THE IMPLEMENTATION OF MOBILE QR-CODE BASED ATTENDANCE SYSTEM AT STATE POLYTECHNIC OF MALANG

UNDERGRADUATE THESIS

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FOREWORD

Praise and gratitude we pray to the presence of Allah SWT/God Almighty for all His grace and guidance, the author was able to complete the thesis entitled "THE IMPLEMENTATION OF MOBILE QR-CODE BASED ATTENDANCE SYSTEM AT STATE POLYTECHNIC OF MALANG". This thesis is written as a requirement to complete the Diploma IV study program in Informatics Engineering Study Program, Department of Information Technology, State Polytechnic of Malang.

We realize that without the support and cooperation of various parties, For that, we would like to express our gratitude to:

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There may be shortcomings and weaknesses, both in the systematics of writing and the language usage of this report. Therefore, the author expects constructive suggestions. Last but not least, to other parties concerned of any part they might have had to realize this work, the author offers his sincerest gratitude.

Malang, 21 June 2021

Researcher

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STATEMENT

I hereby declare that in this thesis there is no work, either in whole or in part, that has been submitted to for an academic degree at university, and to the best of my knowledge there is also no work or opinion that has been written or published by another person, except cited in writing in this thesis and mentioned in the citation list/references.

Malang, 7 July 2022

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Rizky Putra Pradhana Budiman.

TABLE OF CONTENT

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

Budiman, Rizky Putra Pradhana. "The Implementation of Mobile QR-Code Based Attendance System at State Polytechnic of Malang". **Supervisors: (1) Dr. Eng. Rosa Andrie Asmara, ST., MT., (2) Mungki Astiningrum, ST., M.Kom.**

Thesis, Informatics Engineering Study Program, Information Technology Department, State Polytechnic of Malang, 2022

As the advancement of technologies becomes more progressive, State Polytechnic of Malang wished to start digitalizing their student attendance system. The current student attendance system is inefficient because it needs two devices to mark the guest attendance. This thesis was proposed to solve the stated problem by developing a mobile application for event organizers which utilizes QR code scanner as means of student identification with the aim to improve its effectiveness and versatility. QR Code is a type of two-dimensional barcode that consists of squares and lines to represent and encrypt data. The users could arrange events and invite guests through the application. The QR code will be generated on the back-end services using the Python library called PyQRCode, then it will send out the QR code and the invitation through the email. The QR code will be scanned when the event is held, by sending the decoded QR code strings to the backend to check the validity of the QR code. The application was developed using Flutter 2.8.0 framework due to its flexibility to develop in multiple platforms within the same codebase. Google Cloud Platform was used to handle the back-end services because of its robustness and integrated microservices used within the system. The QR code scanning library used in this application was mobile_scanner 2.0. The results showed that the maximum scan distance for the QR code displayed on the smartphone screen is 30cm and the printed QR code can be scanned as far as 40cm. Based on the results above, it can be concluded that the application could be used to substitute the current student attendance system at Politeknik Negeri Malang and other events.

Keywords: Agile Development, Flutter, QR code, Student Attendance System

ABSTRAK

Budiman, Rizky Putra Pradhana. "Implementasi Sistem Absensi Berbasis Mobile QR Code Pada Politeknik Negeri Malang". **Pembimbing: (1) Dr. Eng. Rosa Andrie Asmara, ST., MT., (2) Mungki Astiningrum, ST., M.Kom.**

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Seiring dengan kemajuan teknologi yang semakin maju, Politeknik Negeri Malang berkeinginan untuk mulai mendigitalkan sistem absensi mahasiswanya. Sistem absensi mahasiswa di Politeknik Negeri Malang saat ini kurang efisien karena membutuhkan dua perangkat untuk menandai absensi tamu. Tesis ini diusulkan untuk memecahkan masalah yang disebutkan dengan mengembangkan aplikasi seluler untuk penyelenggara acara yang memanfaatkan pemindai kode QR sebagai alat identifikasi siswa dengan tujuan untuk meningkatkan efektivitas dan keserbagunaannya. kode QR adalah jenis kode batang dua dimensi yang terdiri dari kotak dan garis untuk mewakili dan mengenkripsi data. Pengguna dapat mengatur acara dan mengundang tamu melalui aplikasi. Kode QR akan dihasilkan pada layanan back-end menggunakan pustaka Python yang disebut *PyQRCode*, kemudian akan mengirimkan kode QR dan undangan melalui email. Kode QR akan dipindai saat acara diadakan, dengan mengirimkan string kode QR yang telah didekodekan ke backend untuk memeriksa validitas kode QR. Aplikasi ini dikembangkan menggunakan *framework Flutter 2.8.0* karena fleksibilitasnya untuk dikembangkan di berbagai platform dalam basis kode yang sama. *Google Cloud Platform* digunakan untuk menangani layanan *back-end* karena ketangguhannya dan layanan mikro terintegrasi yang digunakan dalam sistem. *Library* pemindaian kode QR yang digunakan dalam aplikasi ini adalah *mobile_scanner 2.0*. Hasil penelitian menunjukkan bahwa jarak pindai maksimum kode QR yang ditampilkan di layar *smartphone* adalah 30cm dan kode QR yang tercetak dapat dipindai sejauh 40cm. Berdasarkan hasil di atas, dapat disimpulkan bahwa aplikasi ini dapat digunakan untuk menggantikan sistem absensi mahasiswa saat ini di Politeknik Negeri Malang dan acara lainnya. Namun, penyesuaian di masa mendatang perlu dilakukan terutama menambahkan peran admin untuk mencegah penyalahgunaan saat membuat acara/spam.

Kata Kunci: Metode Pengembangan *Agile, Flutter*, Kode QR, Sistem Absensi Mahasiswa

CHAPTER I. INTRODUCTION

1.1. Background

State Polytechnic of Malang (Politeknik Negeri Malang) is a vocational higher education institute in Malang that was established on February 9th, 1982, following the Decision of Director General of the Higher Education, the Minister of Education and Culture, No. 03/DJ/Kep/1979 (Politeknik Negeri Malang, n.d.). As per this thesis was written, State Polytechnic of Malang has opened 6 departments in charge of 17 study programs for Diploma 3 and Diploma 4, chosen by more than 13.000 students to continue their studies.

As the advancement of technologies becomes more progressive, State Polytechnic of Malang wished to start digitalizing most of the student attendance system by using mobile-based QR code scanning as means of student identification. State Polytechnic of Malang aimed to improve their student attendance system to be more effective and versatile compared to the previous system.

A Quick Response code, or commonly known as QR code, is a two-dimensional barcode made up of black and white patterns. The “Quick Response” refers to the instant access to the information hidden within the code. The QR code is one of the most widely used two-dimensional bar codes, which has the advantages of large information capacity, strong error robustness, and low cost (R. Chen et al., 2019).

In the pandemic, a contactless attendance system in the offline events is urgently needed. The manual attendance system that is still using papers and signatures can support the widespread of the virus. The mobile-based QR code attendance system is expected to minimize both direct and indirect physical contact between the event organizers and the attendee, thus minimizing the widespread of the virus (Lotfi et al., 2020). Besides, a paperless attendance system can help the environment by decreasing paper consumptions that contributes to 42% of the global wood harvest (Suraj & Khan, 2015).

The other drawbacks of using the manual paper-based attendance system are it is prone to fraud or violation, hard to manage and organize the data, and it can’t track the timestamp of when the user is attending the event. By utilizing the QR Code-based attendance system, the attendance data will be safely and neatly organized in the system database. QR Code encrypts the unique ID of each user, making it less fraudulent. The system can also track the timestamp of the user presence by storing the timestamp of the QR code when it is scanned.

The previous student attendance system within the State Polytechnic of Malang was still using a standalone, third-party QR code scanner that was connected to a laptop. After the student's QR code had been scanned, the student's data would be displayed instantly on a laptop web page. This is not efficient since it requires 2 devices and the QR code scanner itself cannot display the scanned barcode data instantly. The device itself is bulky, thus making it less mobile compared to smartphones.

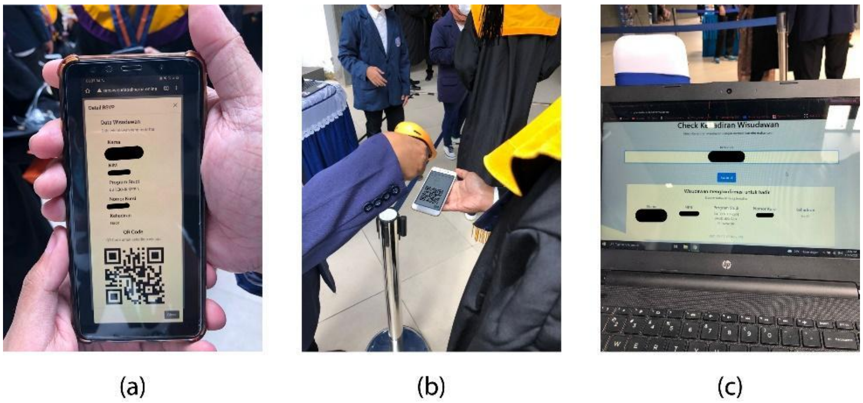


Figure 1.1 The current attendance system that is used during the graduation of State Polytechnic of Malang: (a) The QR code of the attendee, (b) The scanning process by the event organizer using QR code scanner, (c) The output of the QR code that is being displayed by a laptop.

This thesis objective is to provide a solution to the problem mentioned above by implementing a mobile-based QR code attendance system to improve efficiency as it would only utilize one device instead of two. It will no longer need another device such as a laptop to display the data, instead it will be displayed instantly from the user's smartphone. Furthermore, this system can be used on different occasions and events everywhere, from wedding invitations management to an academic graduation ceremony.

1.2 Research Problem

1. How to optimize the current attendance system at Politeknik Negeri Malang?
2. How to implement the mobile QR code scan as the means of identification into State Polytechnic of Malang attendance system?

1.3 Research Scope

1. The platform that will be used for scanning the QR code is native Android.
2. The platform that will be used by the user will be Multiplatform (Flutter Android).
3. The platform that will be used for monitoring and managing the attendee's data will be web-based.
4. The attendance system needs internet connection to retrieve the data from the back end.

1.4 Objectives

The objectives of the thesis research entitled, "**THE IMPLEMENTATION OF MOBILE QR-CODE BASED ATTENDANCE SYSTEM AT STATE POLYTECHNIC OF MALANG**", are stated as follows:

1. To improve the current student attendance system that already been used in State Polytechnic of Malang.
2. To implement this attendance system in various occasions and events.

1.5. Benefits

The expected benefit of this thesis research is to implement better QR code-based attendance system at State Polytechnic of Malang. Furthermore, this attendance/invitation system can be implemented in various occasions and events to minimalize physical contact.

CHAPTER II. LITERATURE STUDY

2.1. Literature Study

Based on the research entitled “A Simple and Efficient Image Pre-processing for QR Decoder”, image preprocessing algorithms are key to expanding the scope of 2D barcodes, lowering the thresholds used, and increasing their practicality. The image preprocessing algorithm on QR code recognition can overcome the influence by noise, inhomogeneous light and geometric distortion. This research simulates defections that usually occur on barcodes such as scratches, poor lighting condition, wrinkles, and defilements. The experimental results have shown that the recognition rate is over 95% and the recognition time is only 5ms (W. Chen et al., n.d.).

Another research titled “Research on QR image code recognition system based on artificial intelligence algorithm” the preprocessed QR code decoding algorithm (in this case based on Backpropagation Neural Network) shows an increase in literacy rate of distorted QR code by 14%. This implies that preprocessed QR code decoding algorithm is better than direct QR code reading since it will correct the errors caused by rough or wrinkled surfaces (Huo et al., 2021).

Research titled “Reading QR Codes on Challenging Surfaces” by David Martinez Carpena stated that the proposed image preprocessing algorithm called Thin Plate Spline on QR code recognition can correct random deformations and cylinders while being close to the projective algorithm in flat deformations. The proposed method resulted in better results in decoding cylindrical deformations than the cylindrical method while being the only method able to read QR codes in image labelled with random deformation (Martinez Carpena, n.d.).

