or general purpose.

Although ZXing API is not the fastest and also not the best at handling low light and smaller sizes of barcodes, it is good enough to be used to generate QR code for this project.

2.5.3 Literature Review on Google Map API

Google Map is one of the best Map application in the world. However, with the Google Map API, developers are able to build Google Map in their applications. There are three main products offered by Google in order to help developers to integrate the powerful Google Map into their application:

- Maps
    - This product allow developers to customize their own custom maps with custom markers, colors, polygons, lines and images.
    - The features of this product included Maps and Street View.
    - The Maps feature allow users to display maps as interactive maps or images.
    - The Street View feature allow users to embed Street View with high resolution satellite imagery.
- Routes
    - This product is able to help users find the best way to get from location A to location B with real time data traffic and comprehensive data.
    - The feature of this product included Directions, Distance Matrix and Roads.
    - The Direction feature allow users to get directions for walking, driving, transit and biking. It is able to calculate the travel times of the users based on real-time traffic.
    - The Distance Matrix feature is able to deliver distances and travel time for one or more locations.
    - The Road feature can be used to create precise itineraries by determining the nearest roads along each point of a vehicle's journey and the route traveled by the vehicle.
- Places
    - This product has more than 100 million points of interest which can help users to discover the world with rich details. The features of this product

included Place Details, Current Place, Find Place, Autocomplete, Geocoding, Geolocation and Time Zone.

- Place Details feature provide addresses, names, reviews, ratings or contact information the places.
- Current Place feature uses real-time signals such as user location or time of day to identify a place.
- Find Place feature is able to turn a name, phone number, address into a place.
- The Autocomplete feature provide location suggestions for users when they are typing.
- The Geocoding feature is able to convert geographic coordinates to addresses and the other way round.
- The Geolocation feature use WiFi or cell towers to detect the precise location of a device.
- The Time Zone feature is able to search the time zone for provided location.

The strength of the Google Map API included it can be easily integrated into Android studio projects. Other than that, the rich documentation and tutorials provided enable developers to quickly pick up to implement the API. The strong support of Google towards the Google Map allowing developers to integrate Google Map into their application easily. However, the drawback of the Google Map API is that it only issue limited request free of charges for the users. Charges might apply to the requests over the limit.

2.6 Literature Review on Interactive

Based on the Oxford Dictionary definition (2018), interactive has the meaning of enabling the 2 way flow of information between a user and a system including an application. However the word "interactive" used in this project is to indicate that the Interactive Digital Business Card application will have more functions that can interact with the users in order to create a better user experience on a digital business card application. The main purpose is to make users to feel more convenient in using the digital business card application so that they will keep on using it and reduce the use of hard copy business card.

2.7 Literature Review on Virtual Contact File (VCF or vCard)

Virtual Contact File (VCF) is a standard electronic business cards file format. Generally, VCF is stored in the "Contact" application in the mobile phone. VCF is able to store business card information such as name, contact number, organization (company), job title, address information, email address, photographs and other information.

There are a few version of VCF files such as vCard 2.1, vCard 3.0 and vCard 4.0. In this project, the VCF format used is vCard 3.0. Below is an example of the vCard 3.0 format used in this project.

```
BEGIN:VCARD

VERSION:3.0

N:Chan You Ming

ORG:iMocha Sdn. Bhd.

TITLE:Intern

TEL;TYPE=WORK,VOICE:+6016-9599578

ADR;TYPE=WORK:;;Unit 29-6, The Boulevard Offices, Mid Valley City, Lingkaran Syed Putra, 59200 Kuala Lumpur.

EMAIL;TYPE=PREF,INTERNET:cyouming1995@gmail.com

END:VCARD
```

Figure 2-15 Format of vCard used in this project

Component	Description
BEGIN	This component indicate the start of the vCard. It is one of the required information in VCF file.
VERSION	This component indicate the version of the vCard used. It is one of the required information in VCF file.
N	This component indicate the name of the person or the object in the vCard. It is one of the required information in VCF file.
ORG	This component indicate the name of an organization or a company. It is an optional information in VCF file.
TITLE	This component indicate the job title of the person in an organization or a company. It is an optional information in VCF file.
TEL	This component indicate the contact number of the person. It is an optional information in VCF file.
ADR	This component indicate the address of the person or his/her organization or company. It is an optional information in VCF file.
EMAIL	This component indicate the email of the person. It is an optional information in VCF file.
END	This component indicate the end of the vCard. It is one of the required information in VCF file.

Table 2-3 Description of vCard components used in this project

CHAPTER 3: SYSTEM METHODOLOGY

3.1 Design Specifications

3.1.1 Methodologies and General Work Procedures

The methodology used to develop the web widget in this project is the Incremental development method. Firstly, we will develop an initial implementation of the system with some basic functions. After that, we will evolve it through several versions until an adequate system has been developed. In another word, the system will be developed phase by phase until the final version of the system.

The Figure 3-1 below shows the process of the incremental development method.

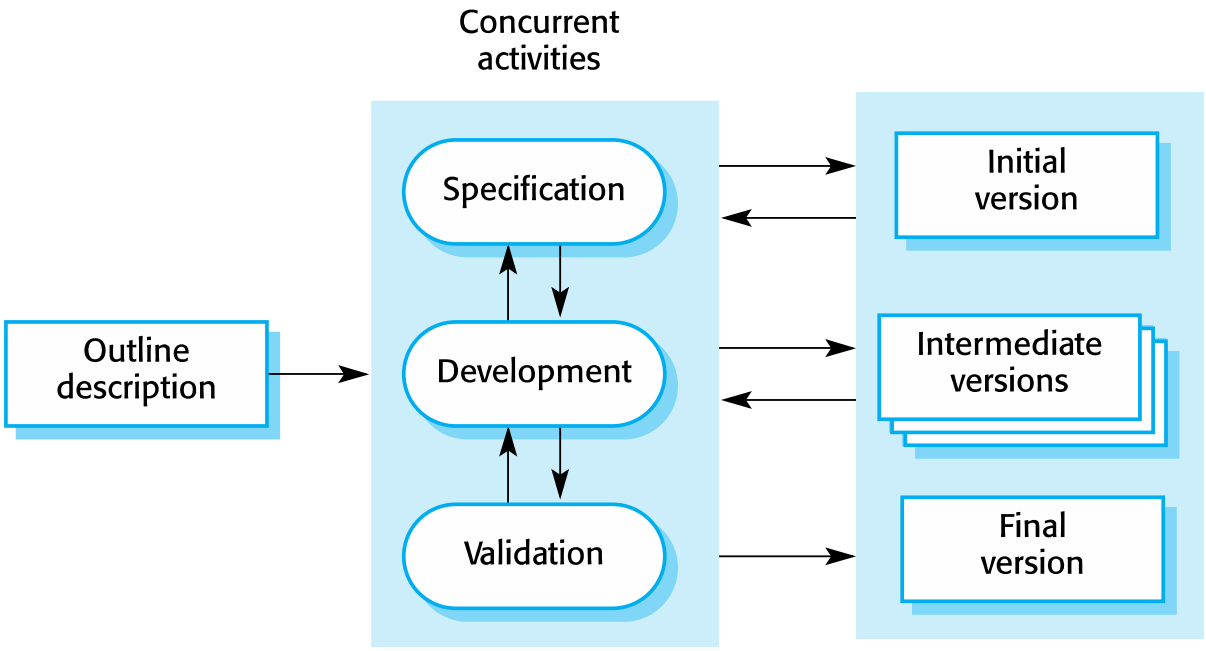


Figure 3-1 Incremental development

The reason for choosing the incremental development method is because this method will enable us to have a rapid delivery and deployment of useful software. Moreover, user feedback can be obtained easily on the development work that has been done. As a result, the software can be fine-tuned based on the user feedbacks after the development of each version of the system.

3.1.2 Tools to use

- Integrated Development Environment (IDE)
  - Android Studio
    - Android Studio is the one of the best IDE used to develop application under Google's Android operating system. It is built on JetBrains' IntelliJ IDEA software and specifically designed for Android application development. It supports Java language programming and works well with Google API. Moreover, Android Studio also provides Android AVD emulator to test the developed application system. Other than that, the drag and drop feature implemented in the user interface design also ease the developers in designing the graphical user interface.
- Application Programming Interface
  - Google Vision API
    - Google Mobile Vision API is an interesting application programming interface developed by Google. This API has the capability to detect objects such as the human face, barcode and text in photos and videos. Currently, this API has included the Face API, Barcode Scanner API and Text Recognition API. In this project, we will be implementing the Barcode Scanner API and Text Recognition API into the system.
  - Google Map API
    - Google Map API enables developers to embed Google Maps into mobile application or web pages to retrieve data from Google Maps. The data retrieved is allowed for either extensive customization or just simple usage.
  - ZXing
    - ZXing is a library that supports the decoding and generating of barcodes such as QR code within images.
- Programming Language
  - Java
    - Java is a general-purpose computer programming language that is currently the most used programing language among programmers. Java is class-based and strictly an object-oriented programming language.

- Database
  - Firebase
    - Firebase is a platform that provide plenty of services such as authentication, database, storage, hosting and etc. It provides a real-time database and backend as a service to ease developers in running backend code without managing servers. Firebase applies structure of server-less database connection which allow developer to connect the system to the database directly with the requirement of networking.

3.1.3 System Performance Definition

In this project, we are going to develop a mobile application for the interactive digital business card. In comparison with other mobile applications for digital business class, this project targeted to improve the interaction between the users and the mobile application.

The targeted interactions included:

- Scanning the printed business card with a camera and store the information inside the mobile application.
- Enable users to locate their business partners/friends company location on the built-in Google Map.
- Automatically update the changes made by users' business partners/friends such as promotion, move to a new company, contact information and others in the business card.
- Chat function that allow users to communicate with friends (other users).
- Quick Response (QR) code to share users' business card in vCard format
- Users is able to group their business cards for easy searching

3.1.4 Verification Plan

Before the completion of the project, verification will be carried out to evaluate whether the project meets all of the requirements. In this project, the verification methods used is as below:

- Inspection
  - In this project, the inspection method is the process to examine the system or the product with our vision.
  - During the development of the software, the inspection method will be used to read the source code from time to time to check for the errors such as syntax errors, logic errors and semantic errors.
- Demonstration
  - In this project, the demonstration method is the process of manipulating the product or the system to ensure the output and the performance is expected or as planned.
  - During the development of the software, the demonstration method will be used to check the functionalities of the software from time to time to ensure the output of the project is as planned.
- Testing
  - The testing method is the process of checking the performance of a system or product with a predefined and controlled series of stimuli, data or inputs to ensure that it will produce an expected output as specified in the system requirements.
  - All the function in the project will be checked to ensure it can produce the expected output for the given inputs.

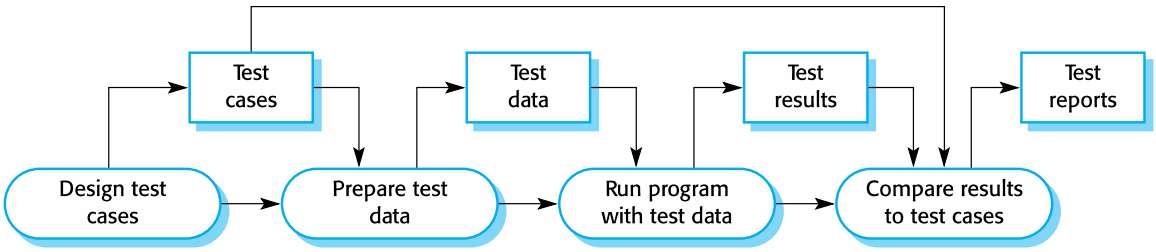


Figure 3-2 Software testing process model

3.2 System Development Life Cycle

The Figure 3-3 below shows the System Development Life Cycle (SDLC) of the phased development of the mobile application.

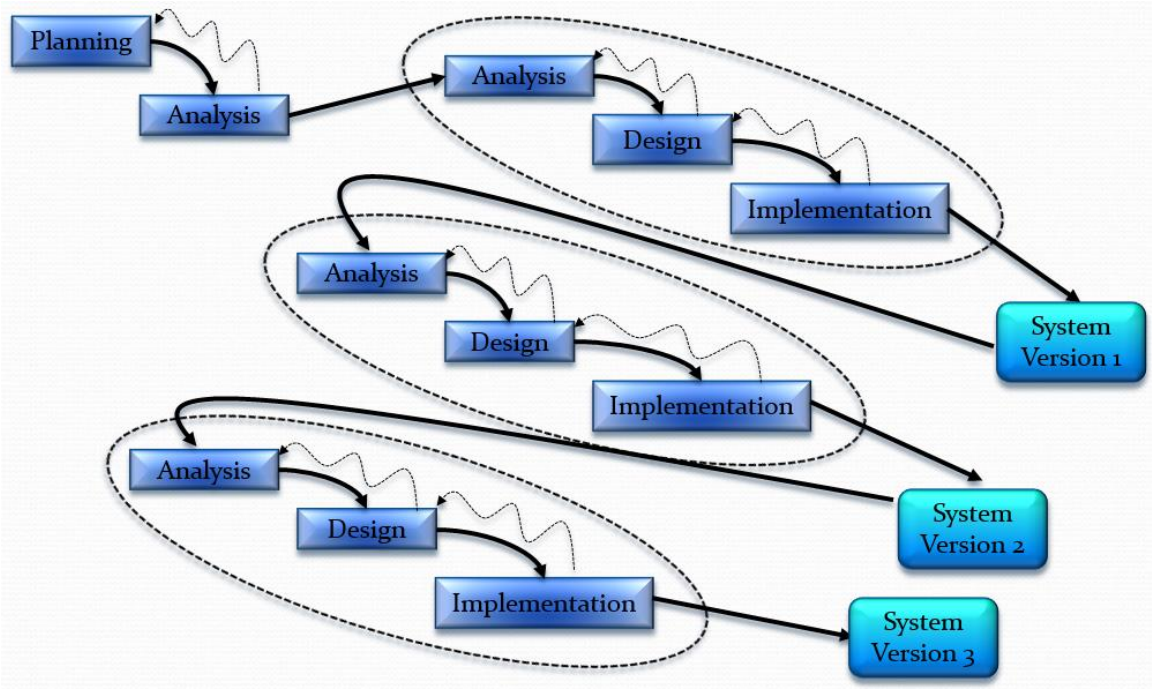


Figure 3-3 SDLC of phased development

At the planning phase, the project is initialized by determining the problem statement and the motivation to start the project. After that, the scope and objectives of the project will be set and documented. All system requirements will also be identified and collected. The tools to develop the system will also be identified and specified.

After that, the literature review will be done in the first analysis phase. This process is to determine the prior arts or current solution towards the problem. The strength and weakness of any previous work will be identified and will be used to compare to our proposed solutions in order to produce a better application. Other than that, all the requirements will be also be filtered and justified before proceed to the next phase. Upon completion of the planning and analysis phases, we will start to develop the system.