2.2 Basic Theory

2.2.1. Barcode

Barcode is a type of data representation in the form of visual, machine-readable form. Barcodes usually represent the data by varying the widths and spacing of parallel lines. Barcodes are commonly referred as one-dimensional barcode and is widely used in wide variety of consumer goods as their product SKU ID or Stock Keeping Unit ID number to distinguish each product from the others. Later, two-dimensional barcodes were invented. 2D barcodes commonly use rectangles dots or other patterns to represent the data instead of bars. 2D barcodes can store more data and have lesser error rate, lesser space, and more versatile compared to 1D barcodes.

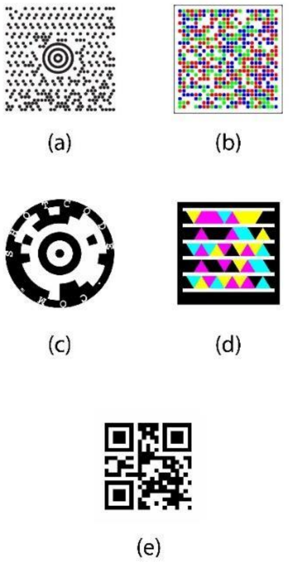


Figure 2.1 2D barcode examples a) MaxiCode b) CrontoSign c) ShotCode d) HCCB e) QR code (Datta Gupta et al., n.d.)

2.2.1.1. QR Codes

QR Code, an initialism of Quick Response code, is a type of two-dimensional barcode that consists of squares and lines to represent and encrypt the data. QR code is the most used type of two-dimensional barcodes due to its reliability and greater storage capacity. QR codes can store a wide variety of data from alphanumeric data to kanji/kana alphabets. Recently, QR Codes are frequently used as a payment method, object hyperlinking, and Augmented Reality (AR). The QR code structure consists of different modules like position markers, timing patterns, version number, format identifier, alignment marker, and data indicator (Huo et al., 2021; Tiwari, 2017).

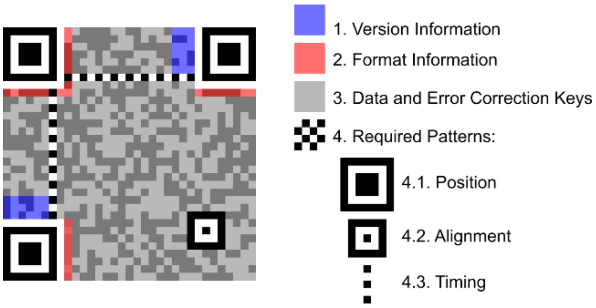


Figure 2.2 QR code structure modules (Huo et al., 2021)

The modules that are pictured on the Figure 2.2 above are detailed below (Huo et al., 2021):

1. Version Information

   Currently there are 40 different versions of QR code and one way of specifying the one that is being used is by using the version information marker.

2. Format Information

   These markers contain information about error tolerance and data mask pattern. This makes the scanning process easier.

3. Data and Error Correction Keys

   These markers are where the data is being shown and encrypted.

4. Required Patterns

   4.1. Position Markers

   These markers guide the scanner to accurately recognize the code and analyzing the orientation of the code, resulting in fast QR code identification.

4.2. Alignment Markings

These markers help the scanner to straighten the QR code if it is distorted or printed on curve surfaces. The more information the code stores, the larger it is and the more alignment patterns they require.

4.3. Timing Pattern

Since QR code works by decoding both vertical and horizontal axis, these markers will greatly improve the accuracy of the data gird configuration. These patterns also help the scanner to identify the size of the data that is stored in the code.

QR code implements a widely used Reed-Solomon Error Correction Codes as its error correction method. There are mainly 4 levels of error correction available, each with their own approximate amount of error correction, as stated on the Table 2.1 below (Tiwari, 2017).

Table 2.1 Reed-Solomon Error Correction Levels and Their Approximate Amount of Correction

No.	Error-Correction Level	Approximate Amount of Correction
1.	L (Low)	7%
2.	M (Medium)	15%
3.	Q (Quartile)	25%
4.	H (High)	30%

Source: Tiwari, 2017

Environmental conditions as well as the size of the QR code should be evaluated when choosing the level of error correction. For instance, higher level of error correction such as level Q or H with approximate of 25% and 30% of error correction is best used in a case where QR codes are prone to damage, distortion, or dirt. Level M is the most used level on account of its balance between error correction amount and simplicity (Tiwari, 2017).

To convert data into a QR code form, it needs to go through several procedures that is pictured in Figure 2.3.

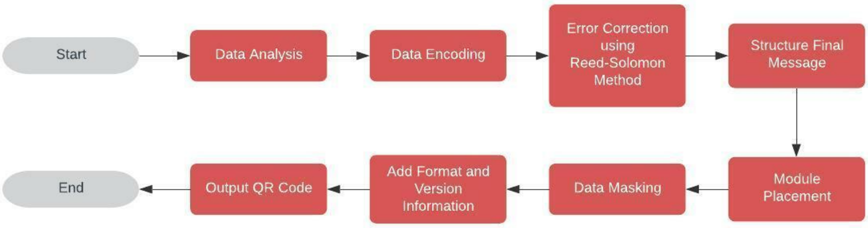


Figure 2.3 QR Code Encoding Process (Tiwari, 2017).

The detail of each process is explained below (Thonky, 2020; Tiwari, 2017):

1. Data Analysis

QR code encodes a string of text, and it has four modes for encoding text: numeric, alphanumeric, byte, and kanji. Each mode encodes the text as a string of bits (0s and 1s), but each mode employs a different method, and each method is optimized to encode the data using the shortest string of bits feasible.

2. Data Encoding

The aim of this process is to encode the inputted data into a string of bits that is split up into data codewords that are each 8 bits long. Each encoding mode has a four-bit mode that distinguish one from another, as seen on the Table 2.2 below.

Table 2.2 List of Modes and Each Indicator

No.	Mode	Mode Indicator
1.	Numeric Mode	0001
2.	Alphanumeric Mode	0010
3.	Byte Mode	0100
4.	Kanji Mode	1000
5.	ECI Mode	0111

Source: Thonky, 2020.

After choosing the encoding mode, the next step will be adding the Character Count Indicator to represent the number of characters that are being encoded. This will help identify the version of the QR code that will be used.

3. Error Correction Coding

   The output of the previous process, which is a string of data bits, will be used in the process to generate error-correction codewords using Reed-Solomon Error Correction Method. This will allow QR code readers/scanners to detect and correct error in QR codes, usually caused by distortion and scratches.

4. Structure Final Message

   The data and error correction codewords as the result of the previous step must be arranged in the proper order. For the larger QR codes, both the data and error correction codewords are generated in blocks and they must be interleaved according to the specifications.

5. Module Placement

   After the data and error correction codewords already interleaved, and the final string bits are already arranged, the bits must be placed in the QR code along with helper patterns such as finder patterns, alignment patterns, and other patterns that are required to decode afterwards.

6. Data Masking

   After the modules are placed in the QR code, the best mask pattern must be determined to make it as easy for the QR code reader to scan as possible. The QR code specification defines eight mask patterns, each alters the QR code according to a particular pattern.

7. Format and Version Information

   The final process before outputting the generated code is to add format and version information. Format string contains the information of which error correction level used in the matrix. If the QR code is version 7 or bigger, an 18-bit version information string must be included in the matrix, sitting in the bottom left and top right corners of the QR code.

After the QR code is already generated, the QR code must be decoded to obtain any useful information from the matrix. There are some procedures of decoding the QR code, as seen on Figure 2.4 below:

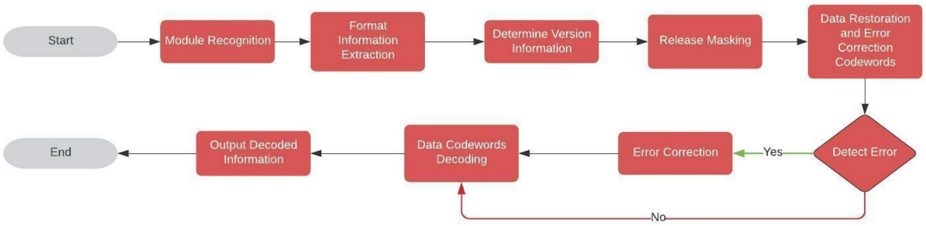

Start
Module Recognition
Format Information Extraction
Determine Version Information
Release Masking
Data Restoration and Error Correction Codewords
Detect Error
Yes
Error Correction
No
Data Codewords Decoding
Output Decoded Information
End

Figure 2.4 QR Code Decoding Process (Tiwari, 2017)

The detail of each process is explained below (Tiwari, 2017):

1. Module Recognition

   This process detects light and dark modules and convert it to an array of binary bits (0s and 1s) by locating and getting the image of the symbol.

2. Format Information Extraction

   This process will regain the information about the format that will be used to identify which error correction level is used in the matrix.

3. Determine Version Information

   If the QR code is version 7 or bigger, it is necessary to obtain the information regarding the version of the QR code. It is crucial to identify the version of the QR code as it is used to identify the approximate amount of data, error correction level, and the character type.

4. Release Masking

   In this process, we need to release the data mask from the matrix. To do so, XOR the encoding pattern with the encoding region but pattern with the mask pattern that has been extracted from the format information.

5. Data Restoration and Error Correction Codewords

   This process aims to restore the data and error correction codewords by reading the symbol characters.

6. Error Detection and Correction

   This process objective is to detect any error caused by defects or scratches on the matrix and correct it by using the error correction codewords that were obtained from the previous step.

7. Data Codewords Decoding

   The final step will be decoding the data codewords that were regained from the last step. To do so, divide the data codewords into segments according to the Mode Indicators and Character Count Indicators. Finally, decode the data using the determined mode in use and output the information.

2.2.2. Computer Vision

Computer vision is a field of study that utilizes statistical methods in order to regain useful information using models with the aid of geometry, physics, and learning theory (Forsyth & Ponce, 2012). The output of computer vision process is image understanding. Because the performance of a computer vision system is determined by the application system design, many scholars have proposed expanding and categorizing computer vision into a variety of areas and applications, including assembly line automation, remote sensing, robotics, computer and human communications, tools for the visually impaired, and others (Wiley & Lucas, 2018).

2.2.3. Image Binarization

Document Image Binarization is a pre-processing stage in the analysis and processing of document images. It improves the performance of OCR and layout analysis techniques used in document processing. The conversion of a document image into a bi-level document image is known as image binarization. Pixels in an image are divided into two groups: black and white pixels. The primary purpose of picture binarization is to divide a document into foreground and background text (Jyotsna et al., 2016). There are multiple algorithms that can be used for image binarization such as Otsu Method, Histogram Peaks, K-Means, Pun Method, and Kittler and Illingworth Method, each with their own advantages and disadvantages (Stathis et al., 2008).

2.2.4. Geometric Rectification/GeoCorrection

When an image is distorted geometrically, such as when a QR code is distorted by an improper shooting angle, geometric rectification is used to restore the picture to its original shape (W. Chen et al., n.d.). An image correction will be a transformation from a deformed image img^{0} of size (n^{0}, m^{0}) to the original image *img* of size (n, m). The inputs to any image correction will be the deformed image img^{0} and two k-tuples of points $src \in (\mathbb{N}_{n}^{0} \times \mathbb{N}_{m}^{0})^{k}$ and $dst \in (\mathbb{N}_{n} \times \mathbb{N}_{m})^{k}$, named references. Suppose that the i elements of *src* and *dst* correspond to a point in the deformed image and one in the original image that match, and that the references represent the information received from the feature detection step. The number of and type of references that will work best depends on the correction function that is being utilized(Martinez Carpena, n.d.).

2.2.5. Android

Android is an open-source, mobile operating system developed by Google. It is the most used mobile operating system in the world, topping at 70.75% of mobile operating system market share on November 2021 (GlobalStats, n.d.).

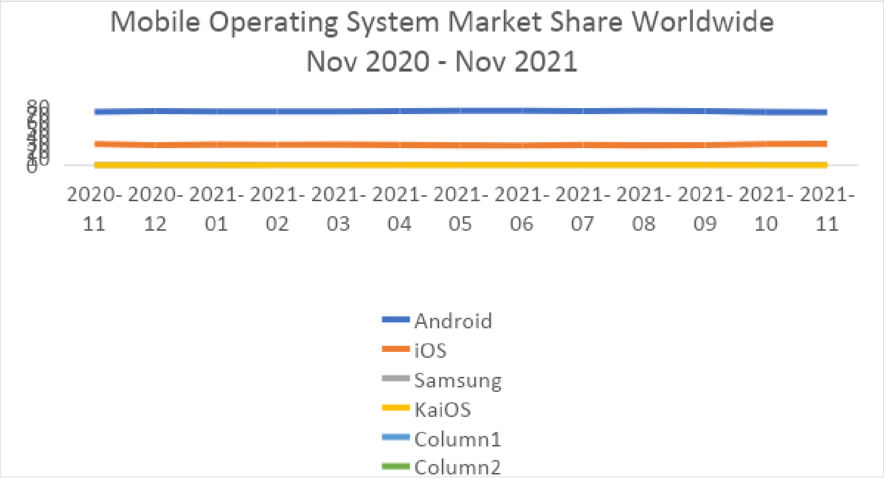


Figure 2.5 Charts of Mobile Operating System Market Share Worldwide from November 2020 to November 2021 (GlobalStats, n.d.)