During the development process of the system of a different version, we will verify and analysis the project tasks for the system of current version. After that, we will be proceeding to the design phase. During the design phase, we will be designing the system

of the current version by drawing the architecture pattern, activity diagram and class diagram to stimulate the real system application process using the Visual Paradigm. The system then will be developed and tested in the implementation phase. The development process of the system will be repeated for every version until the system is completely built.

3.3 Work Breakdown Structure

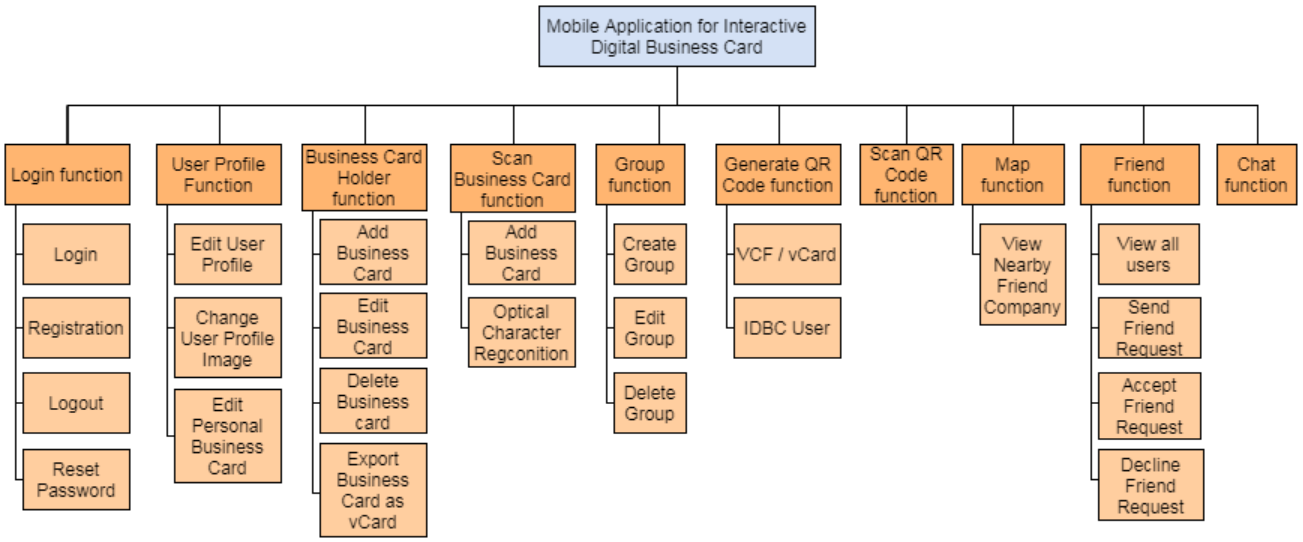


Figure 3-4 Work Breakdown Structure for the project

Phase/System Version	Project Task
1	• Login function (Registration, Login, Logout, Reset Password) • User Profile function • Business Card Holder function • Scan Business Card function (text-recognition)
2	• Group function • Generate QR Code function • Scan QR Code function
3	• Map function (Geo-based awareness to locate nearby contact companies) • Friend function (including dynamically update of Friend business card) • Chat function

Table 3-1 Phased development of the project

3.4 Timeline

3.4.1 Timeline for Deliverables and Milestones

The Table 3-2 below shows the timeline for deliverables of the proposed method.

Phase/ System Version	Project Task	Project Duration (Weeks)			
		1	2	3	4
1	Login function (Registration, Login, Logout, Reset Password)	✓			
	User Profile function	✓			
	Business Card Holder function	✓			
	Scan Business Card function (text-recognition)	✓			
					Total = 4 weeks
2	Group function		✓		
	Generate QR Code function	✓			
	Scan QR Code function	✓			
					Total = 4 weeks
3	Map function (Geo-based awareness)		✓		
	Friend function (including dynamically update of Friend business card)		✓		
	Chat function		✓		
					Total = 6 weeks

Table 3-2 Timeline for deliverables of the proposed method

The Table 3-3 below shows the project milestones of the project.

Project Milestones	**2018**					
	Mar	**Apr**	**May**	**Jun**	**Jul**	**Aug**
Project Initialization						
Completion of system version 1						
Completion of system version 2						
Completion of system version 3						
Project Completion						

Table 3-3 Project milestones of the project

3.4.2 Graphical – Gantt Chart Format

The Table 3-4 below shows the Gantt Chart of the project.

Activities	**Period (month)**	**2018**											
		Mar		**Apr**		**May**		**Jun**		**Jul**		**Aug**	
Preparation of the project	0.5												
Development of system version 1	1												
Test and evaluate system version 1	0.5												
Development of system version 2	1												
Test and evaluate system version 2	0.5												
Development of system version 3	1.5												
Test and evaluate system version 3	0.5												
Compile and document project results	-												

Table 3-4 Gantt chart of the project

CHAPTER 4: SYSTEM DESIGN

4.1 System Flowchart

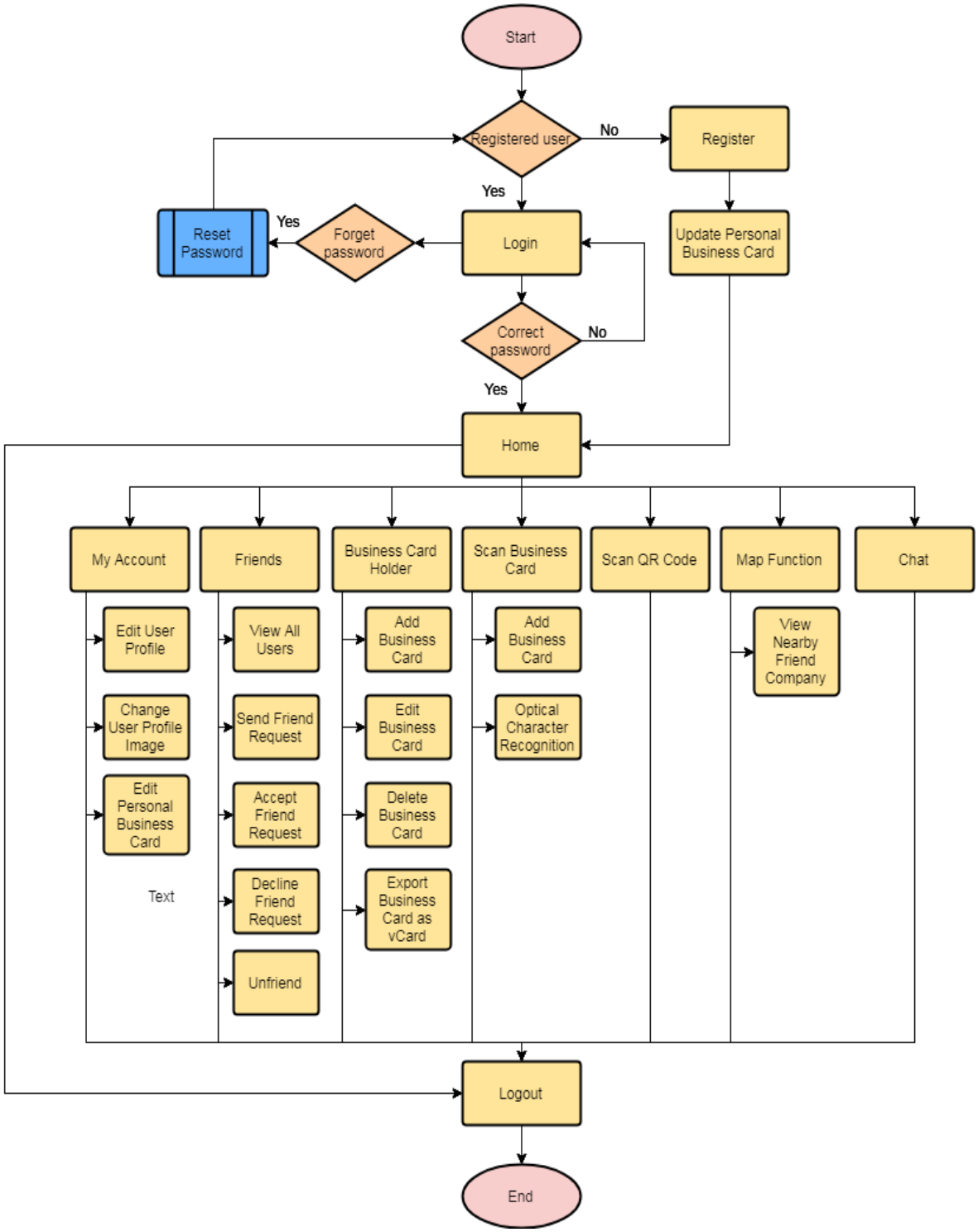


Figure 4-1 System Flow Chart of the application

4.2 Entity-Relationship Diagram (ERD)

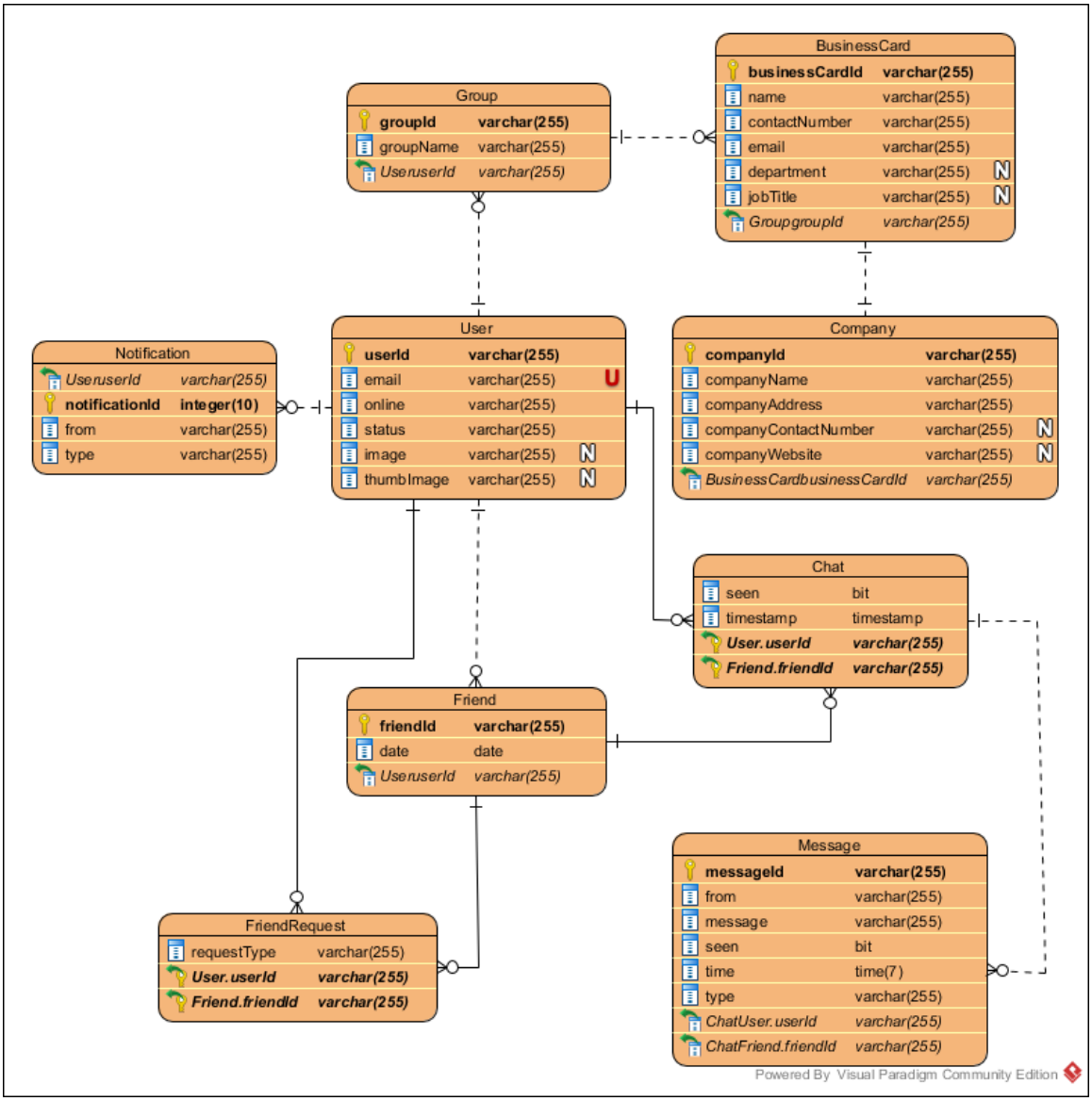


Figure 4-2 ERD of the project

4.3 Use Case Diagram

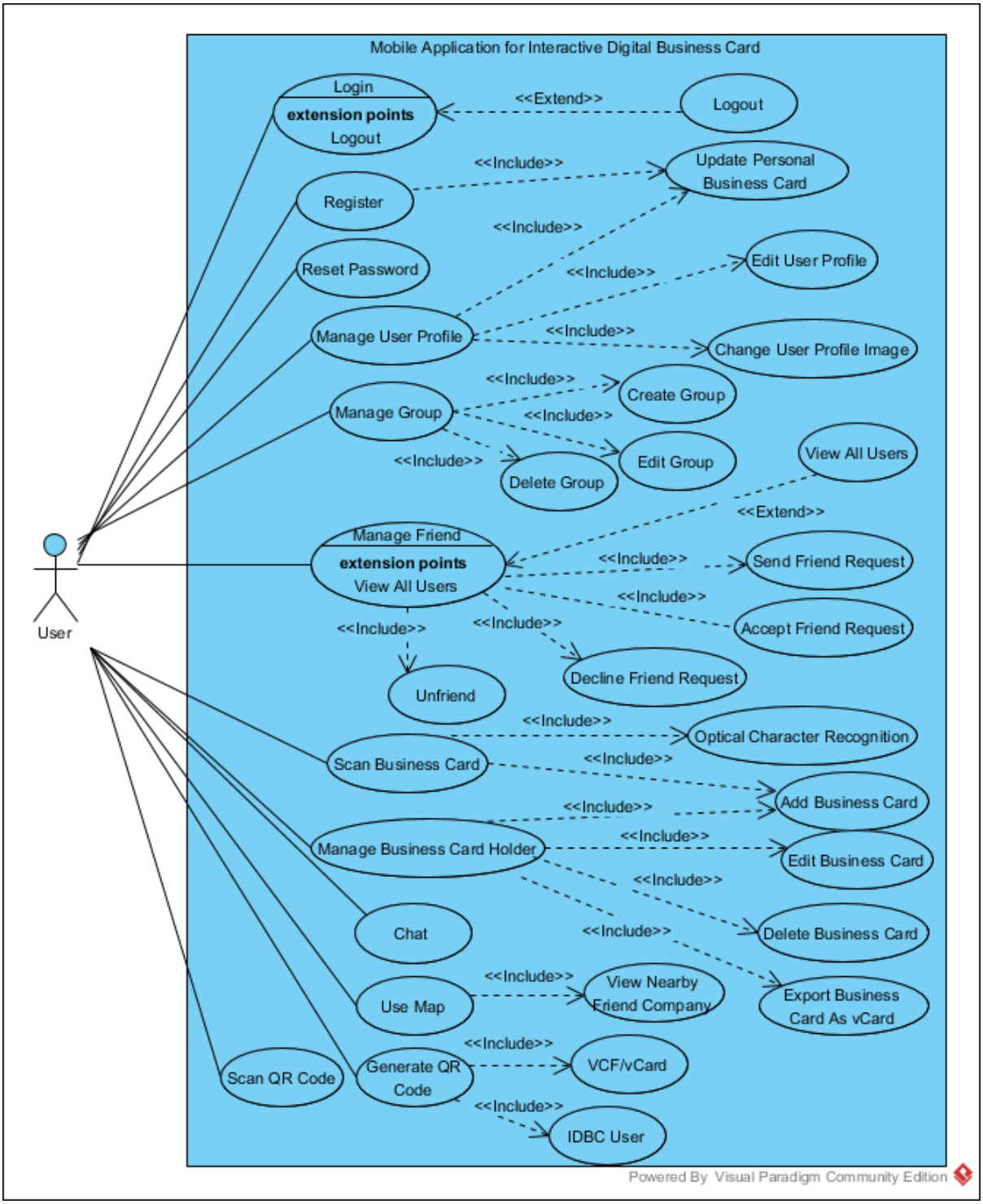


Figure 4-3 Use Case Diagram of the project

4.3.1 Use Case Description of Login

Use Case ID	UC001	
Feature	F001 Login	
Purpose	To allow user login to an account.	
Actor	User	
Trigger	User execute the application.	
Precondition	System is connected to the internet. User not logged into the application.	
Scenario Name	**Step**	**Action**
Main Flow	1	User enter email address and password.
	2	User press "Login" button.
	3	System validate user's email address and password.
	4	System redirect user to main menu.
Alternative Flow – Invalid email address or password	1.1	User enter invalid email or invalid password.
	1.2	System display error message.

Table 4-1 Use case description of Login

4.3.2 Use Case Description of Register

Use Case ID	UC002	
Feature	F002 Register	
Purpose	To allow user register an account.	
Actor	User	
Trigger	User execute the application.	
Precondition	System is connected to the internet. User not logged into the application.	
Scenario Name	**Step**	**Action**
Main Flow	1	User enter full name, email address and password.
	2	User press "Register" button.
	3	System validate user's email address and password.
	4	System register the user and redirect the user to "Update Personal Business Card" activity.
	5	User enter required information.
	6	System validate user's information.

	7	System create "Personal Business Card" for the user and redirect user to the main menu.
Alternative Flow – Invalid email address or password	1.1	User enter invalid email address or password
	1.2	System display error message.

Table 4-2 Use case description of Register

4.3.3 Use Case Description of Reset Password

Use Case ID	UC003	
Feature	F003 Reset Password	
Purpose	To allow user to reset the password of his/her account.	
Actor	User	
Trigger	User press "Forget Password?" at the Login screen.	
Precondition	System is connected to the internet.	
Scenario Name	**Step**	**Action**
Main Flow	1	User enter registered email address.
	2	User press on "Reset Password" button.
	3	System validate user's email address.
	4	System send an email to user's email address to let user reset password.
Alternative Flow – Invalid email address	1.1	User enter invalid email address.
	1.2	System display error message.

Table 4-3 Use case description of Reset Password

4.3.4 Use Case Description of Logout

Use Case ID	UC004	
Feature	F004 Logout	
Purpose	To allow user to logout from the application.	
Actor	User	
Trigger	User press "Logout" Button.	
Precondition	System is connected to the internet. User is logged in to the application.	
Scenario Name	**Step**	**Action**

Main Flow	1	System prompt a dialog to ask user whether he/she is sure to logout.
	2	User press "Logout" button in the dialog.
	3	System logout the user

Table 4-4 Use case description of Logout

4.3.5 Use Case Description of Manage User Profile

Use Case ID	UC005	
Feature	F005 Manage User Profile	
Purpose	To allow user to manager his/her user profile.	
Actor	User	
Trigger	User press "My Account" button in Menu or Navigation Pane.	
Precondition	System is connected to the internet. User is logged in to the application.	
Scenario Name	**Step**	**Action**
Main Flow	1	System navigate user to "My Account" activity.
	2	User view account and personal business card details.
Alternative Flow – Edit user profile	2.1	User press on "Edit Profile" button.
	2.2	System display "Edit Account" dialog.
	2.3	User fill in required information.
	2.4	User press "Save Changes" button.
	2.5	System validate information.
	2.6	System update user profile information.
	2.7	System dismiss "Edit Account" dialog and return user to "My Account" activity.
Alternative Flow – Change user profile image	2.1	User press on "Change Image" button.
	2.2	System direct user to "Gallery".
	2.3	User select image from "Gallery"
	2.4	System update user profile image.
	2.5	System return user to "My Account" activity.
Alternative Flow – Edit personal business card	2.1	User press on "Edit Business Card" button.
	2.2	System display "Updating Business Card" dialog.
	2.3	User fill in required information.
	2.4	User press "Update" button.

	2.5	System validate information.
	2.6	System update user's personal business card.
	2.7	System dismiss "Updating Business Card" dialog and return user to "My Account" activity.

Table 4-5 Use case description of Manager User Profile

4.3.6 Use Case Description of Generate QR Code

Use Case ID	UC006	
Feature	F006 Generate QR Code	
Purpose	To allow user to share his personal business card with QR code.	
Actor	User	
Trigger	User press "Share QR" button in "My Account" activity.	
Precondition	System is connected to the internet. User is logged in to the application.	
Scenario Name	**Step**	**Action**
Main Flow	1	System display "Share QR as" dialog to let user to choose either export personal business card as QR code in "vCard" format or "IDBC User" format.
	2	User press on "vCard" in the "Share QR as" dialog.
	3	System generate QR code of the user's personal business card in "vCard" format.
Alternative Flow – User choose "IDBC User" format	2.1	User press on "IDBC User" in the "Share QR as" dialog.
	2.2	System generate QR code of the user's personal business card in "IDBC User" format.

Table 4-6 Use case description of Generate QR Code

4.3.7 Use Case Description of Manage Business Card Holder

Use Case ID	UC007
Feature	F007 Manage Business Card Holder
Purpose	To allow user to manager his/her business card holder.
Actor	User

Trigger	User press "Business Card Holder" button in Menu or Navigation Pane.	
Precondition	System is connected to the internet. User is logged in to the application.	
Scenario Name	**Step**	**Action**
Main Flow	1	System display a list containing all user's business cards.
	2	User view his/her business card list.
Alternative Flow – User add business card	2.1	User press into "Add Business Card" button.
	2.2	System display "Add Business Card" dialog.
	2.3	User fill in required information.
	2.4	User press "Add" button.
	2.5	System validate information.
	2.6	System add business card into database.
	2.7	System dismiss "Add Business Card" dialog and redirect user back to "Business Card Holder" activity.
Alternative Flow – User edit business card	2.1	User press one of the business card in the list.
	2.2	System load information of the selected business card and direct user to "View Business Card" activity.
	2.3	User press on the Menu Item List.
	2.4	User press on "Edit Business Card" button.
	2.5	System display "Updating Business Card" dialog.
	2.6	User fill in required information.
	2.7	User press "Update" button.
	2.8	System validate information.
	2.9	System update user's personal business card.
	2.10	System dismiss "Updating Business Card" dialog and return user to "Business Card Holder" activity.
Alternative Flow – User delete business card	2.1	User press one of the business card in the list.
	2.2	System load information of the selected business card and direct user to "View Business Card" activity.
	2.3	User press on the Menu Item List.
	2.4	User press on "Delete Business Card" button.
	2.5	System display "Confirm To Delete?" dialog.
	2.6	User press on "Yes" button.

	2.7	System delete business card from database and return user to "Business Card Holder" activity.
Alternative Flow – User export business card as vCard	2.1	User press one of the business card in the list.
	2.2	System load information of the selected business card and direct user to "View Business Card" activity.
	2.3	User press on the Menu Item List.
	2.4	User press on "Export Business Card" button.
	2.5	System export business card to vCard and invoke "Contact" application to import the vCard.

Table 4-7 Use case description of Manager Business Card Holder

4.3.8 Use Case Description of Manage Group

Use Case ID	UC008	
Feature	F008 Manage Group	
Purpose	To allow user to manager his/her business card holder's groups.	
Actor	User	
Trigger	User press "Group" button in "Business Card Holder" activity.	
Precondition	System is connected to the internet. User is logged in to the application.	
Scenario Name	**Step**	**Action**
Main Flow	1	System display a list containing all user's groups.
	2	User view his/her group list.
Alternative Flow – User create new group	2.1	User press into "Create New Group" button.
	2.2	System display "Create New Group" dialog.
	2.3	User fill in required information.
	2.4	User press "Add" button.
	2.5	System validate information.
	2.6	System add group into database.
	2.7	System dismiss "Create New Group" dialog and redirect user back to "Group" activity.
Alternative Flow – User edit group (Rename Group)	2.1	User press one of the group in the list.
	2.2	System load information of the selected group and direct user to "View Group" activity.
	2.3	User press on the Menu Item List.

	2.4	User press on “Rename Group” button.
	2.5	System display “Rename Group” dialog.
	2.6	User fill in required information.
	2.7	User press “Rename” button.
	2.8	System validate information.
	2.9	System update user’s group.
	2.10	System dismiss “Rename Group” dialog and return user to “Group” activity.
Alternative Flow – User delete group	2.1	User press one of the group in the list.
	2.2	System load information of the selected group and direct user to “View Business Card” activity.
	2.3	User press on the Menu Item List.
	2.4	User press on “Delete Group” button.
	2.5	System display “Delete Group” dialog and ask whether the user is sure to delete the group.
	2.6	User press on “Yes” button.
	2.7	System delete group from database and return user to “Group” activity.

Table 4-8 Use case description of Manage Group

4.3.9 Use Case Description of Manage Friends

Use Case ID	UC009	
Feature	F009 Manage Friends	
Purpose	To allow user to manager his/her friends in the application.	
Actor	User	
Trigger	User press “Friends” button in Menu or Navigation Pane.	
Precondition	System is connected to the internet. User is logged in to the application.	
Scenario Name	**Step**	**Action**
Main Flow	1	System display a list containing all user’s friends.
	2	User view his/her friend list.
Alternative Flow – User view friend profile	2.1	User press one of the friend in the list.
	2.2	System display “Select Options” dialog to ask whether user want to view friend’s profile or chat with friend.

	2.3	User press “Open Profile” button.
	2.4	System load friend information and direct user to “Friend User Profile” activity.
Alternative Flow – User chat with friend	2.1	User press one of the friend in the list.
	2.2	System display “Select Options” dialog to ask whether user want to view friend’s profile or chat with friend.
	2.3	User press “Send message” button.
	2.5	System direct user to “Chat” activity.
Alternative Flow – User send friend request	2.1	Current user press on the “All Users” tab in “Friends” activity.
	2.2	System load and display information of all users.
	2.3	Current user press on one of the user.
	2.4	System load the selected user’s information and direct user to “Friend User Profile” activity.
	2.5	Current user press on “Send Friend Request” button.
	2.6	System send a request to the selected user to inform there is a friend request sent by the current user.
Alternative Flow – Accept Friend Request	2.1	User press on the “Friend Requests” tab in “Friends” activity.
	2.2	System load and display all friend request of current user.
	2.3	User press on one of the friend request.
	2.4	System load the friend request information and direct user to “Friend User Profile” activity.
	2.5	User press on “Accept Friend Request” button.
	2.6	System remove the friend request from the database. System add the selected user as friend of the current user and save into database.
Alternative Flow – Decline Friend Request	2.1	User press on the “Friend Requests” tab in “Friends” activity.
	2.2	System load and display all friend request of current user.
	2.3	User press on one of the friend request.
	2.4	System load the friend request information and direct user to “Friend User Profile” activity.
	2.5	User press on “Accept Friend Request” button.
	2.6	System remove the friend request from the database.

Table 4-9 Use case description of Manage Friends

4.3.10 Use Case Description of Scan Business Card

Use Case ID	UC010	
Feature	F010 Scan Business Card	
Purpose	To allow user to scan business card and perform OCR.	
Actor	User	
Trigger	User press "Scan Business Card" button in Menu or Navigation Pane.	
Precondition	System is connected to the internet. User is logged in to the application. System had been granted permissions included "Camera", "Read External Storage" and "Write External Storage" permissions.	
Scenario Name	**Step**	**Action**
Main Flow	1	User press on "Select an image/capture photo" button in "Scan Business Card" activity.
	2	User press on "Camera" icon and take picture of the hardcopy business card.
	3	System redirect user to "Crop Image" activity.
	4	User crop the captured image.
	5	System perform OCR on the image and display it in an EditText.
	6	User verify and make changes on the business card information in the EditText.
	7	System forward user to "Add Business Card" activity and fill up respective information in the activity.
	8	User verify and perform modification on the information.
	9	User press on "Add" button.
	10	System validate the information.
	11	System add the business card into database and redirect user to "Business Card Holder" activity.
Alternative flow – OCR function is unable to extract text from image	4.1	If the user did not rotate the image to face up 90 degree in during the crop process, the OCR function will not be able to extract text from image. User is required to rotate the business card image until it is upright at the "OCR" activity by pressing "Rotate" button.

Table 4-10 Use case description of Scan Business Card

4.3.11 Use case description of Chat Function

Use Case ID	UC011	
Feature	F011 Chat function	
Purpose	To allow user to chat with friend.	
Actor	User	
Trigger	User press "Chat" button in Menu or Navigation Pane.	
Precondition	System is connected to the internet. User is logged in to the application. User has at least a "Friend" in the application.	
Scenario Name	**Step**	**Action**
Main Flow	1	System load and display all current user and friends' chats.
	2	User press on one of the friend's chat in the list.
	3	System redirect user to "Chat Room" activity.

Table 4-11 Use case description of Chat Function

4.3.12 Use Case Description of Map Function

Use Case ID	UC012	
Feature	F012 Map function	
Purpose	To allow user to view nearby friend's company and use map function.	
Actor	User	
Trigger	User press "Map Function" button in Menu or Navigation Pane.	
Precondition	System is connected to the internet. User is logged in to the application. User has at least a "Friend" in the application.	
Scenario Name	**Step**	**Action**
Main Flow	1	System direct user to "Friends Nearby" activity. System load and display all nearby friends' company in a list.
	2	User view the nearby friends' company list.
Alternative Flow – User use map function	2.1	User press on the "Map Function" button in the "Friends Nearby" activity.
	2.2	System navigate user to the built-in "Map" activity.

Table 4-12 Use case description of Map Function

4.3.13 Use Case Description of Scan QR Function

Use Case ID	UC013	
Feature	F013 Scan QR function	
Purpose	To allow user to scan QR code.	
Actor	User	
Trigger	User press on "Scan QR Code" button in Menu or Navigation Pane.	
Precondition	System is connected to the internet. User is logged in to the application. System had been granted "Camera" permission.	
Scenario Name	**Step**	**Action**
Main Flow	1	System invoke QR Scanner activity.
	2	User scan QR code using the QR scanner.
	3	System get the QR code result. The QR code is in vCard format, system will export the vCard to "Contact" application.
Alternative Flow – IDBC format	3.1	System get the QR code result. The QR code is in "IDBC User" format, system will redirect user to the selected user's profile activity.