Android offers much more customizability and free, open-source software compared to its counterpart, Apple iOS. It is not only used in smartphones, but also in wide variety of gadgets such as smartwatches, smart TVs, and automotive head units. Developing an Android application is much more flexible compared to iOS and can be developed in various operating system such as Windows, MacOS, and Linux using an Integrated Development Environment (or IDE) called Android Studio (Rishabh Software, 2021).

2.1.3. Flutter

Flutter is an open-source multiplatform framework developed by Google and the community aimed to build a cross platform application based on a single code. Flutter used Dart as their programming language of choice. Flutter offers “Hot Reload” and “Hot Restart” features. UI changes can be quickly compiled to the software, making it easier to debug and build the UI. Since it is compiled directly to the operating system, Flutter apps performed as fast as natively developed applications. Recently, many companies started to build applications using flutter framework such as: Google Ads, Hamilton, Cryptograph, etc. (Flutter, n.d.-a).

2.1.4. Google Cloud Platform

Google Cloud Platform is a package of cloud computing services offered by Google. Google Cloud offers solutions for storage, analytics, big data, machine learning, and application development needs within one ecosystem that is synchronized and integrated one to each other. Google Cloud has been used on various universities such as Manhattan College, Northeastern University, San Jose State University, and MIT University. Google Cloud Platform offers Compute Engine, Cloud Storage, Kubernetes, Vision AI, Cloud SQL, etc. (Google Cloud, 2021).

CHAPTER III. DEVELOPMENT METHODOLOGY

3.1. Target Market Analysis

This thesis aims to develop an attendance system applying mobile QR code as the means of identification. The mobile QR code attendance system will provide greater flexibility and simplify the attendance process. This system can also reduce paper waste by not printing the invitation on a paper. Furthermore, this application planned to not only be deployed as an attendance system, but also to be a universal invitation/attendance system that can be used by everyone. To prevent any attendance fraud or violence, the picture of the user should be added to the system since the user register to the system. By doing this, the event organizer can confirm if the user and the shown QR code is matched or not. In the later development, a real time face recognition security system can be added to prevent any attendance fraud or violation.

3.2. System Description

Based on the partner's requirement above, the description of the system is stated below:

Title	:	Mobile QR Code Attendance System
User	:	Event organizers and attendee/invitee.
Content	:	This application contains about events information that available in application and attendance system at the available events
Platform	:	Mobile and multiplatform
Technology	:	QR Code

The application requirements are divided into software requirements and hardware requirements.

2.2.5. Software Requirements

The software and packages needed in order to develop this application are stated as follows.

- Operating System: Windows
- Text processing: Microsoft Word
- Integrated Development Environment: Android Studio
- Cloud Backend: Google Cloud Platform
- ML Code Editor: Google Colab

2.2.6. Hardware Requirement

The hardware and tools needed in order to develop this application are stated as follows.

- Mobile testing device: Android Smartphone (Android 7.0 Nougat or higher)
- Development device: 2nd generation Intel Core or newer, or AMD CPU with support of Windows Hypervisor; 8GB RAM or more; minimum 12GB available disk space (IDE + Android SDK + Android Emulator + Flutter SDK); 1280x800 minimum screen resolution (Flutter, n.d.; Google, n.d.).

3.3 Development Process

The development process of the mobile QR code attendance system will implement Agile Software Development Lifecycle using Scrum Model. The flow of the Agile development is pictured in Figure 3.1 below.

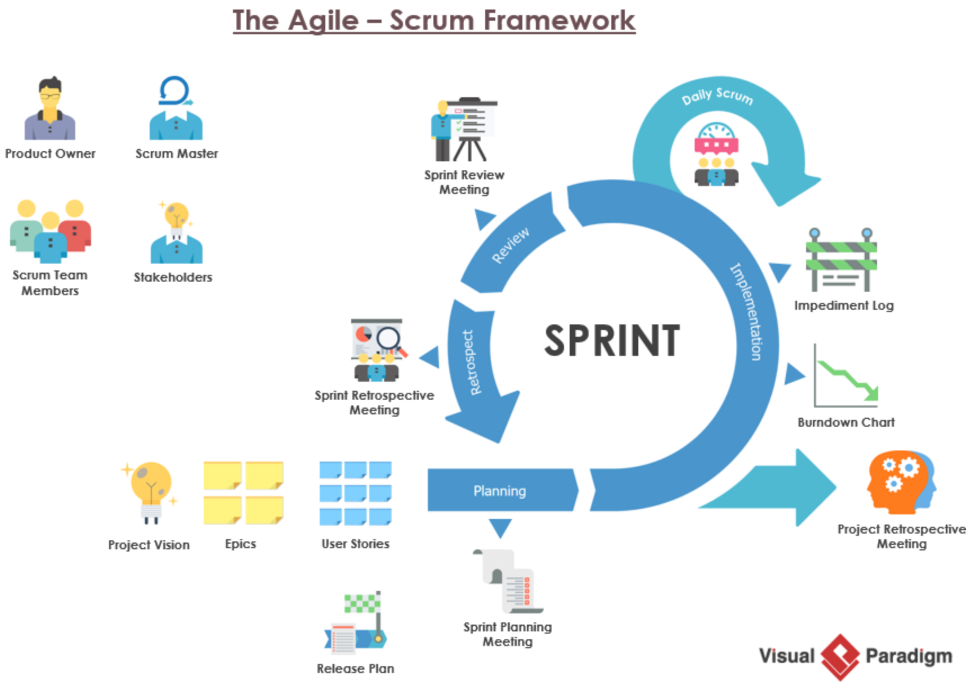


Figure 3.1 Agile Scrum Development Process (Visual Paradigm, 2021)

The detail of the Agile-Scrum Software Development Life Cycle process is explained below (Schwaber, 2004):

1. Sprint Planning

   Based on the Figure 3.1, the first process will be planning process. As with any projects should be, planning is an important step before starting the project. The planning process consists of determining the goal of the project, the value to the organization or client, and how to achieve the goal itself. The output of this process is the Sprint Backlog, which is a list of tasks, estimates, and assignments to help the team starting the work. The task list must be thorough enough to reflect mutual commitment and carry the team through the first part of the Sprint.

2. Daily Scrum Meeting

   During the implementation or the development of the project, daily scrum meeting must be held to ensure the work of all team members are synchronized and schedule any meetings that the team needs to progress. At the daily scrum, each team member will need to answer these 3 questions: What have you done since the last daily scrum, what will you do on this project between now and the next daily scrum, and what are the obstacles that hinder your project.

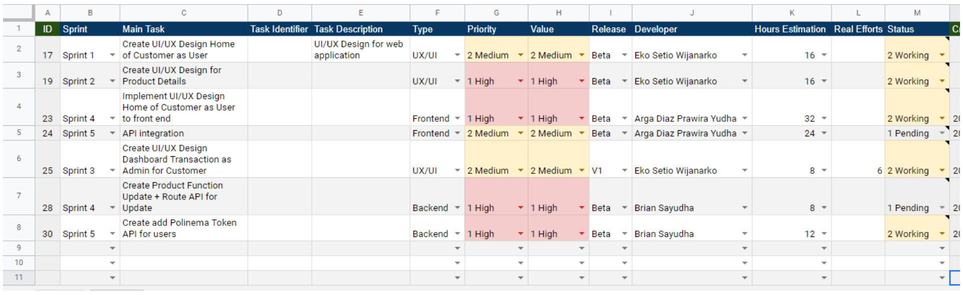
3. Sprint Review Meeting

   At the end of the Sprint, a sprint review meeting is initiated. The sprint review meeting aims to collaboratively determine what the team should do on the next sprint. On this meeting, the team presents the progress and what the team has done during the Sprint.

4. Sprint Retrospectives Meeting

   Between the Sprint Review and the next Sprint Planning process, the Sprint Retrospectives Meeting will be held by the ScrumMaster. This meeting aims to encourages the team to revise the development process to make the project development more effective and enjoyable for the next Sprint, as long as the revisions are within the Scrum process framework.

The weekly sprint progress should be recorded in a logbook to record what the team has done in the past week. The template of the weekly logbook is shown in Figure 3.7.



ID	Sprint	Main Task	Task Identifier	Task Description	Type	Priority	Value	Release	Developer	Hours Estimation	Real Efforts	Status	C
17	Sprint 1	Create UI/UX Design Home of Customer as User		UI/UX Design for web application	UX/UI	2 Medium	2 Medium	Beta	Eko Setio Wijanarko	16		2 Working	
19	Sprint 2	Create UI/UX Design for Product Details			UX/UI	1 High	1 High	Beta	Eko Setio Wijanarko	16		2 Working	
23	Sprint 4	Implement UI/UX Design Home of Customer as User to front end			Frontend	1 High	1 High	Beta	Arga Diaz Prawira Yudha	32		2 Working	2
24	Sprint 5	API integration			Frontend	2 Medium	2 Medium	Beta	Arga Diaz Prawira Yudha	24		1 Pending	2
25	Sprint 3	Create UI/UX Design Dashboard Transaction as Admin for Customer			UX/UI	2 Medium	2 Medium	V1	Eko Setio Wijanarko	8	6	2 Working	2
28	Sprint 4	Create Product Function Update + Route API for Update			Backend	1 High	1 High	Beta	Brian Sayudha	8		1 Pending	2
30	Sprint 5	Create add Polinema Token API for users			Backend	1 High	1 High	Beta	Brian Sayudha	12		2 Working	2

Figure 3. 2 Template of Weekly Sprint

The project ScrumMaster in this research is thesis advisor, Dr. Eng. Rosa Andrie Asmara, ST., MT., and the product owner of this project is Rizky Putra Pradhana Budiman. The sprint of this thesis will be defined later in the sprint planning, but it must be within the project timeline and the Gantt chart at the chapter IV of this thesis.

3.4 System Design

3.4.1. QR Code Generation System

Figure 3.2 below represents the flowchart of the QR code generation system

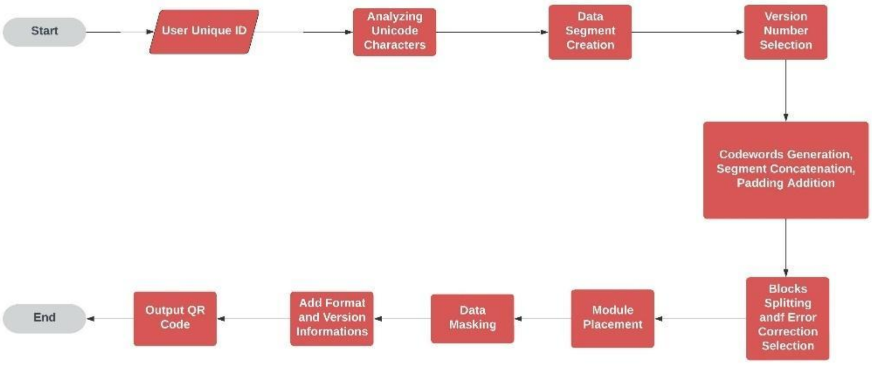

Start
User Unique ID
Analyzing Unicode Characters
Data Segment Creation
Version Number Selection
Codewords Generation, Segment Concatenation, Padding Addition
Blocks Splitting andf Error Correction Selection
Module Placement
Data Masking
Add Format and Version Informations
Output QR Code
End

Figure 3.3 QR Code Generation System

The first process of the QR code generation is analyzing the Unicode characters based on the input. This process will determine whether the input will be encoded in numeric, alphanumeric, byte, or kanji mode. After that, the process continues to the creation of the data segment. This process converts each character to bits according to the selected Unicode mode. The next process is selecting the version number based on the length of the input. After that, the process continues to codewords generation, segment concatenation, and padding additions. After that, the error correction codewords mode is determined to ensure the best yet simplest error correction mode applied to the QR code. Next, all modules are placed to the QR code before the data mask is applied. Finally, the format and version information are finally added to the QR code to help the scanner encoding the QR code (Nayuki, 2018; Tiwari, 2017).