Table 4-13 Use case description of Scan QR Function

4.4 Activity Diagram

4.4.1 Login

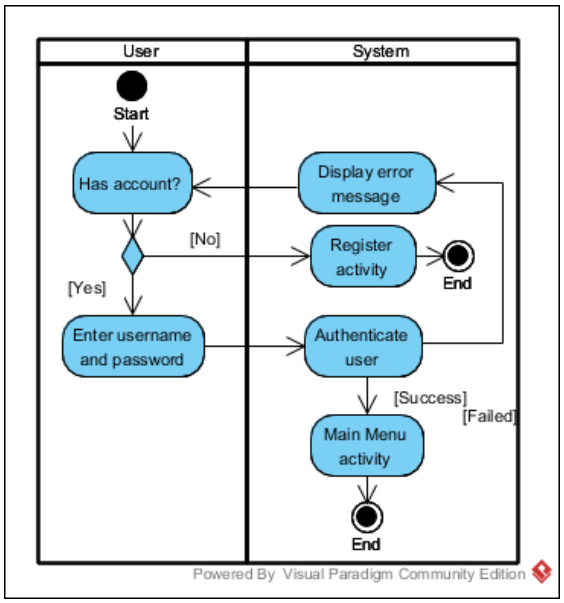


Figure 4-4 Activity diagram of Login

4.4.2 Register

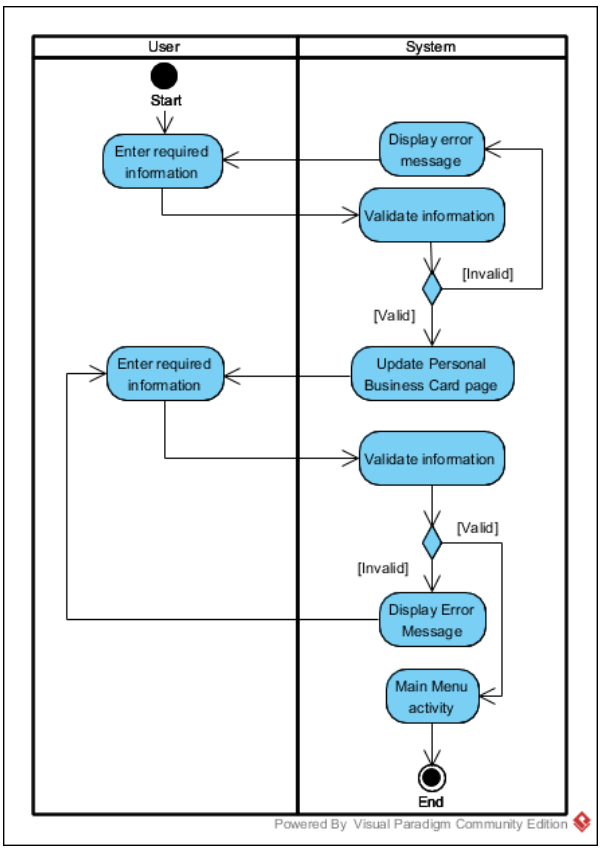


Figure 4-5 Activity diagram of Register

4.4.3 Reset Password

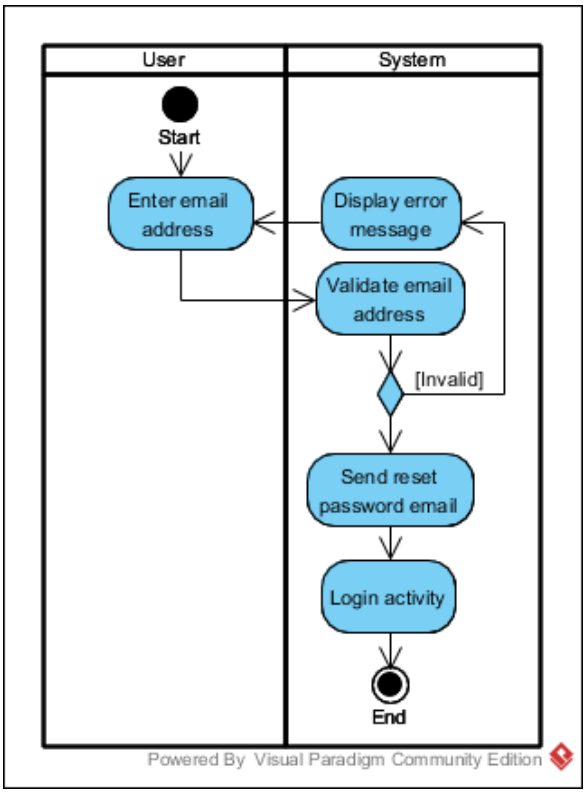


Figure 4-6 Activity diagram of Reset Password

4.4.4 Manage User Profile: Update Personal Business Card

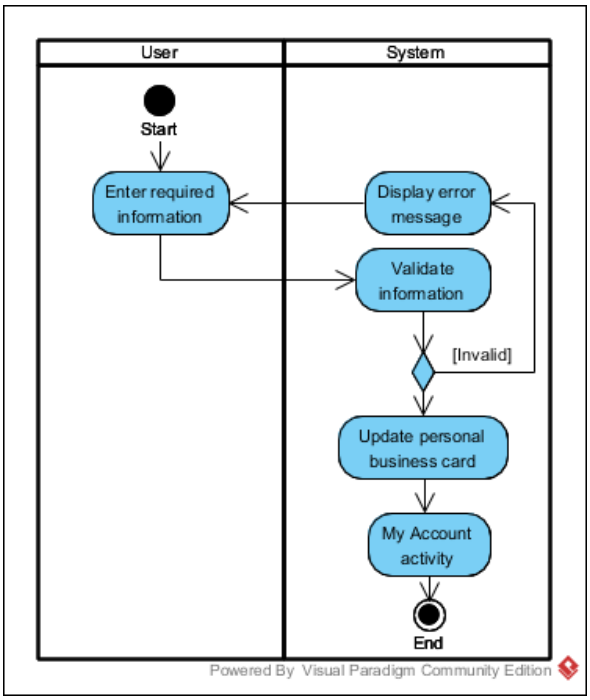


Figure 4-7 Activity diagram of Update Personal Business Card

4.4.5 Manage User Profile: Edit User Profile

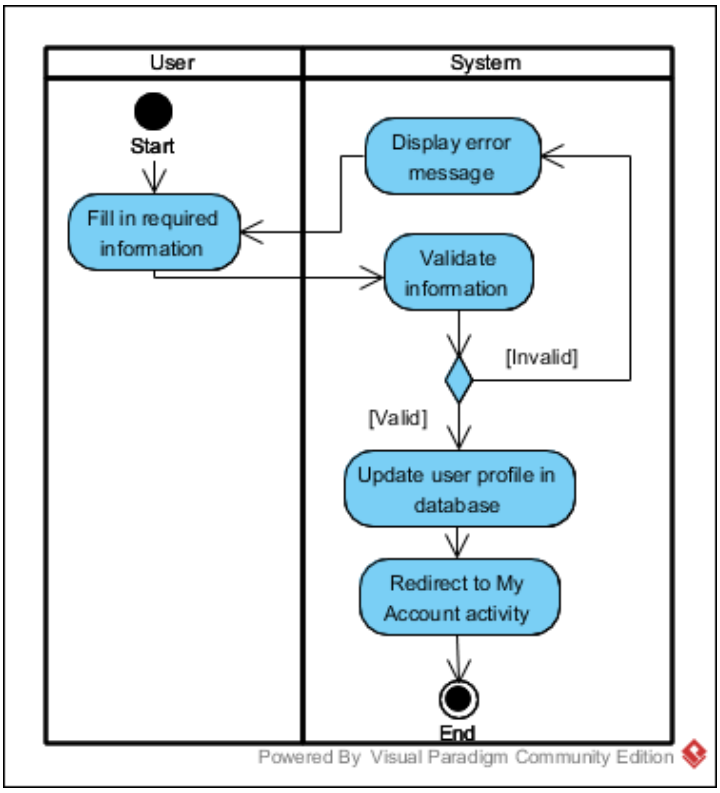


Figure 4-8 Activity diagram of Edit User Profile

4.4.6 Manage User Profile: Change User Profile Image

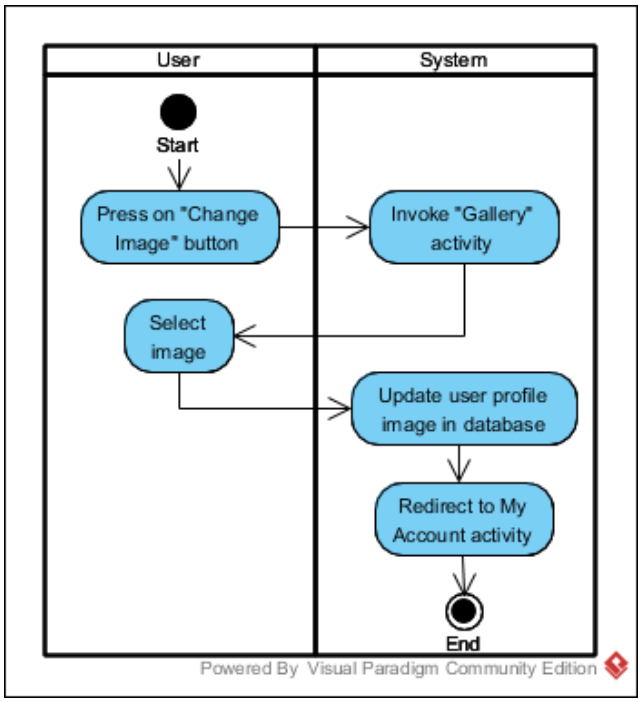


Figure 4-9 Activity diagram for Change User Profile Image

4.4.7 Generate QR Code

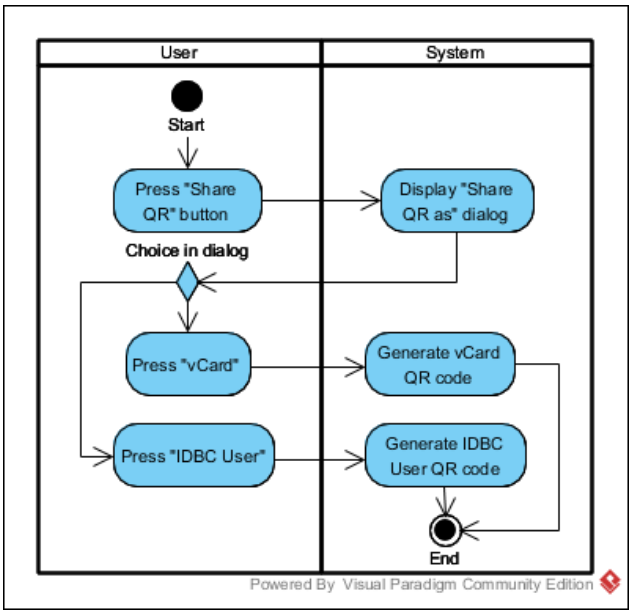


Figure 4-10 Activity diagram of Generate QR Code

4.4.8 Manage Business Card Holder: Add Business Card

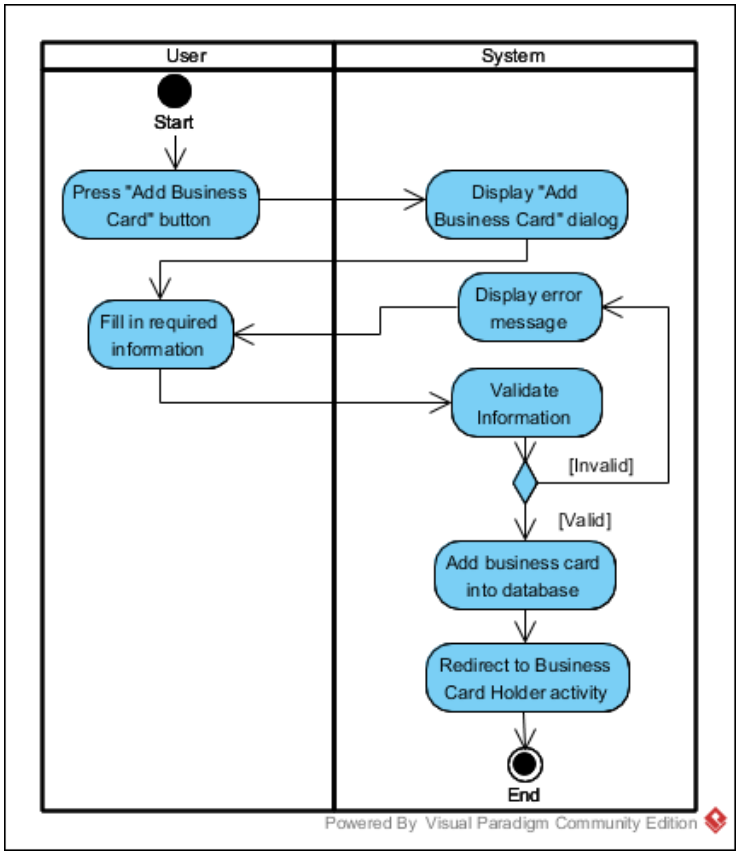


Figure 4-11 Activity diagram of Add Business Card

4.4.9 Manage Business Card Holder: Edit Business Card

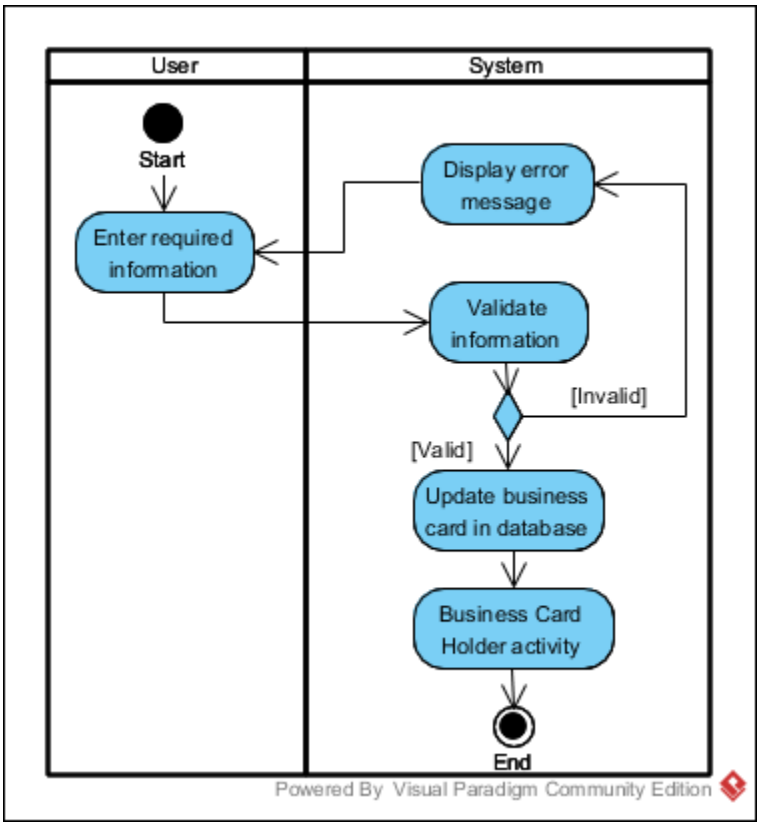


Figure 4-12 Activity diagram of Edit Business Card

4.4.10 Manage Business Card Holder: Delete Business Card

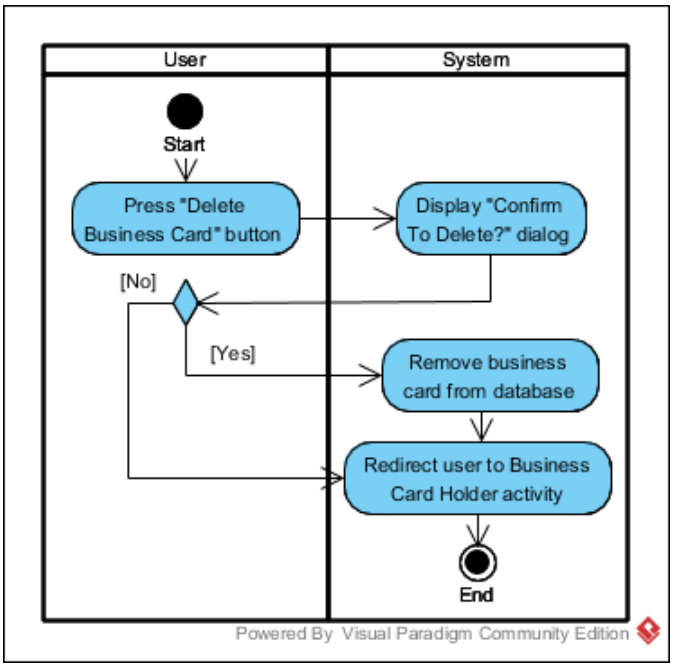


Figure 4-13 Activity Diagram of Delete Business Card

4.4.11 Manage Business Card Holder: Export Business Card as vCard