3.4.2. QR Code Processing System

Figure 3.3 below represents the flowchart of the QR Code processing system.

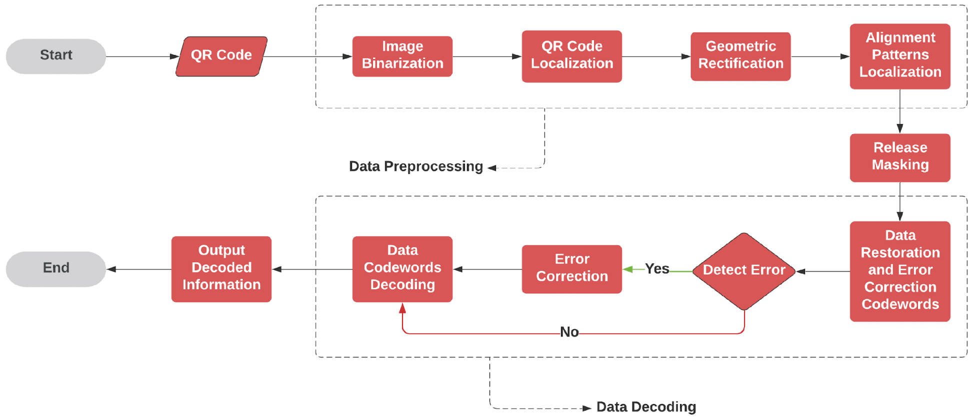


Figure 3.4 QR Code Processing Flowchart

Firstly, the QR code will be preprocessed. The preprocessing stage contains image binarization, QR code localization, geometric rectification, and alignment patterns localization. All of which will directly influence the read success rate. After the QR code has been preprocessed, the process continues to release masking and data decoding. Data decoding process includes error-correction process using Reed-Solomon Error Correction Method and decoded according to QR code standards. The outputted information will be used later in the attendance system (Huo et al., 2021; Tiwari, 2017).

3.4.3. Attendance System

Figure 3.4 below represents the flowchart of the attendance system that will be developed.

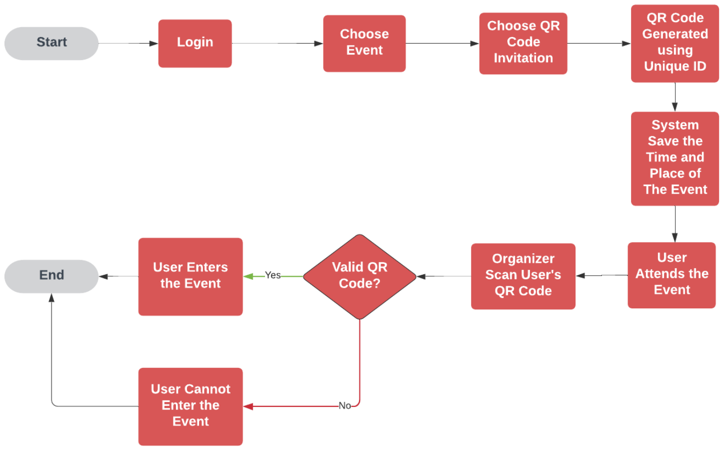

Start
Login
Choose Event
Choose QR Code Invitation
QR Code Generated using Unique ID
System Save the Time and Place of The Event
User Attends the Event
Organizer Scan User's QR Code
Valid QR Code?
Yes
User Enters the Event
End
No
User Cannot Enter the Event

Figure 3.5 Attendance System Flowchart

The attendance system will be developed on Flutter Android. The first step that the user must do is to log in to the application. After the user already logged in, the user must choose an event to attend. The user's next step will be registering to the chosen event. After that, the user chooses "QR Code" as the invitation ID. Then, the QR code will be generated automatically from the system and each attendee will have unique QR code. On the D-Day of the event, the QR code will be shown by the user to the organizer to identify if the user is on the guest list or not. If the QR code is valid, the user can attend the event.

3.4.4. Use Case Diagram

Figure 3.5 below represents the use case diagram of the system that will be developed.

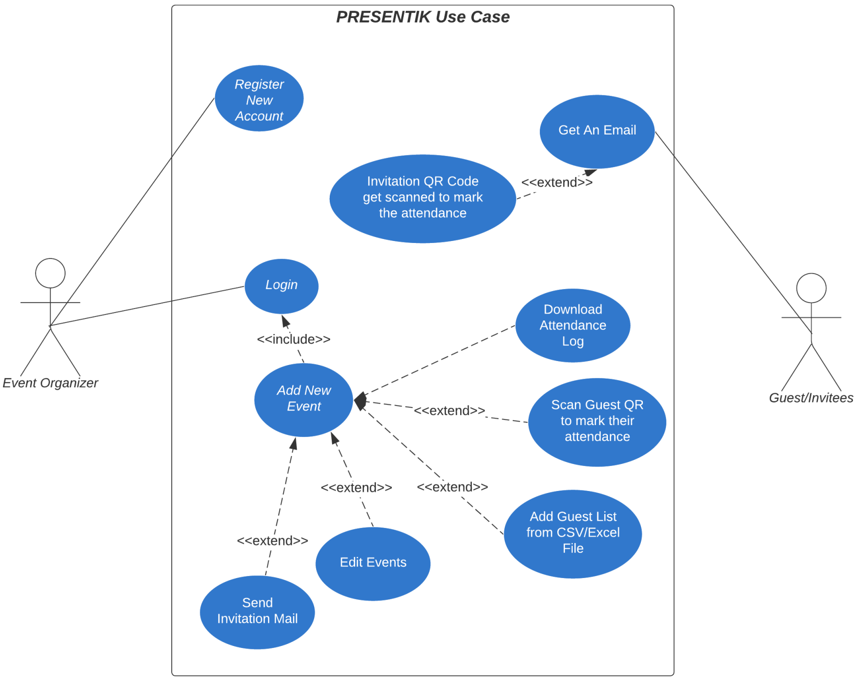


Figure 3.6 Use Case Diagram

There are 2 main actors in this use case diagram, the event invitee/attendee, and the event organizer. The event attendee can register or login to the system, and then choose the event that they want to attend. After that, they can choose QR Code attendance system. When the attendee is on the event, the attendee can show the QR Code that later will be scanned by the event organizer. In the other hand, the event organizer can register or login to the system. After that, the event organizer can create an event. On the D-Day of the event, the event organizer can scan the attendee's QR code to mark the attendee's presence to the system.

3.4.5. System Architecture

Figure 3.6 below represents the system architecture of the system that will be developed.

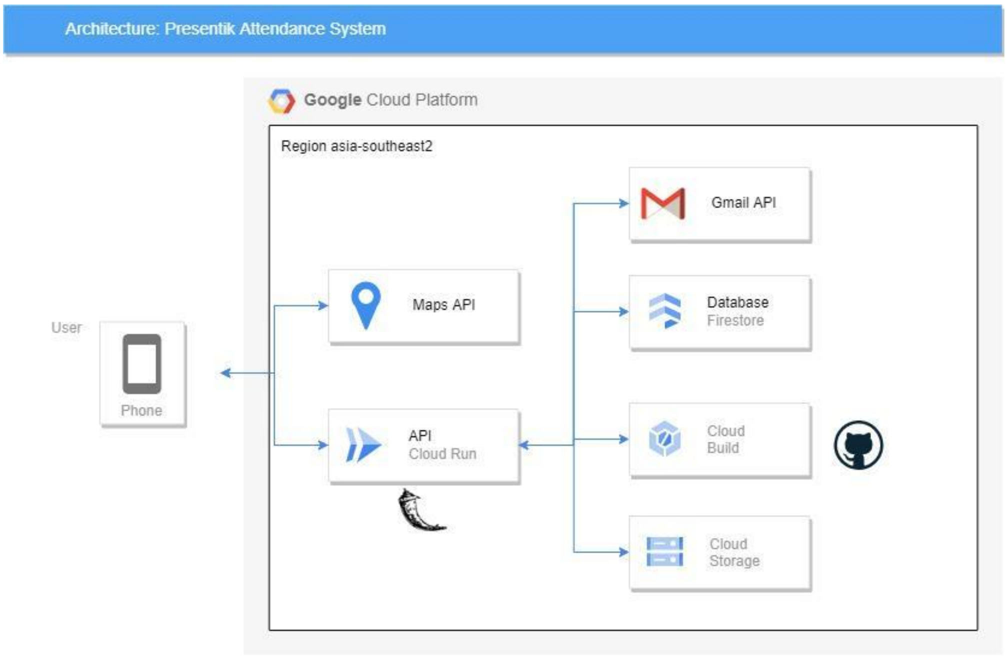


Figure 3.7 System Architecture

The QR code recognition/encoding process is done on the front-end. The client will be mobile based, and then the encoded QR code data, which is the event attendee's unique ID of the event, will be run through the API to the back end. The back end will only utilize Firestore to store the user data and Cloud Storage to store the user QR Code.

3.5 System Testing

The system will be tested using Espresso Android UI Test Kit. This will automatically test the UI using macro that will be recorded in the emulator within Android Studio. For the android unit tests will be conducted using Junit 4 framework and Mockito to mock the necessary modules. Black box testing will also be done to test the functionalities of the app. The subject of the test will be the students of TI-4G class, each will test and fill the questionnaire regarding the application performance and experience.

CHAPTER IV. SYSTEM ANALYSIS AND DESIGN

4.1 System Overview

The QR Code Based Attendance System called “PRESENTIK” is an Android based application that is developed to enhance the previous system which used laptop and a standalone QR code scanner. This application can add the event’s guest list by uploading a certain CSV format and send the invitations through email. The QR code will be generated by the back-end system and forwarded in the email to the invitees. The event organizer would be able to register an event and select the location by searching the location so the invitees can use Google Maps to search for the exact location.

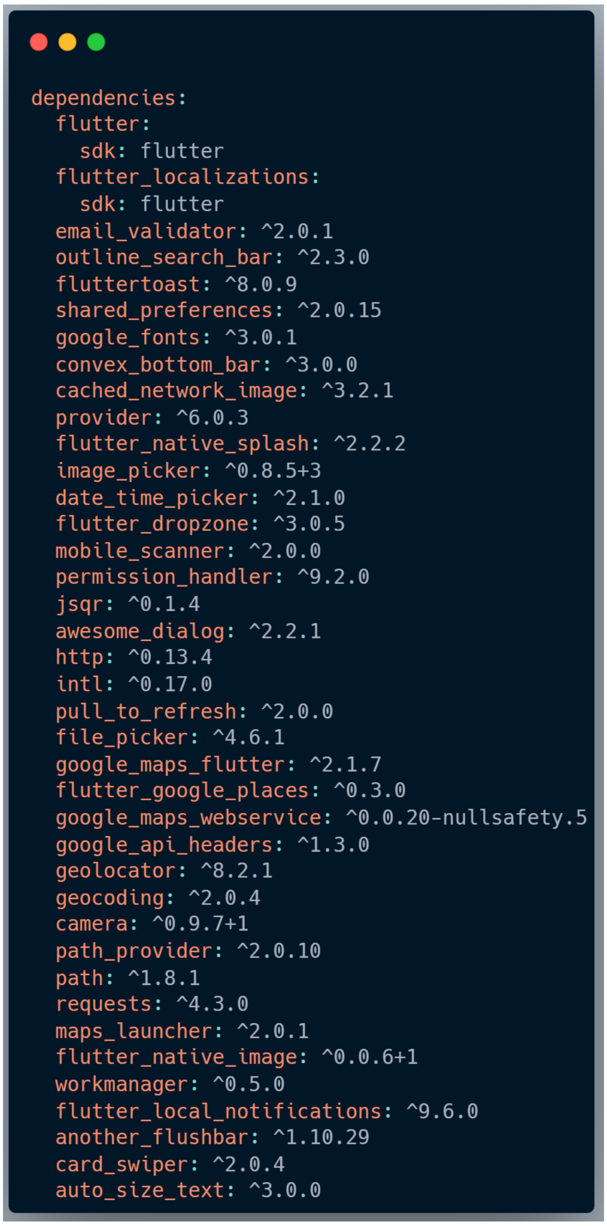
There are two requirements that support the development of the application, which are the software requirement and the hardware requirement.