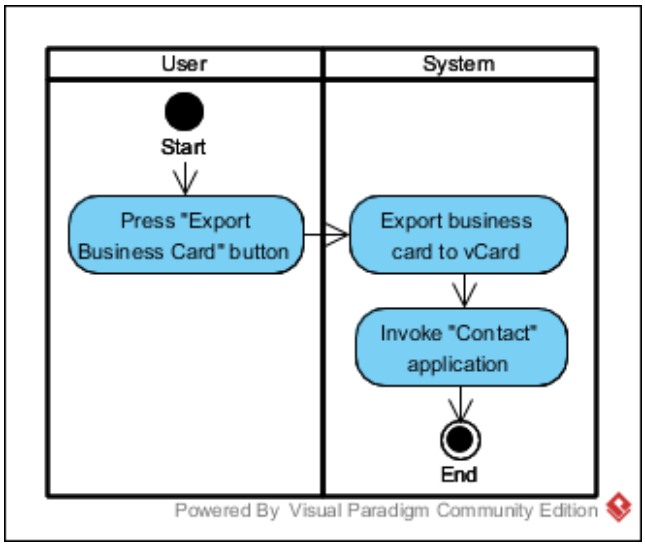


Figure 4-14 Activity Diagram of Export Business Card as vCard

4.4.12 Manage Group: Create Group

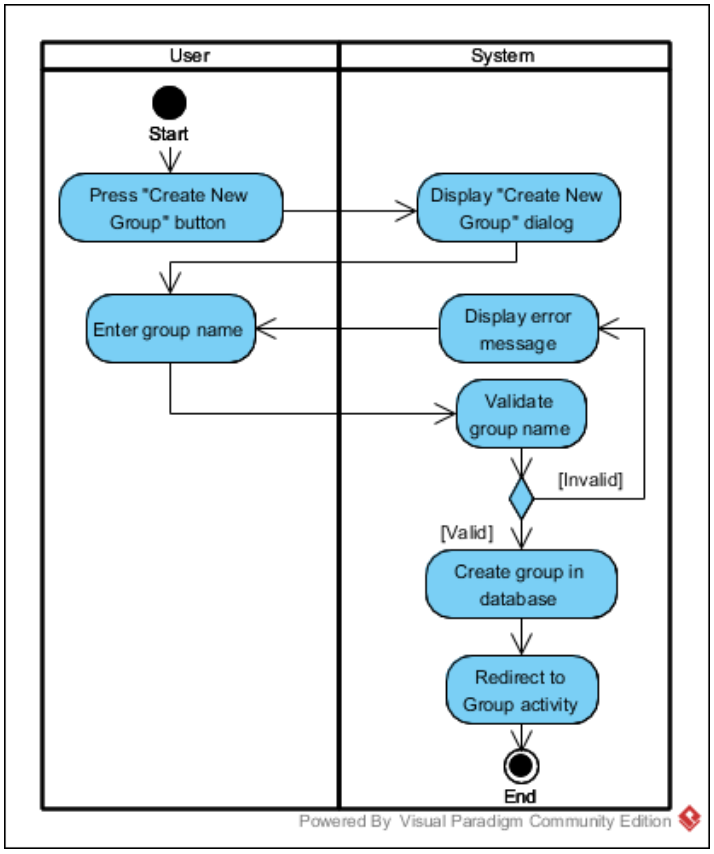


Figure 4-15 Activity diagram of Create Group

4.4.13 Manage Group: Edit Group

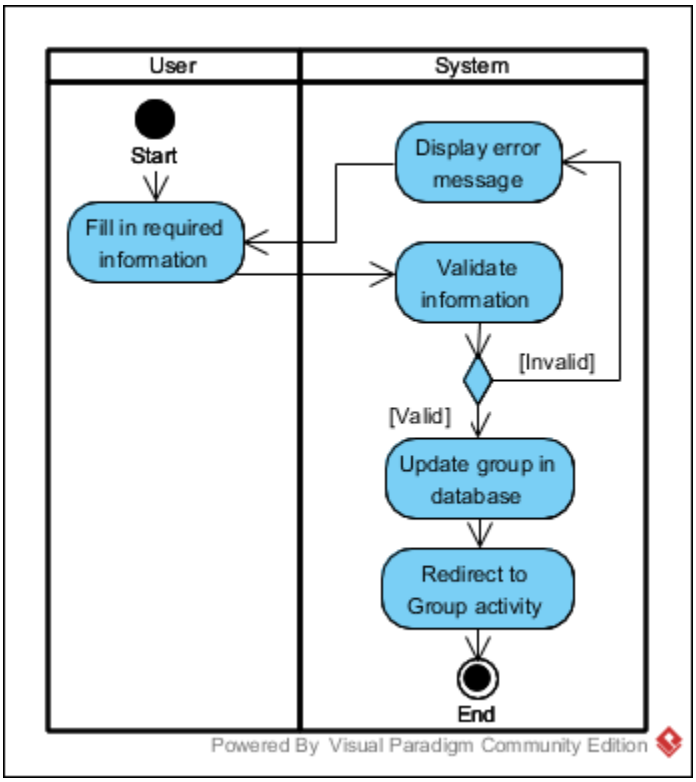


Figure 4-16 Activity diagram of Edit Group

4.4.14 Manage Group: Delete Group

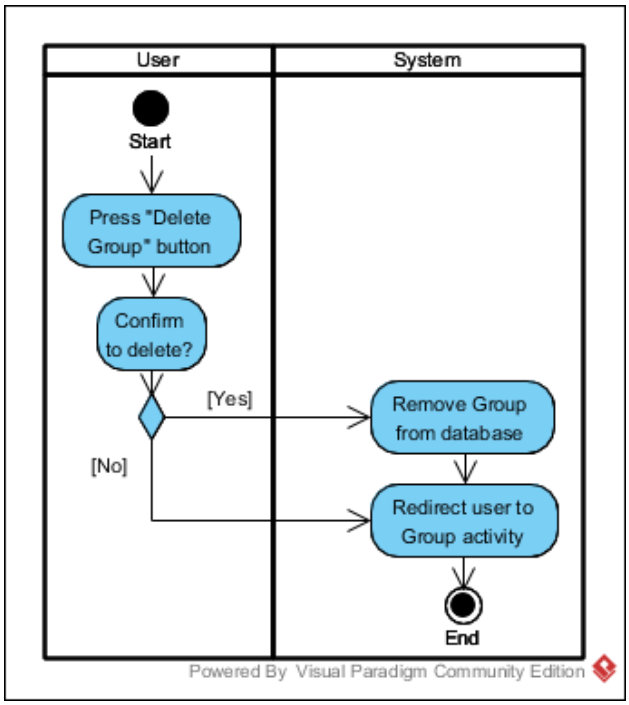


Figure 4-17 Activity diagram of Delete Group

4.4.15 Manage Friend: Send Friend Request

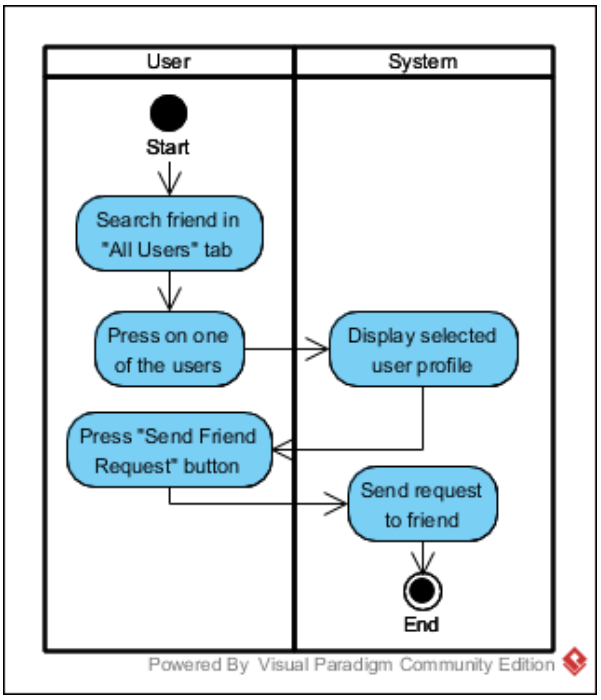


Figure 4-18 Activity diagram of Send Friend Request

4.4.16 Manage Friend: Manage Friend Request

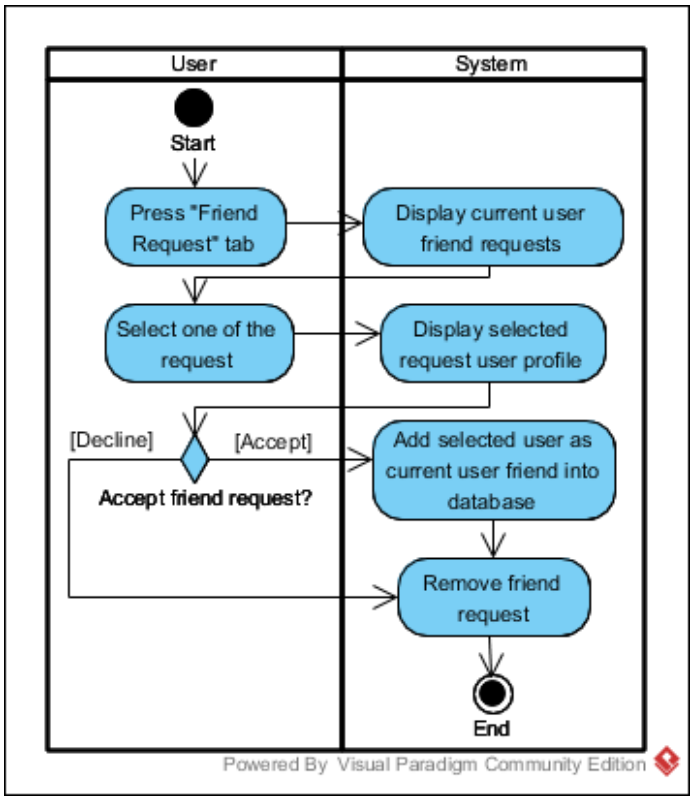


Figure 4-19 Activity diagram of manage friend request

4.4.17 Scan Business Card

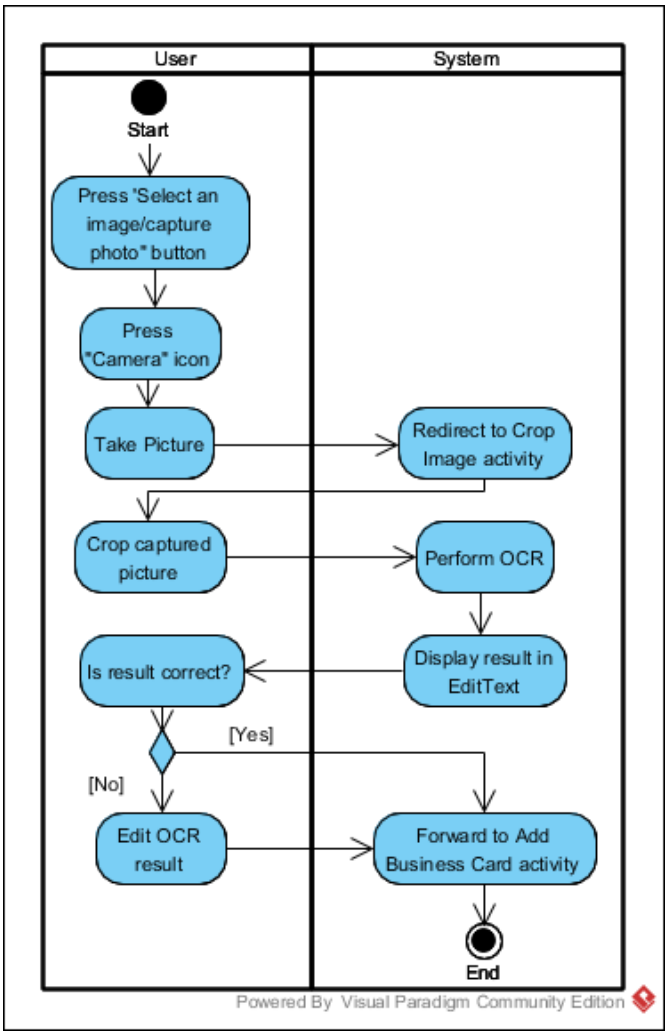


Figure 4-20 Activity diagram of Scan Business Card

4.4.18 Chat Function

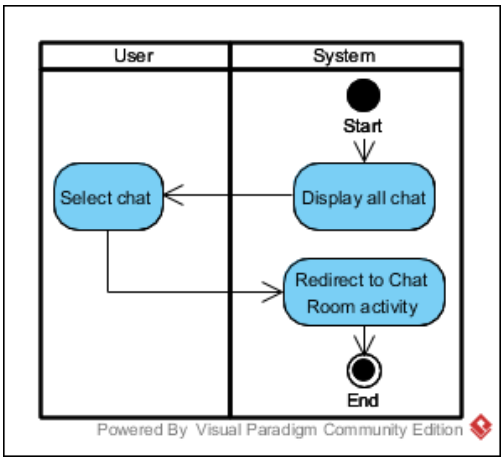


Figure 4-21 Activity diagram of Chat Function

4.4.19 Map Function

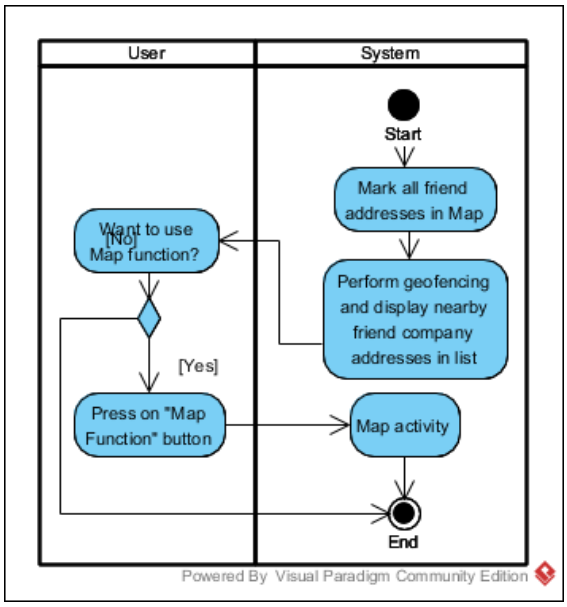


Figure 4-22 Activity diagram of Map Function

4.4.20 Scan QR Code

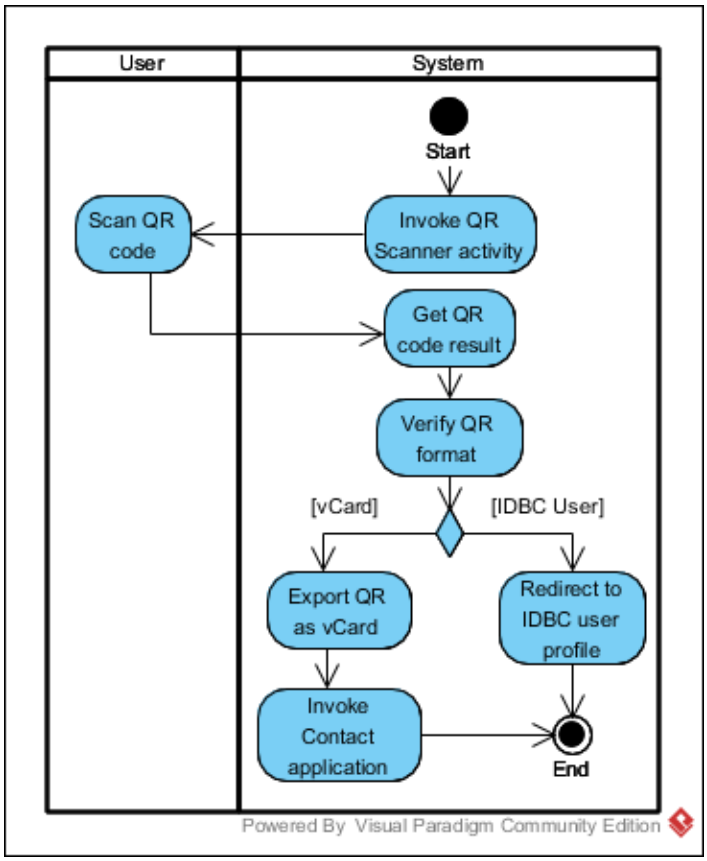


Figure 4-23 Activity diagram of Scan QR Code

4.5 System User Interface Design

4.5.1 Splash Activity

Figure 4-24 Splash activity user interface

The "Splash Activity" is the first activity page the user will see after execute the application. In this activity, the application will check whether the user is authenticated or not. If the user is authenticated, the application will direct user to the Main Menu, else it will direct user to the login page.

4.5.2 Login Activity and Logout Activity

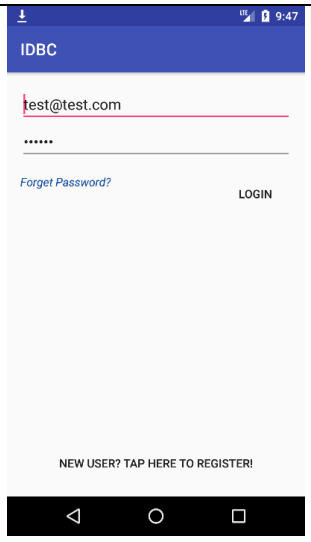


Figure 4-25 Login activity user interface

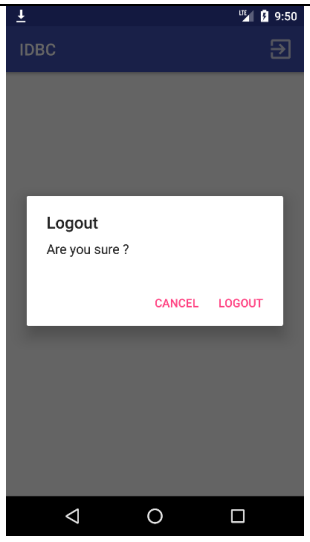


Figure 4-26 Logout activity user interface

4.5.3 Register Activity

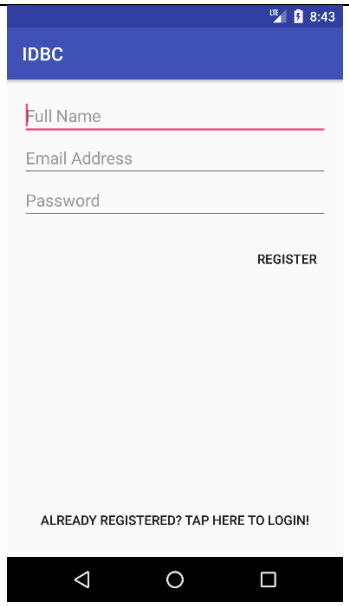


Figure 4-27 Register activity user interface

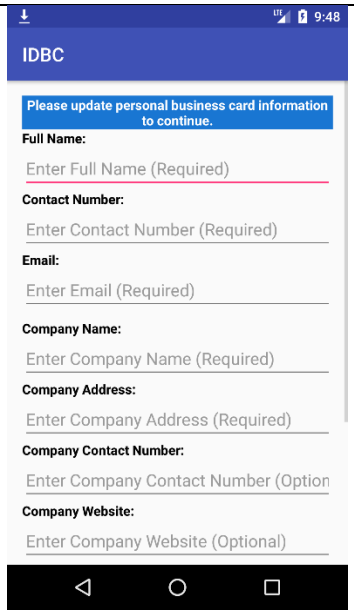


Figure 4-28 Update Personal Business Card activity user interface

After fill up the information and registered user account, the user will be direct to update his personal business card information. After that, the user will be direct to Main activity.

4.5.4 Reset Password Activity

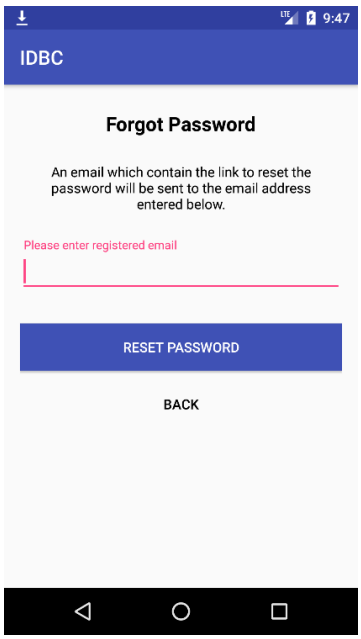


Figure 4-29 Reset Password user interface

4.5.5 Main Activity and Navigation Pane

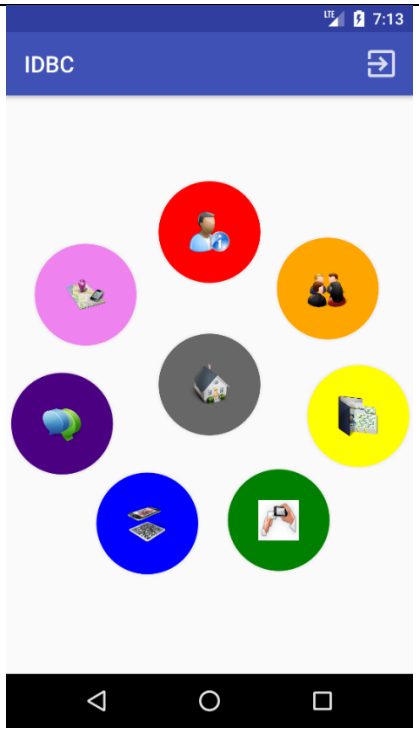


Figure 4-30 Main activity user interface

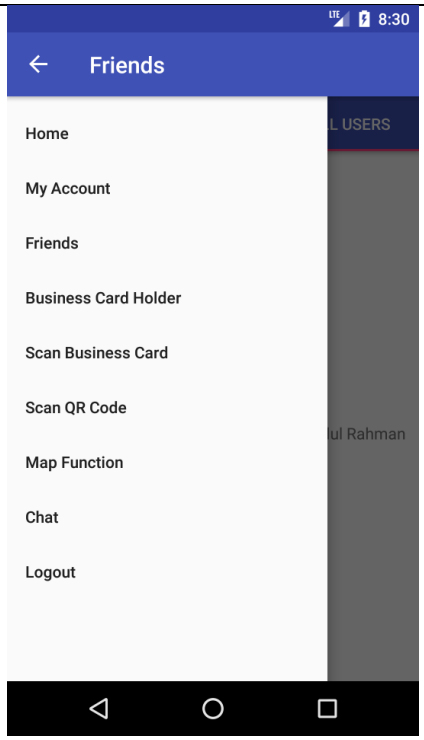


Figure 4-31 Navigation Pane user interface

Icon	Color	Description
	Dark Grey	Home (Navigate user to Main activity)
	Red	My Account (Navigate user to User Profile activity)
	Orange	Friend (Navigate user to Friends activity)
	Yellow	Business Card Holder
	Green	Scan Business Card
	Blue	Scan QR Code (Navigate user to Scan QR Code activity)
	Purple	Chat (Navigate user to Chat activity)
	Pink	Map (Navigate user to Map activity)