4.1 Software Requirement.

- Android Studio 2021.2.1 (Chipmunk), for the multiplatform development IDE
- Flutter 3.0.1, for the multiplatform development framework
- Microsoft Office, as tool for proposal and report writing.
- Figma, as the UI/UX design software
- Postman, as the API endpoint checker
- Docker, to create program images that can be easily distributed to other machines or OS.
- Google Cloud Platform, to manage the backend side of the application. The tools that are being utilized to support this application are:
    - GCP Bucket (Cloud Storage), to store events photos and invitees’ photos.
    - Firestore, for NoSQL database management. This database management system works best for mobile applications thanks to its low latency and efficiency.
    - Cloud Run, to host the API on the GCP.

- Artifact Registry/Container Registry, for the seamless CI/CD which is connected to GitHub.
- Google Maps API, to obtain and display maps data and coordinated to the application.
- Gmail API, to send the invitation mail with the QR Code to the invitees.

In addition to the software requirements above, the dependencies required to develop the application are stated as follows:



```
dependencies:
  flutter:
    sdk: flutter
  flutter_localizations:
    sdk: flutter
  email_validator: ^2.0.1
  outline_search_bar: ^2.3.0
  fluttertoast: ^8.0.9
  shared_preferences: ^2.0.15
  google_fonts: ^3.0.1
  convex_bottom_bar: ^3.0.0
  cached_network_image: ^3.2.1
  provider: ^6.0.3
  flutter_native_splash: ^2.2.2
  image_picker: ^0.8.5+3
  date_time_picker: ^2.1.0
  flutter_dropzone: ^3.0.5
  mobile_scanner: ^2.0.0
  permission_handler: ^9.2.0
  jsqr: ^0.1.4
  awesome_dialog: ^2.2.1
  http: ^0.13.4
  intl: ^0.17.0
  pull_to_refresh: ^2.0.0
  file_picker: ^4.6.1
  google_maps_flutter: ^2.1.7
  flutter_google_places: ^0.3.0
  google_maps_webservice: ^0.0.20-nullsafety.5
  google_api_headers: ^1.3.0
  geolocator: ^8.2.1
  geocoding: ^2.0.4
  camera: ^0.9.7+1
  path_provider: ^2.0.10
  path: ^1.8.1
  requests: ^4.3.0
  maps_launcher: ^2.0.1
  flutter_native_image: ^0.0.6+1
  workmanager: ^0.5.0
  flutter_local_notifications: ^9.6.0
  another_flushbar: ^1.10.29
  card_swiper: ^2.0.4
  auto_size_text: ^3.0.0
```

Figure 4.1 List of Dependencies.

4.2 Hardware Requirements

- Android smartphone, to test the application on a real device.
- Laptop with specification Intel(R) Core (TM) i7 CPU @ 2.2GHz, RAM 16 Gb, SSD 512 GB, HDD 1 TB.

4.2 User Analysis

This application is mainly used by the event organizer. For now, the invitees do not need to have a role in the application because the invitation will be sent through email. The event organizer can manage their own events by adding the guest list by uploading a CSV file to the system and sending the invitation through email that will be done by the system. The system will notify the event organizer when the email is already sent to all invitees. The invitees may come to the event on the D-Day and show their QR code to the event organizer. The event organizer then scans the QR code to accept the invitees.

4.3 Functional Requirements

Functional requirements are the features that PRESENTIK is capable of. The functional requirements of this application are as follows:

- This application can manage the events data, including edit the events, create events, and delete events.
- This application can scan QR codes of the invitees.
- This application can do automated email generation and delivery to the invitees' emails.

4.4 Non-Functional Requirements

In the contrary of the Functional Requirements, Non-Functional Requirements are the constraints or the requirements imposed on the system. The non-functional requirements of this applications are:

- After registering a new account, user will be directed to the login page instead of the home page.
- The email delivery process will be done in the background. After the process is finished, the user will be notified.
- The user may add the guests list of the event by uploading a CSV with the provided format from the system.

- The system scans the invitees' QR code. If the application recognizes the QR code, the application will automatically mark the invitee's attendance.
- The location of the attendance cannot be more than 100 meters from the location of the event.
- The user can only choose the location by searching the location from the search box.
- The user can only mark the invitee's attendance during the event.
- This application can only run in Android Smartphones with the minimum Android version of 5.0 (Lollipop) with minimum RAM of 2 GB.

5.1 System Design

4.5.1 Use Case Diagram

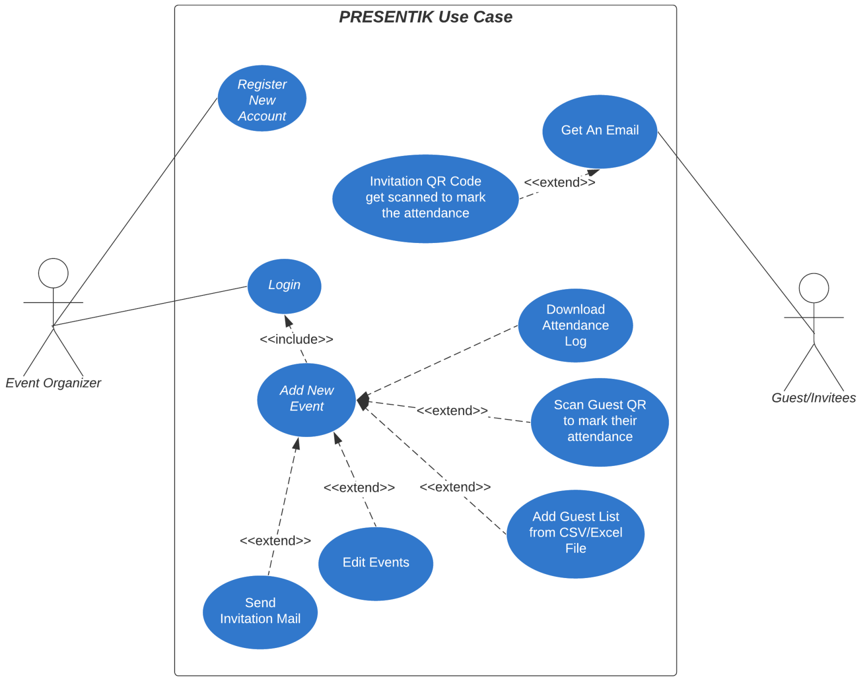


Figure 4.2 PRESENTIK Use Case Diagram

As shown on the Figure 4.2 above, this application only utilizes 1 actor: event organizer. The event organizer can manage all the events that they created. The event organizer can register a new account in the system. Then, the event organizer can log in and choose the 'event organizer' role while logging in. To create a new event, the event organizer can add new event to the system by filling the detailed information regarding the events.

After the event is already added, the event organizer can edit the event's information if there is a change in the event. Event organizer can also add the guest lists to the event by uploading a CSV file formatted by the system. When the guests are already added to the event, the event can no longer be edited by the event organizer.

After the guests are already added to the event, the event organizer can send the invitation through email. The invitation contains the information of the event such as: event place, address date, time, and the QR code to mark the invitees' attendance. When it is the day of the event, the invitees may come to the event and show the event organizers their QR code invitation. The event organizer scans them, and it will automatically mark the attendance. If the attendance takes place more than 100 meters from the location, the attendance will be invalid.

4.5.2 Register and Login Flowchart

The flowchart of the register process is shown below.

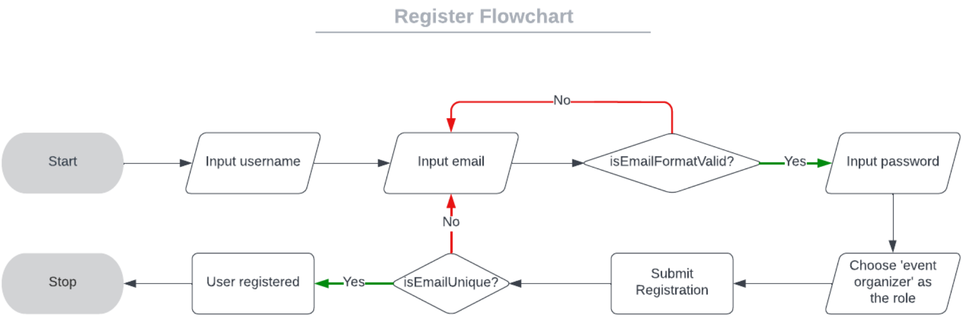


Figure 4.3 Register Process Flowchart

The register process will begin with the user inputting their username, a valid email, and the password for the account. If the email is not in a valid format, the user will be prompted to enter a valid email format. After the user information is already fulfilled, the user must choose 'Event Organizer' as the role. Finally, the user can submit all information to the system. The system will check if the email is already registered to another account or not. If the system detects that the email is already registered, the user will have to add another valid email. If the email hasn’t been registered to any other account, then the user info will be added to the system, thus the user is registered.

The flowchart of the login process is shown below.

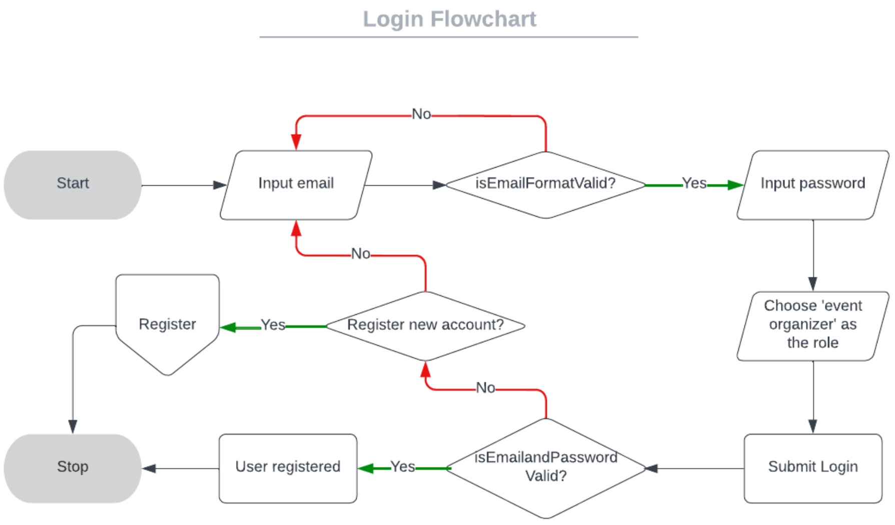


Figure 4.4 Login Process Flowchart

The login process begins with the user inputting the registered email. If the email is not in a valid format, the user will be prompted to enter a valid email format. After that, the user must fill the password. When the required form is filled, the user can submit the information to the system. If the email and password doesn’t match, the user will be prompted to enter the valid email and password combination. If the email and password matched, the user will be logged in.

4.5.3 Create Event Flowchart

The flowchart of the event creation process is shown below.

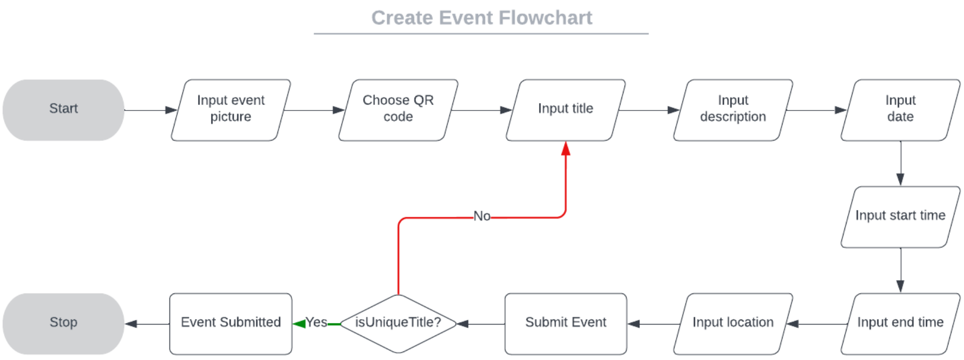


Figure 4.5 Create Event Process Flowchart

The create event process begins with the user adds the picture / illustration of the event. After that, the user can choose QR code as the means of identification. After choosing QR code, the user can add the title, description, date, start time, and the end time of the event. Next, the user can add the location of the event by searching the place in the integrated maps and search box. Finally, the user submits the event information. If the same event is already registered within the system, the user will be prompted to enter different title. If not, the event will be added to the system.

4.5.4 Add Guest List Flowchart

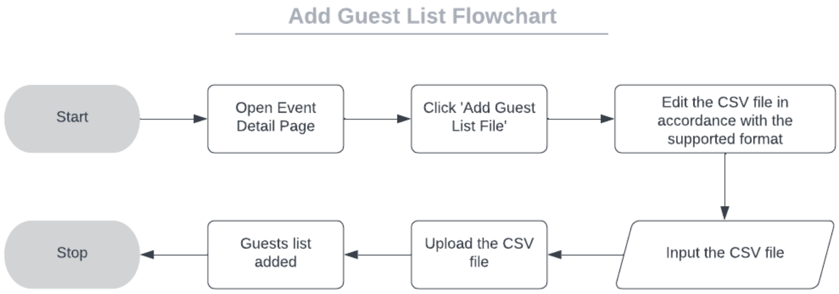


Figure 4.6 Add Guest List Process Flowchart

The process of adding the guests list starts with the user opens the detail of the event that they want to add the guests. Then, the user clicks ‘Add Guest List File’ button. The user will be redirected to a new page to upload the CSV file. The user can look at the CSV template that is supported by the system. The user can make a copy from the CSV template and then edit them as they required. After finishing the guest's information, the user uploads the file to the system. The system will automatically add the guests alongside with their information to events based on the CSV file.

4.5.5 Send Email Invitation Flowchart

The flowchart of the email invitation delivery process is shown below.

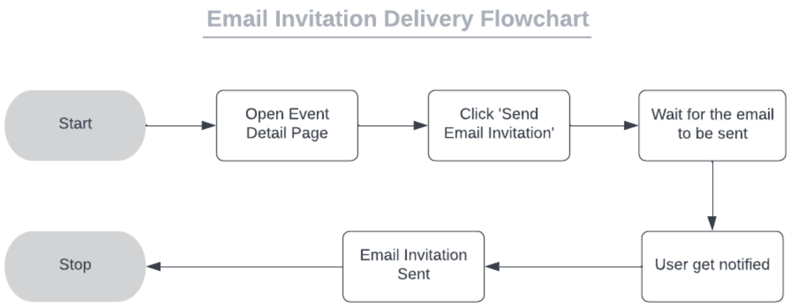

Email Invitation Delivery Flowchart
Start
Open Event Detail Page
Click 'Send Email Invitation'
Wait for the email to be sent
User get notified
Email Invitation Sent
Stop

Figure 4.7 Email Invitation Delivery Flowchart

The email invitation can only be sent if the guests are already added to the event. The email invitation delivery started with the user opens the detail page of the event that they want to broadcast the invitation. After navigated to the detail page, the user clicks the 'Send Email Invitation' button. Shortly, the user will be notified that the system is preparing and delivering the email invitation. After the invitations already sent, the user will be notified by the system.

4.5.6 QR Code Attendance Flowchart

The flowchart of the QR code attendance process is shown below.

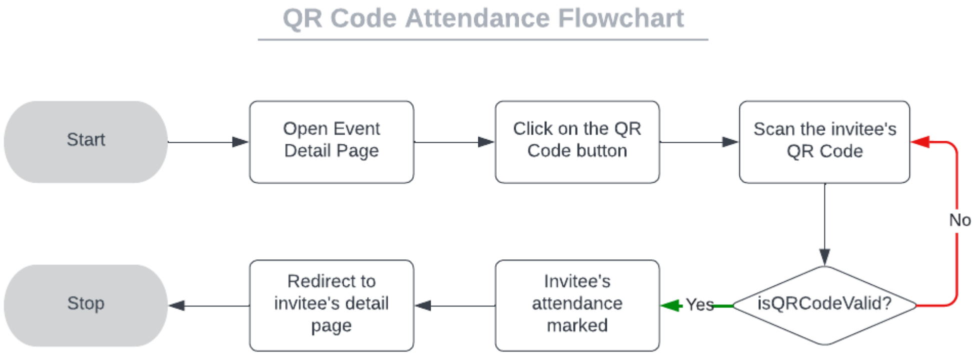

QR Code Attendance Flowchart
Start
Open Event Detail Page
Click on the QR Code button
Scan the invitee's QR Code
No
isQRCodeValid?
Yes
Invitee's attendance marked
Redirect to invitee's detail page
Stop

Figure 4.8 QR Code Attendance Process Flowchart

The QR code attendance system process begins when the user opens the detail page of the event that the user wants to mark the attendance. After opening the event detail page, the user clicks on the QR code button at the bottom right corner of the screen. The user will be redirected to the QR code scanner screen. Then, the user scans the QR code of the invitees, located in the email invitation.

After the code has been scanned, the system will check if it is a valid QR code or not. If the QR code is valid, the invitee's attendance will be automatically marked. Otherwise, the user will be prompted to scan a valid QR code.

4.5.7 System Architecture

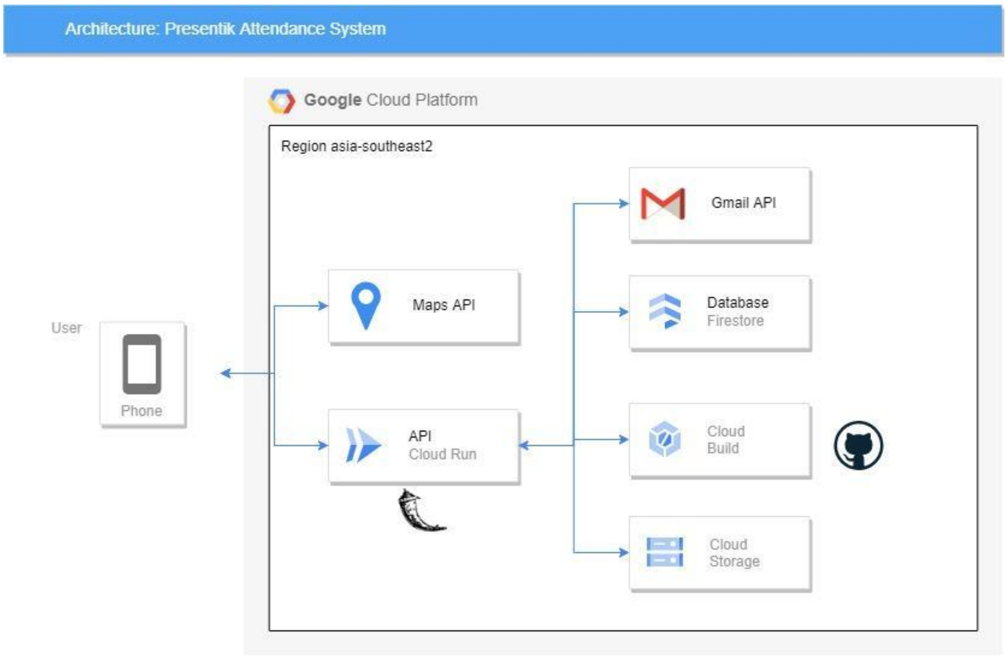


Figure 4.9 System Architecture

Using mobile-based multiplatform information system requires a fast and lightweight implementation of database management system to ensure the application is fast and snappy. Therefore, using the Google Cloud Platform and its APIs and frameworks as the platform to develop and maintain the backend system is suitable for the requirement specified before. Google Cloud Platform ensures the backend system of this application can be integrated flawlessly and within the same environment.

The use of NoSQL database schema, especially Google Firestore, is suitable for the development of the database system thanks to its fast read speed. Flask is used for the backend development framework and deployed using Cloud Run with Docker. This, alongside with Cloud Build that has been integrated to a GitHub repository, ensures the CI/CD of the backend systems are applied seamlessly. The integration of the backend to the frontend system is done by using

Rest API deployed using Cloud Run with Gunicorn container. Cloud Storage Bucket is utilized to store medias and files such as attendance logs, event photos, and invitees' photos.

Other APIs are also implemented in the backend systems to support the feature of this information system such as Maps API and Gmail API. Maps API is applied for the event location selection by the user. Maps API provides beautiful Google Maps interface that is integrated to the system, making the user pinpoints the exact location of the event. Maps API also provides a repository consists of thousands or millions of places data that can be searched to ease the user to choose the location of the event. Gmail API helps develop the email broadcast system that is used to send the invitation to the invitees.

4.5.8 Database Design

The database tables that will be used in the Firebase Firestore database framework. The database structure will be adjusted to the NoSQL database schema to fit the Firestore framework. The following are the SQL Table Structure of the QR Code Attendance System (Presentik):

Table 4.1 User Table

Attribute	Data Type	Properties
id	VARCHAR(20)	NOT NULL, PRIMARY, AUTO GENERATED
username	VARCHAR(255)	NOT NULL
Email	VARCHAR(255)	NOT NULL
password	VARCHAR(255)	NOT NULL
Photo_profile	VARCHAR(255)	NULLABLE
Is_organizer	BOOLEAN	NOT NULL
Is_participant	BOOLEAN	NOT NULL
Is_reception	BOOLEAN	NOT NULL
Logged_in_as	VARCHAR(255)	NOT NULL

Table 4.2 Event Table

Attribute	Data Type	Properties
id	VARCHAR (20)	NOT NULL, PRIMARY, AUTO GENERATED
attendance_id	VARCHAR(20)	NOT NULL, FOREIGN KEY
user_id	VARCHAR(20)	NOT NULL, FOREIGN KEY
location_id	VARCHAR(20)	NOT NULL, FOREIGN KEY
image	VARCHAR(255)	NULLABLE
name	VARCHAR(255)	NOT_NULL
date	DATE	NOT NULL
start_time	TIMESTAMP	NOT NULL
end_time	TIMESTAMP	NULLABLE
description	VARCHAR(255)	NULLABLE
is_face_attendance	BOOLEAN	NOT_NULL
is_qr_code_attendance	BOOLEAN	NOT_NULL
is_online	BOOLEAN	NOT_NULL
qr_attendance_limit	INT	NULLABLE
face_recogntion_method	VARCHAR(255)	NULLABLE

Table 4.3 Guest Details Table

Attribute	Data Type	Properties
id	VARCHAR (20)	NOT NULL, PRIMARY, AUTO GENERATED
name	VARCHAR(255)	NOT_NULL
image	VARCHAR(255)	NOT_NULL
email	VARCHAR(255)	NOT_NULL
phone number	VARCHAR(15)	NULLABLE
Category 1	VARCHAR(255)	NOT_NULL
Category 1 value	VARCHAR(255)	NOT NULL
Category 2	VARCHAR(255)	NOT NULL
Category 2 value	VARCHAR(255)	NULLABLE

Table 4.4 Attendance Table

Attribute	Data Type	Properties
id	VARCHAR (20)	NOT NULL, PRIMARY, AUTO GENERATED
location_id	VARCHAR(20)	NOT NULL, FOREIGN KEY
time	TIMESTAMP	NOT_NULL
is_qr_code	BOOLEAN	NOT_NULL
is_face_recognition	BOOLEAN	NOT_NULL

Table 4.5 Categories Table

Attribute	Data Type	Properties
id	VARCHAR (20)	NOT NULL, PRIMARY, AUTO GENERATED
event_id	VARCHAR(20)	NOT NULL, FOREIGN KEY
name	VARCHAR(255)	NOT_NULL
enum	VARCHAR(255)	NOT_NULL
is_auto_generated	BOOLEAN	NOT_NULL

Table 4.6 Location Table

Attribute	Data Type	Properties
id	VARCHAR (20)	NOT NULL, PRIMARY, AUTO GENERATED
latitude	FLOAT	NOT NULL
longitude	FLOAT	NOT_NULL
name	VARCHAR(255)	NOT_NULL
address	VARCHAR(255)	NOT_NULL

4.5.9 UI Designing/Planning

The initial plan of the user interface design will be explained in this sub-chapter. Ideally, this application will support various screen ratio and platforms such as Web, iOS, and Android. But for Presentik, the user interface will only cover the Android smartphones since it focuses on the portability and flexibility of the QR code attendance system. The initial design of the application is shown below.