Table 4-14 Menu Icon Description in Main activity

4.5.6 My Account Activity

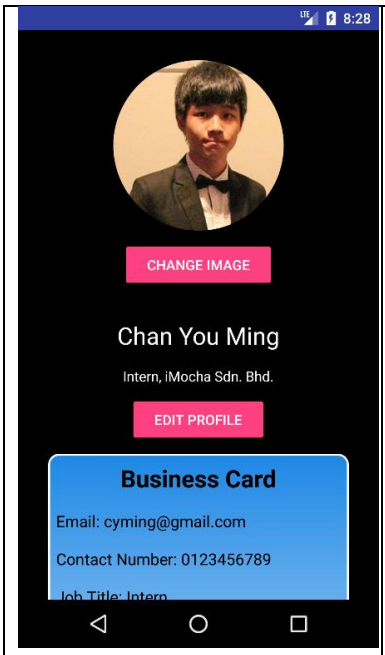


Figure 4-32 My Account activity user interface: User Profile

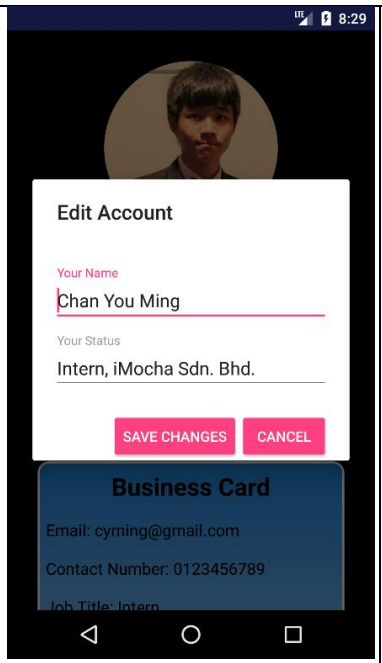


Figure 4-33 My Account activity user interface: Edit User Profile

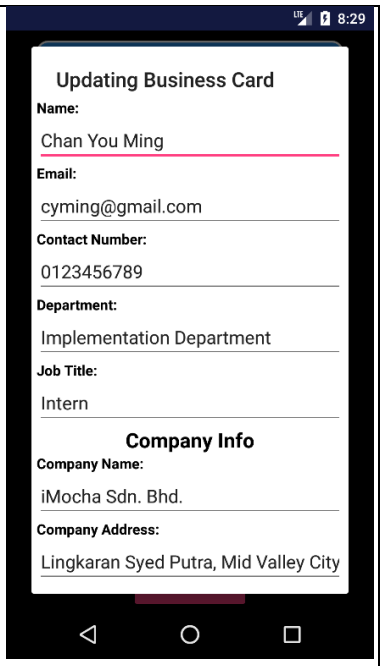


Figure 4-34 My Account activity user interface: Update Personal Business Card

4.5.7 Generate QR Code Activity

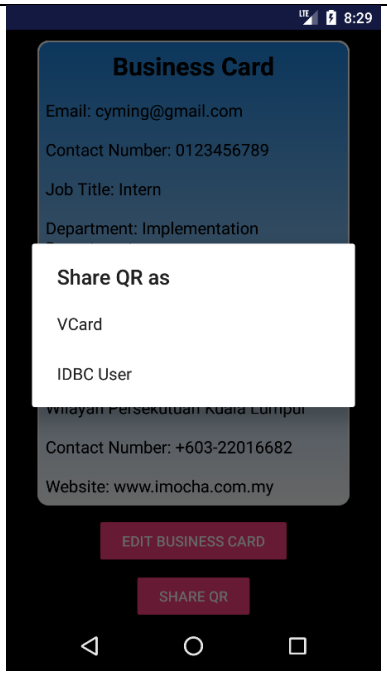


Figure 4-35 Generate QR Code activity user interface

Figure 4-36 QR code generated for user's personal business card

4.5.8 Scan QR Code Activity

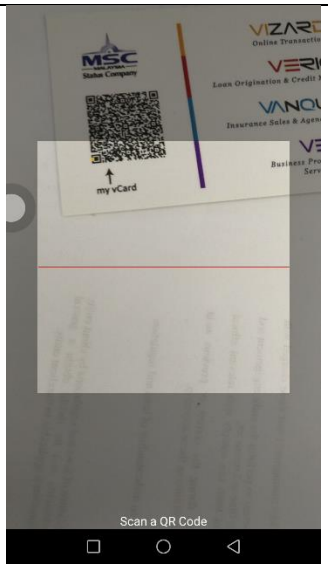


Figure 4-37 QR code scanner

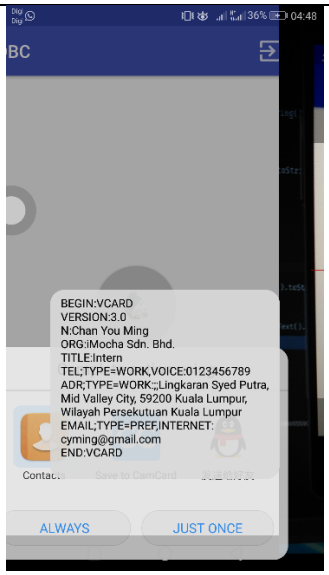


Figure 4-38 Scan QR code result for vCard format QR

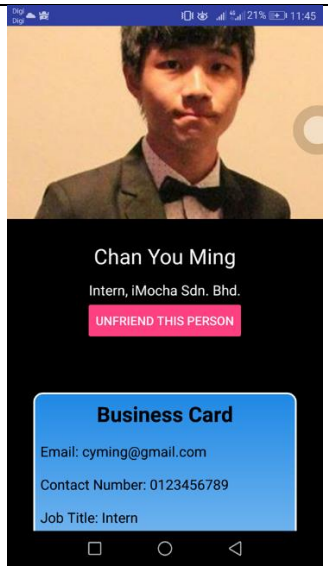


Figure 4-39 Scan QR code result for IDBC user

4.5.9 Manage Business Card Holder Activity

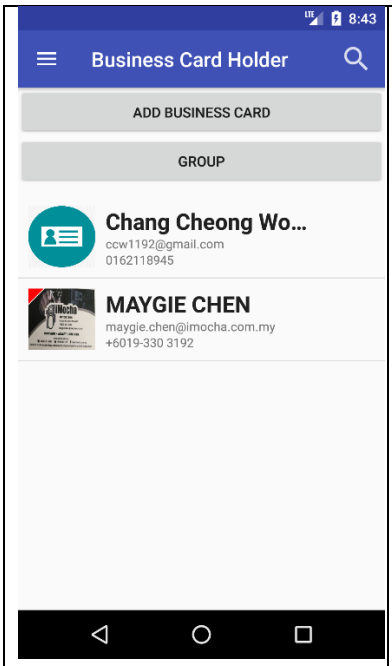


Figure 4-40 Business Holder activity user interface

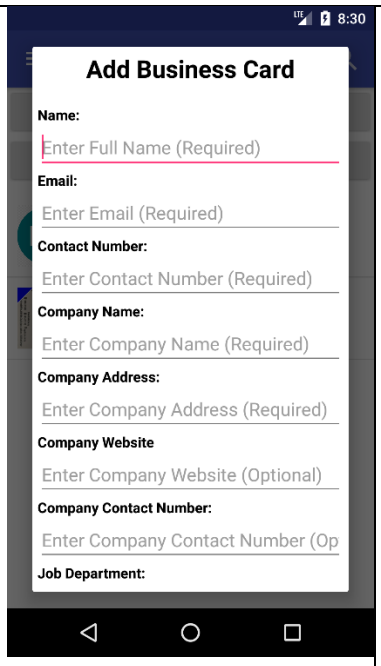


Figure 4-41 Add Business Card user interface

Figure 4-42 Business Card profile with side menu pressed

4.5.10 Manage Friend Activity

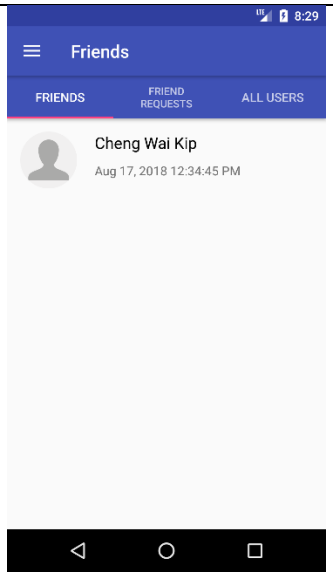


Figure 4-43 Friends Tab

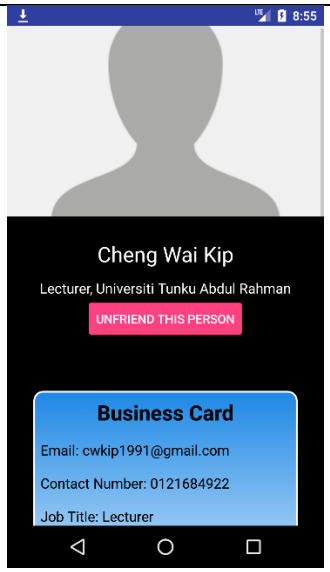


Figure 4-44 Friend profile

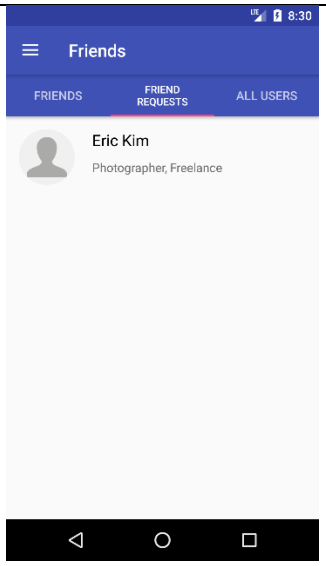


Figure 4-45 Friend Request Tab

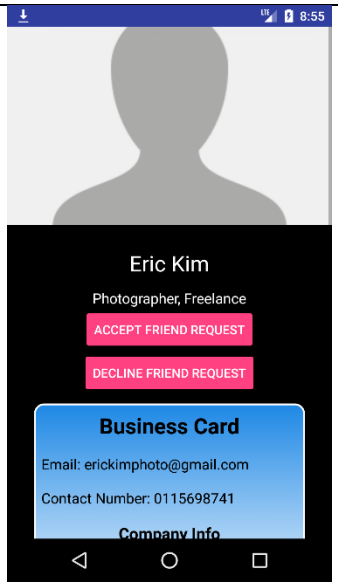


Figure 4-46 Friend Request profile

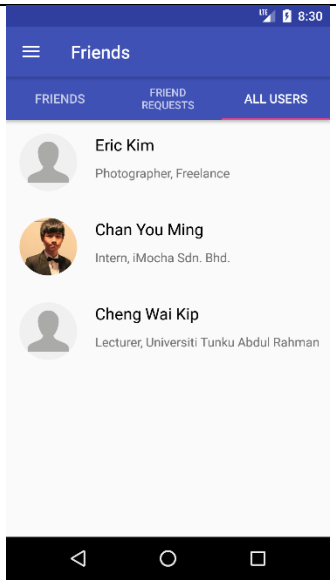


Figure 4-47 All Users Tab

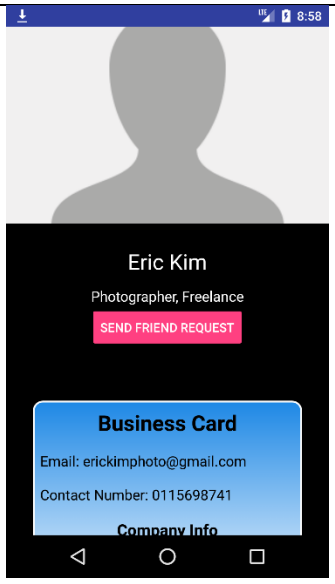


Figure 4-48 User Profile for not Friend user

4.5.11 Manage Group Activity

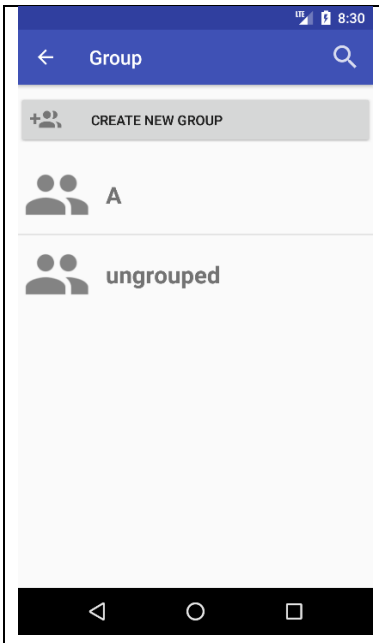


Figure 4-49 Group activity user interface

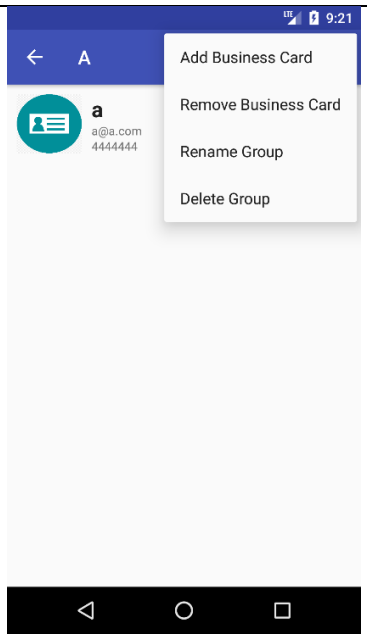


Figure 4-50 Group profile with side menu pressed

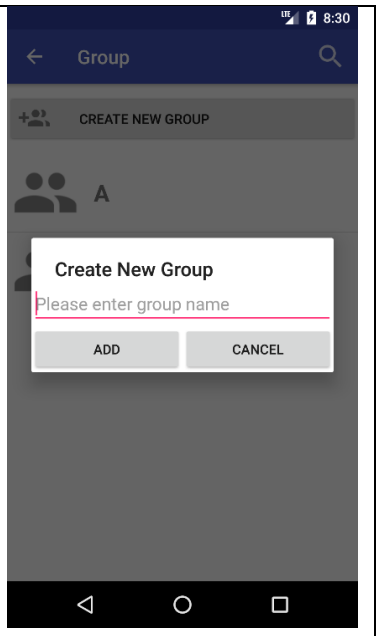


Figure 4-51 Create New Group user interface

4.5.12 Scan Business Card Activity

Figure 4-52 Crop Image activity user interface

Figure 4-53 OCR activity user interface

Figure 4-54 Add Business Card with checkbox of OCR result

4.5.13 Map Activity

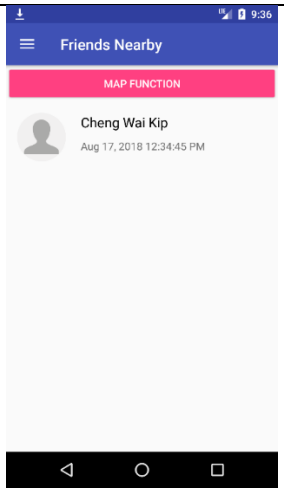


Figure 4-55 Nearby friends' company list

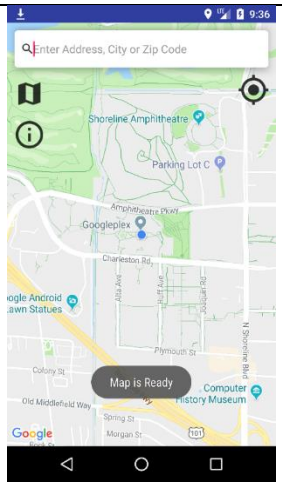


Figure 4-56 Map function user interface

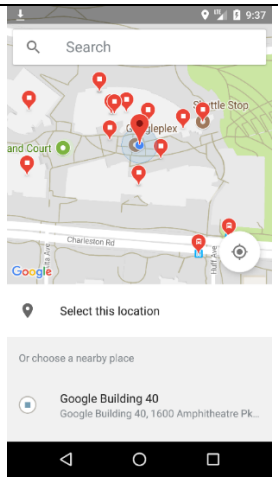


Figure 4-57 Nearby Places

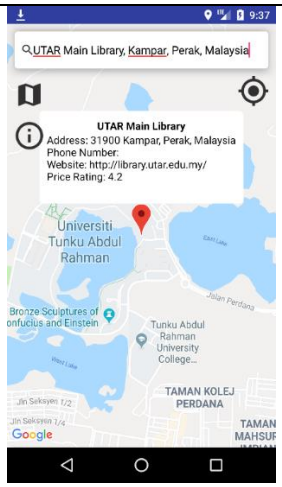


Figure 4-58 Map features

Icon	Description
	Navigate user to Near Places map function
	Show user current location on the map
	Show the location information such as address, phone number, website and price rating of the location

Table 4-15 Icon description in map function

4.5.14 Chat Activity

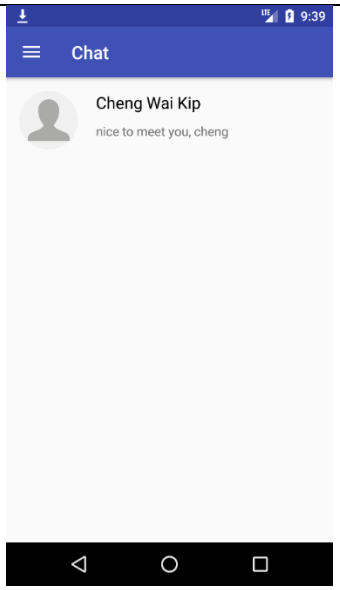


Figure 4-59 Chat activity main page

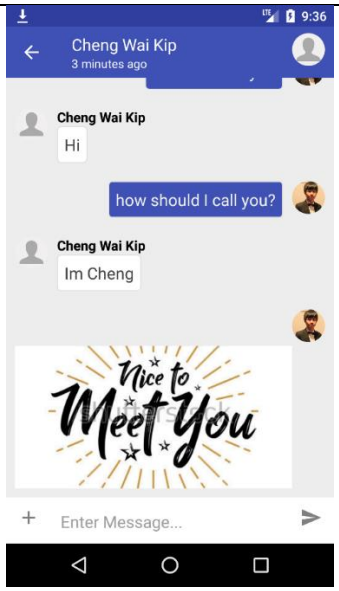


Figure 4-60 Chat activity

In Chat activity, user is able to send text message and also send image as message.

CHAPTER 5: IMPLEMENTATION AND TESTING

5.1 Implementation Issues and Challenges

The first issue faced in this assignment is the "build.gradle" dependency of the Android Studio. In order to solve this problem, we must synchronize all dependencies of the same package with the same version to avoid errors.

Next, due to the strong support of Google towards Android Studio IDE, the IDE will be updated frequently. This might cause the some of the project created previously not able to work correctly in the new IDE environment. To avoid this problem, we are not going to upgrade the IDE version if not necessary. The current version of IDE is strong enough to support all the features required to complete the project.

Other than that, the APIs (included Google Mobile Vision API and Google Map API) and Firebase database used in this project is also keep updating by Google. To avoid any error caused to the project, we do not simply update the version that we initially use for the all the API if they are working ideally. However, if the update version of the APIs and Firebase database show a better performance, we will be updating their version in our project and read the update news to see what should be changed to the old code in order to avoid errors after updating.

The development time for the project is also a challenge during the completion of this project. Due to the limited time, a good plan must be adopted in order to finish the project in time.