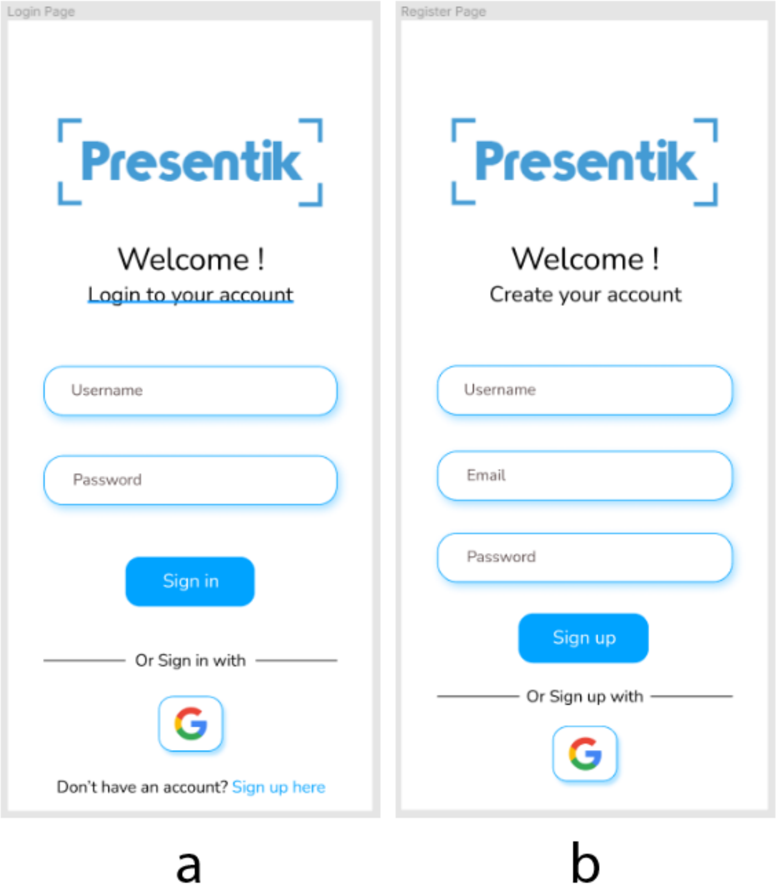


Figure 4.10 a) Login Page Interface, b) Register Page Interface

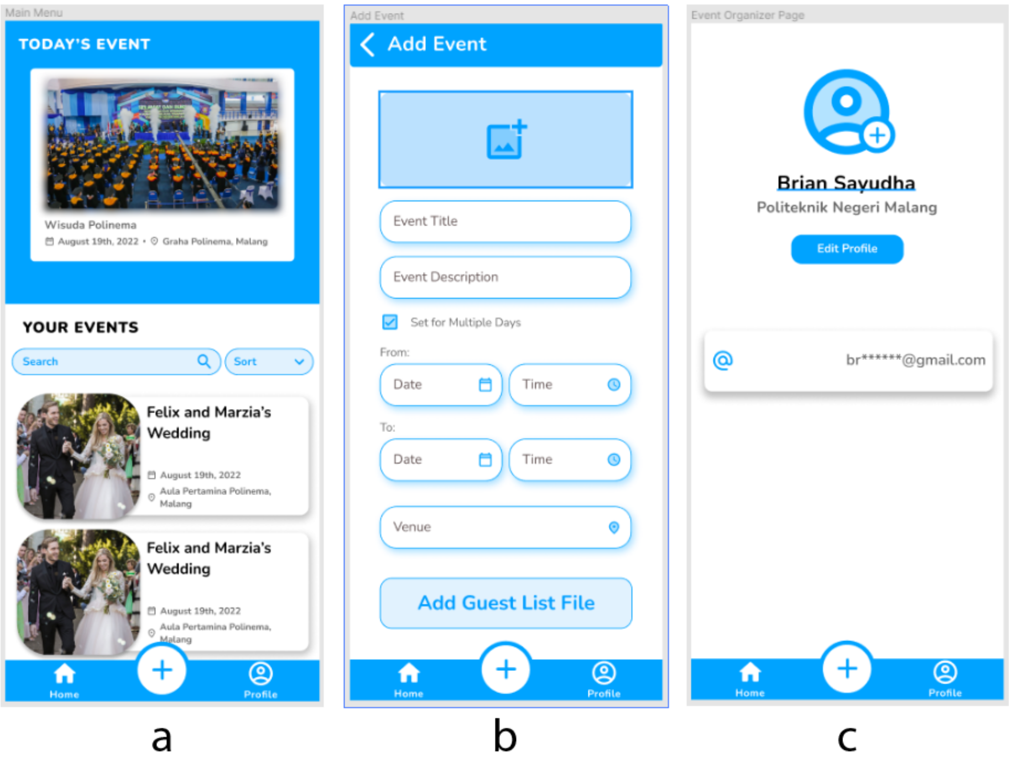
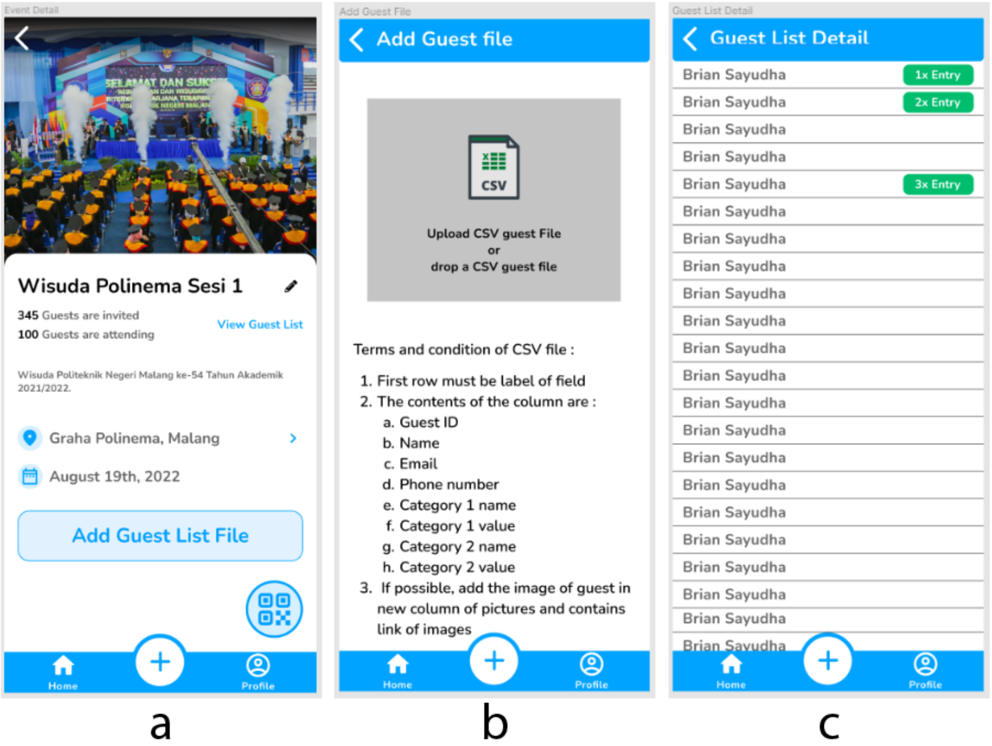


Figure 4.11 a) Home Page Interface, b) Create Event Page Interface, c) User Profile Page



Wisuda Polinema Sesi 1

345 Guests are invited
100 Guests are attending

View Guest List

Wisuda Politeknik Negeri Malang ke-54 Tahun Akademik 2021/2022.

Graha Polinema, Malang

August 19th, 2022

Add Guest List File

Home

Profile

Add Guest file

Upload CSV guest File
or
drop a CSV guest file

Terms and condition of CSV file :

1. First row must be label of field
2. The contents of the column are :
   a. Guest ID
   b. Name
   c. Email
   d. Phone number
   e. Category 1 name
   f. Category 1 value
   g. Category 2 name
   h. Category 2 value
3. If possible, add the image of guest in new column of pictures and contains link of images

Home

Profile

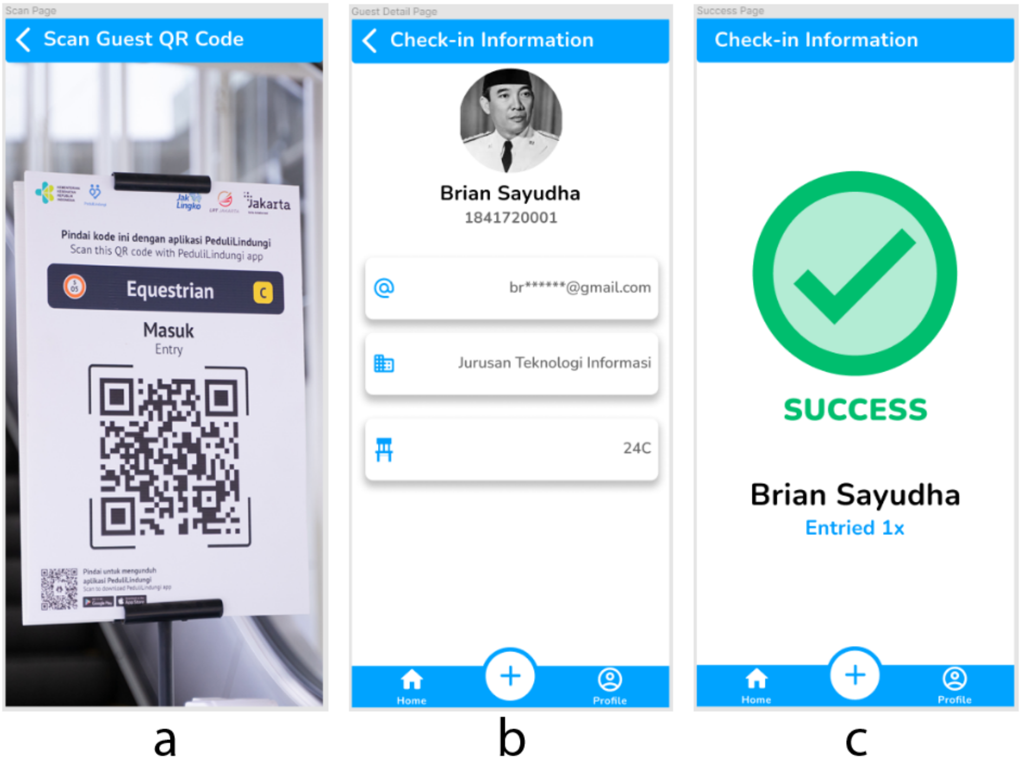
Guest List Detail

Brian Sayudha	1x Entry
Brian Sayudha	2x Entry
Brian Sayudha	
Brian Sayudha	
Brian Sayudha	3x Entry
Brian Sayudha	
Brian Sayudha	
Brian Sayudha	
Brian Sayudha	
Brian Sayudha	
Brian Sayudha	
Brian Sayudha	
Brian Sayudha	
Brian Sayudha	
Brian Sayudha	
Brian Sayudha	
Brian Sayudha	
Brian Sayudha	
Brian Sayudha	
Brian Sayudha	
Brian Sayudha	
Brian Sayudha	

Home

Profile

Figure 4.12 a) Event Detail Interface, b) Add Guest File Interface, c) Guest List Interface



Brian Sayudha
1841720001

br******@gmail.com

Jurusan Teknologi Informasi

24C

Brian Sayudha
Entried 1x

Figure 4.13 a) QR Code Scan Page, b) Guest Detail Page, c) QR Scan Success Page.

4.5.10 System Testing

The system will be tested with Black Box Testing method. The testing will be done with scripted scenarios by dividing the role as ‘event-organizer’ and ‘receptionist’. This testing method will ensure that the functionalities and features of the system will run smoothly and without a bug.