5.2 System Testing

5.2.1 Use Case Testing

Use Case	Condition	Input	Actual Output	Expected Output	Result
Login	Main flow	Correct email address and password.	Successfully login, navigate to main menu.	Successfully login, navigate to main menu.	Pass
	Alternative flow	Invalid email	System display error message.	System display error message.	Pass
		Invalid password	System display error message.	System display error message.	Pass
Register	Main flow	Valid email address, password and correct information	Successfully register, navigate to main menu.	Successfully register, navigate to main menu.	Pass
	Alternative flow	Invalid email	System display error message.	System display error message.	Pass
		Invalid password	System display error message.	System display error message.	Pass
		Incorrect information	System display error message.	System display error message.	Pass
Reset password	Main flow	Valid email address	System send an email to user's email address to let user reset password.	System send an email to user's email address to let user reset password.	Pass
	Alternative flow	Invalid email address	System display error message.	System display error message.	Pass
	Main flow	Follow correct procedure	System display user profile.	System display user profile.	Pass

Manage User Profile	Edit user profile	Valid information	System update user profile into database.	System update user profile into database.	Pass
		Invalid information	System display error message.	System display error message.	Pass
	Change user profile image	Valid input	System update user profile image into database.	System update user profile image into database.	Pass
		Invalid input	System display error message.	System display error message.	Pass
	Edit personal business card	Valid information	System update user's personal business card in database.	System update user's personal business card in database.	Pass
		Invalid information	System display error message.	System display error message.	Pass
Generate QR Code	Main flow	"vCard" format	System generate vCard format QR code	System generate vCard format QR code	Pass
	Alternative flow	"IDBC" format	System generate IDBC user format QR code	System generate IDBC user format QR code	Pass
Manage Business Card Holder	Main flow	Follow correct procedure	System display business card list.	System display business card list.	Pass
	Add business card	Fill in required information correctly.	System add business card into database.	System add business card into database.	Pass
		Fill in required information but with wrong format.	System display error message.	System display error message.	Pass

		Does not fill in required information.	System display error message.	System display error message.	Pass
	Edit business card	Fill in required information correctly.	System update business card into database.	System update business card into database.	Pass
		Fill in required information but with wrong format.	System display error message.	System display error message.	Pass
		Does not fill in required information.	System display error message.	System display error message.	Pass
	Delete business card	Follow correct procedure.	System remove business card from database.	System remove business card from database.	Pass
	Export business card as vCard	Follow correct procedure.	System export business card to "vCard" and invoke "Contact" application to import the vCard.	System export business card to "vCard" and invoke "Contact" application to import the vCard.	Pass
Manager Group	Main flow	Follow correct procedure	System display group list.	System display group list.	Pass
	Create new group	Fill in required information.	System create new group in database.	System create new group in database.	Pass
		Did not fill in required information.	System display error message.	System display error message.	Pass
	Rename group	Fill in required information.	System update group in database.	System update group in database.	Pass

		Did not fill in required information.	System display error message.	System display error message.	Pass
	Delete group	Follow correct procedure.	System remove group from database.	System remove group from database.	Pass
Manage friend	Main flow	Follow correct procedure.	System display friend list.	System display friend list.	Pass
	View friend profile	Follow correct procedure.	System display friend profile.	System display friend profile.	Pass
	Chat with friend	Follow correct procedure.	System direct user to "Chat" activity.	System direct user to "Chat" activity.	Pass
	Send friend request	Follow correct procedure.	System send a request to the selected user to inform there is a friend request sent by the current user.	System send a request to the selected user to inform there is a friend request sent by the current user.	Pass
	Accept friend request	Follow correct procedure.	System remove the friend request from the database and add the selected user as friend of the current user and save into database.	System remove the friend request from the database and add the selected user as friend of the current user and save into database.	Pass
	Decline friend request	Follow correct procedure.	System remove the friend request from the database.	System remove the friend request from the database.	Pass

Scan Business Card	Main flow	Follow correct procedure.	System add the business card into database.	System add the business card into database.	Pass
Chat function	Main flow	Follow correct procedure.	System redirect user to "Chat" activity.	System redirect user to "Chat" activity.	Pass
Map function	Main flow	Follow correct procedure.	System display nearby friends' company list.	System display nearby friends' company list.	Pass
	Map activity	Follow correct procedure.	System navigate user to the built-in "Map" activity.	System navigate user to the built-in "Map" activity.	Pass
Scan QR function	Main flow	vCard format	System export the vCard to "Contact" application.	System export the vCard to "Contact" application.	Pass
	Alternative flow	IDBC User format	System redirect user to the selected user's profile activity	System redirect user to the selected user's profile activity	Pass

Table 5-1 Use Case Testing

CHAPTER 6: CONCLUSION

6.1 Project Review

6.1.1 Project Achievement

Project Objectives	Achievement
To develop a database that maintains users' digital business cards information.	Achieved
To reduce the use of the printed business card.	Achieved
To centralize the data so that everyone gets the latest information.	Achieved
To develop a more interactive mobile application for the digital business card.	Achieved
To design a user-friendly interface	Achieved
To provide a geo-based awareness of business card contacts' company location with map function mobile application to users	Achieved
To provide a digital business card mobile application with QR code generator for the user's personal business card for easy exchange.	Achieved
To provide a free of charge digital business card mobile application to users.	Achieved
To provide a digital business card mobile application with dynamic content.	Achieved
To provide a digital business card mobile application with indexes to group the business card contacts.	Achieved
To provide a digital business card mobile application with scanning and OCR function to scan and save hardcopy business cards.	Achieved
To provide a digital business card mobile application with chat function.	Achieved
To initiate and promote the practice of "paperless office".	Achieved
To test and evaluate the application	Achieved

Table 6-1 Project achievement based on project objectives

From the table above, we can observe that all project objective had been achieved.

6.1.2 Project Strength

Below are the strengths of this project compared to other Business Card applications:

- Built-in chat function.
- Built-in map function.
- Geo-based awareness of contact company location with the map function.
- Get contact updates dynamically.
- Unlimited scanning (OCR) without any changes.
- Able to perform OCR offline.
- Generate QR code of personal business card for easy sharing.
- Indexes/Group to differentiate the type of business card contact.

6.1.3 Project Weakness

The weakness of this project is listed below:

- Unable to detect business card automatically using mobile phone camera.
- Unable to access contact information across multiple devices (only Android devices enabled)
- Unable to detect non-Latin based language such as Chinese, Japanese, Korean language and so on.
- Unable to identify the entity (user) attribute accurately after perform the OCR

6.2 Future Work

Based on the weakness above, the future works can be done included:

- Custom design a camera activity that will detect the card shape object using the boundary edge of the card. With this implementation, the application will be able to detect business card automatically.
- Develop IOS application and web application to support this project in all devices.
- Implement the Google Cloud Vision API in order to detect non-Latin based language. However, the Google Cloud Vision API does not support offline OCR

function and have limited request, charges might apply if exceed the limited OCR request.

- With the growing of the Interactive Digital Business Card users, the OCR database stored in the Firebase will also increase. With the large datasets, it is possible to perform deep learning in the classification of business card entity's attribute so that the application will be able to fill up respective information of the business card automatically. There are variety deep learning model to be used included Convolutional Neural Network and Recurrent Neural Network. The learning type is supervised learning.

6.3 Conclusion

In a nutshell, the mobile application for interactive digital business card is introduced to promote the 'paperless office'. If everyone used the digital business card, then the paper waste produced will be greatly reduced. This will help to save the environment by cutting down the number of trees needed to produce papers.

Other than that, the mobile application for interactive digital business card is also aimed to provide a greater experience to the users in using the digital business card. The interactive functions for this mobile application included scan and store printed business card, dynamic content of digital business card, geo-based awareness with map function, and QR code generator for a digital business card for easy exchange.

The methodology of this project is incremental development method. Specifically, the phased development will be used to develop the mobile application. All the interactive functions will be implemented in the mobile application with the use of the Google Vision API, Google Map API and ZXing. The project is initialized in Mar 2018 and completed in Aug 2018. The time use for the completion of the whole project is less than 6 months.

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APPENDICES

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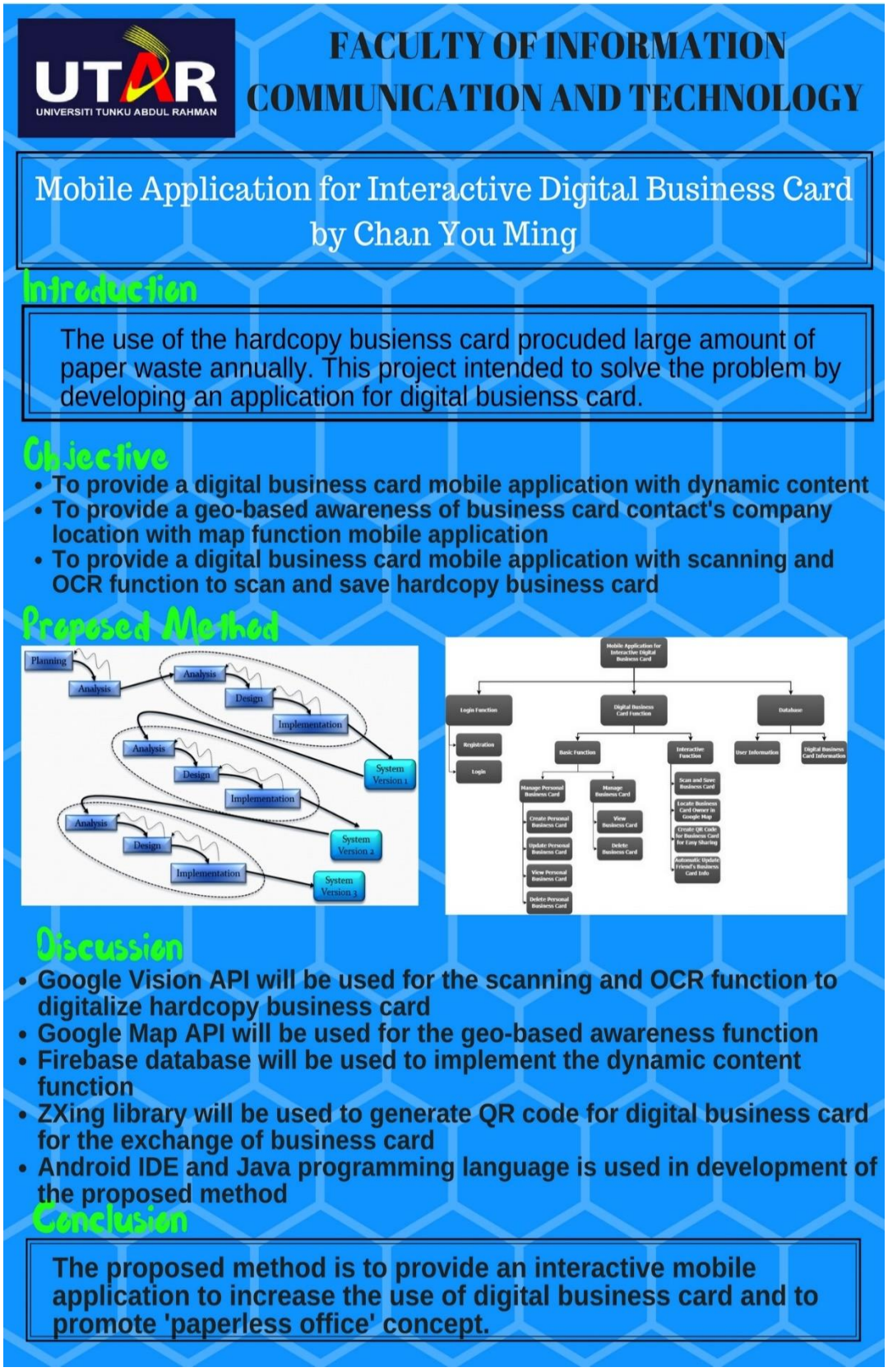

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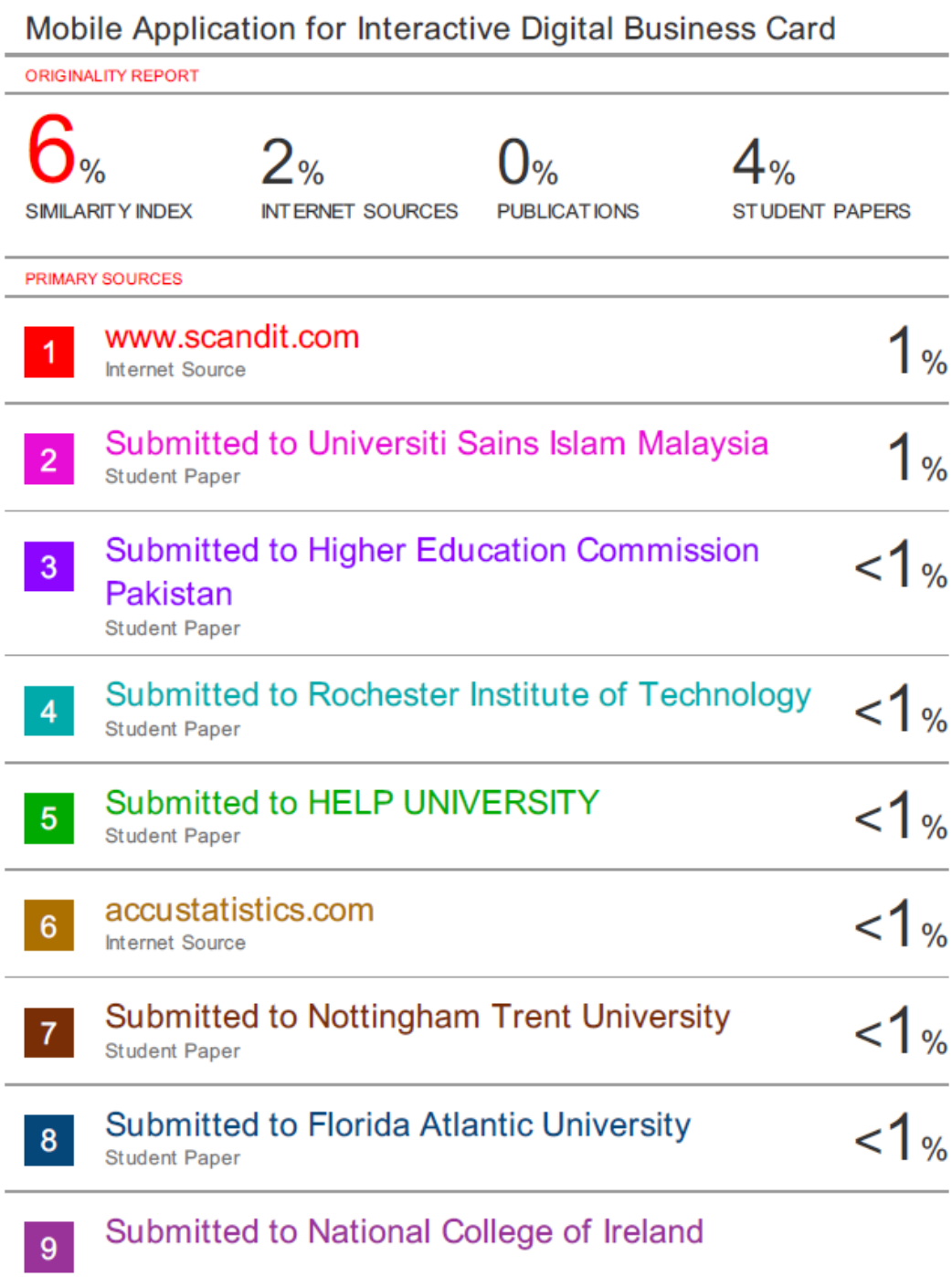

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