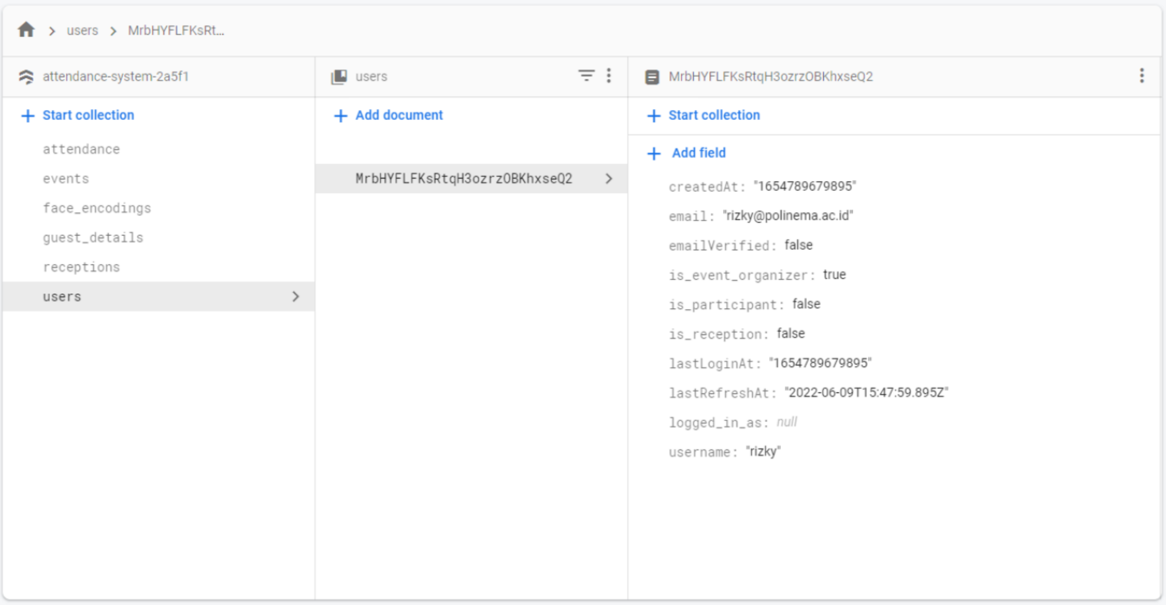
CHAPTER V. SYSTEM IMPLEMENTATION

5.1 Database Implementation

The database that is implemented in this information system is the NoSQL database. NoSQL database stores data quite different than the SQL database. The NoSQL database provides faster read speed and lighter than the SQL database. The initialization process of the NoSQL database. For these reasons, the NoSQL database is much more suitable to be implemented in mobile-based application. The NoSQL database framework chosen for this system is Firebase Firestore, included within Google Cloud Platform.

5.1.1 User Collection

The ‘User’ data collections will is below.

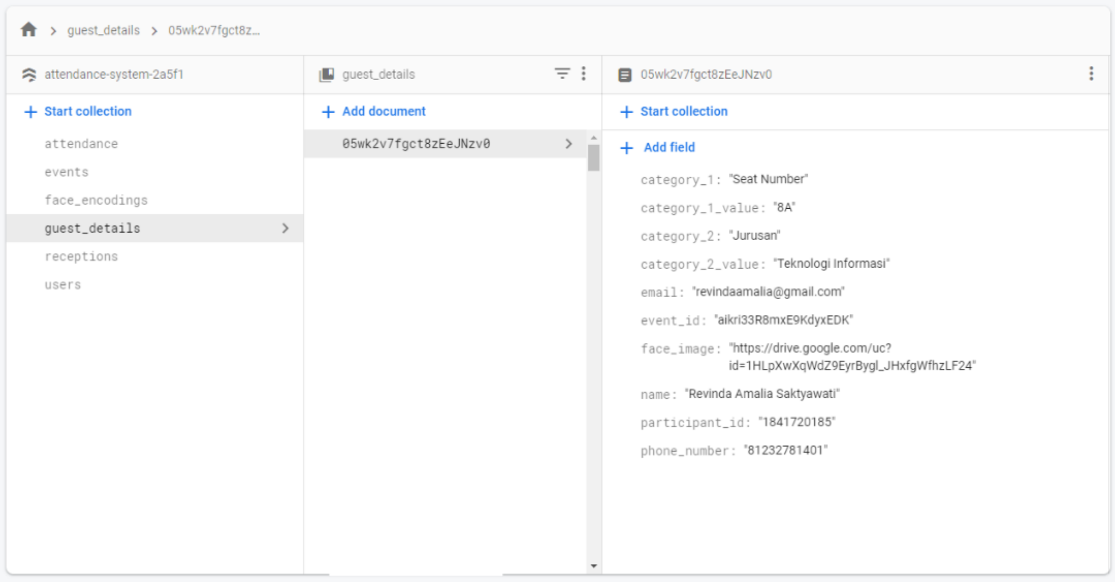


createdAt: "1654789679895"
email: "rizky@polinema.ac.id"
emailVerified: false
is_event_organizer: true
is_participant: false
is_reception: false
lastLoginAt: "1654789679895"
lastRefreshAt: "2022-06-09T15:47:59.895Z"
logged_in_as: null
username: "rizky"

Figure 5.1 User Collection

5.1.2 Guest Collection

The ‘Guest’ data collections is shown below.



attendance
events
face_encodings
guest_details
receptions
users

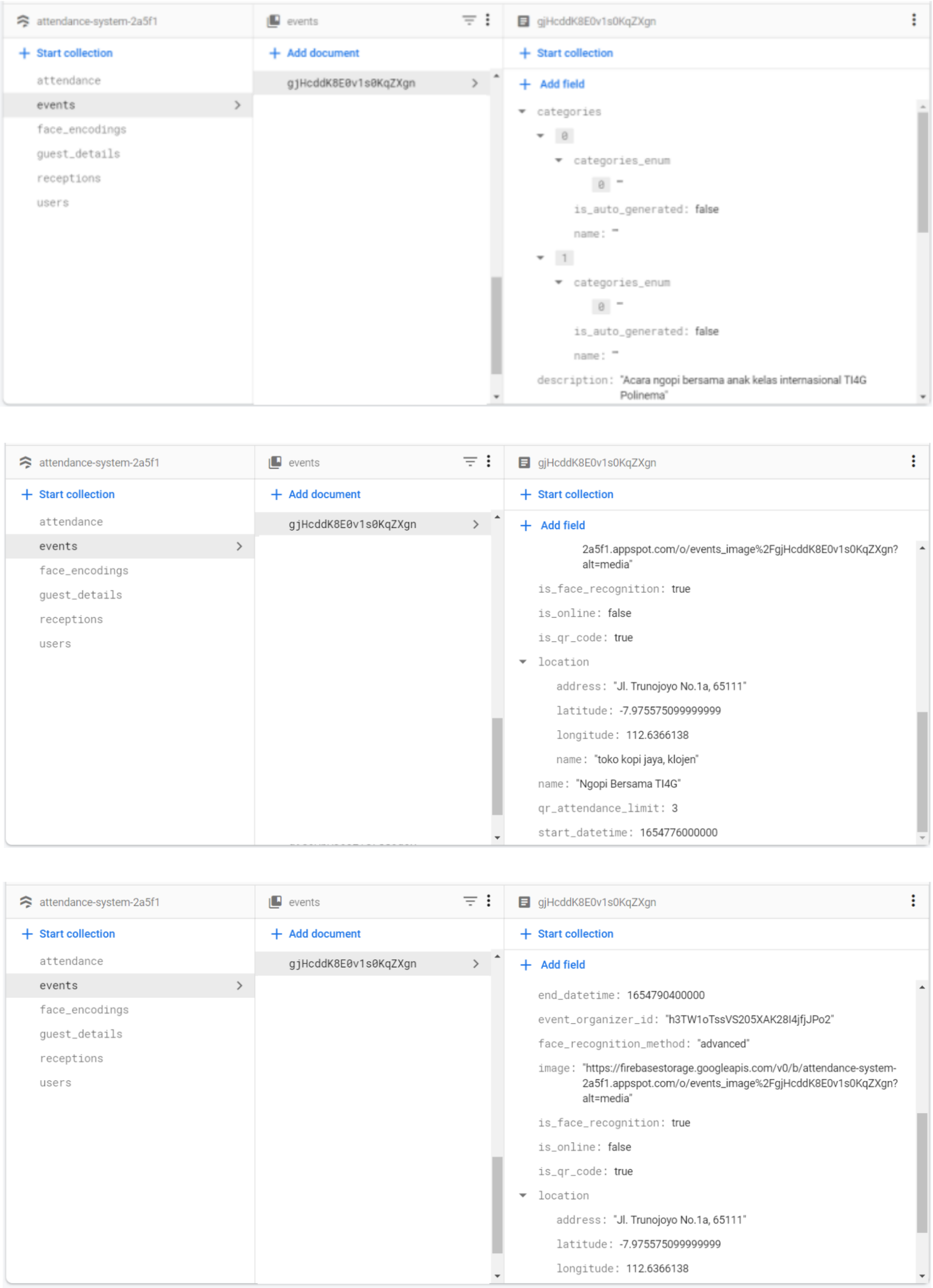
05wk2v7fgct8zEeJNzv0

```
category_1: "Seat Number"
category_1_value: "8A"
category_2: "Jurusan"
category_2_value: "Teknologi Informasi"
email: "revindaamalia@gmail.com"
event_id: "aikri33R8mxE9KdyxEDK"
face_image: "https://drive.google.com/uc?
            id=1HLpXwXqWdZ9EyrBygl_JHxfgWfhzLF24"
name: "Revinda Amalia Saktyawati"
participant_id: "1841720185"
phone_number: "81232781401"
```

Figure 5.2 Guest Collections

Event Collection

The ‘Event’ data collections is shown below.



```
categories
  0
    categories_enum
      0 ""
    is_auto_generated: false
    name: ""
  1
    categories_enum
      0 ""
    is_auto_generated: false
    name: ""
description: "Acara ngopi bersama anak kelas internasional TI4G
             Polinema"
```

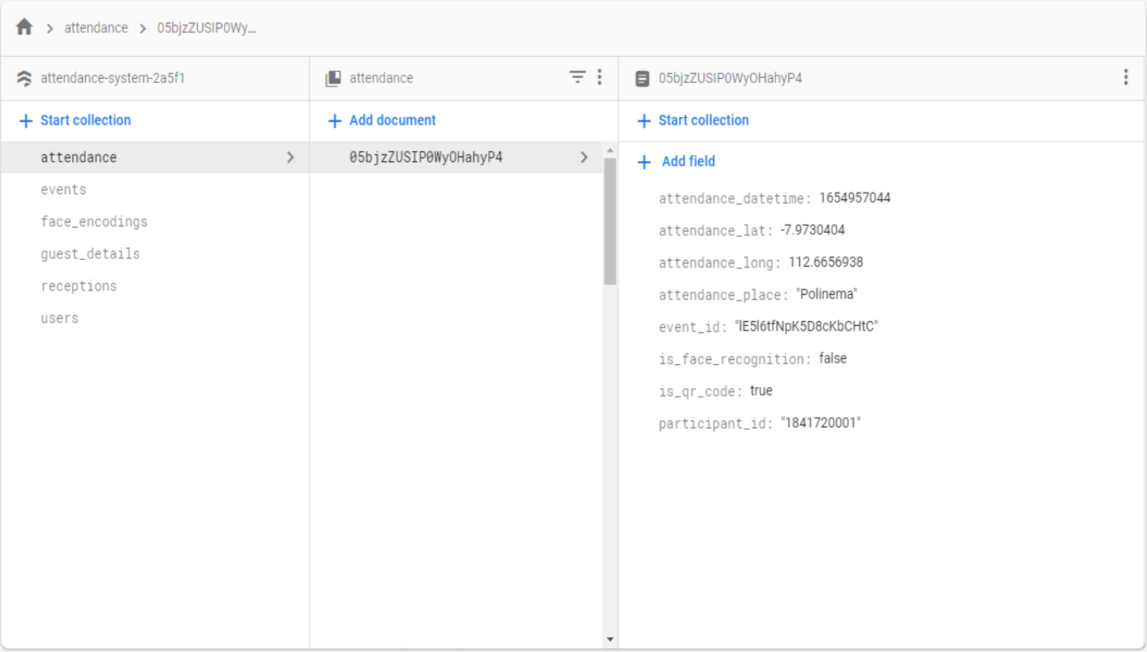
```
          2a5f1.appspot.com/o/events_image%2FgjHcddK8E0v1s0KqZXgn?
          alt=media"
is_face_recognition: true
is_online: false
is_qr_code: true
location
    address: "Jl. Trunojoyo No.1a, 65111"
    latitude: -7.975575099999999
    longitude: 112.6366138
    name: "toko kopi jaya, klojen"
name: "Ngopi Bersama TI4G"
qr_attendance_limit: 3
start_datetime: 1654776000000
```

```
end_datetime: 1654790400000
event_organizer_id: "h3TW1oTssVS205XAK28I4jfjJPo2"
face_recognition_method: "advanced"
image: "https://firebasestorage.googleapis.com/v0/b/attendance-system-
        2a5f1.appspot.com/o/events_image%2FgjHcddK8E0v1s0KqZXgn?
        alt=media"
is_face_recognition: true
is_online: false
is_qr_code: true
location
    address: "Jl. Trunojoyo No.1a, 65111"
    latitude: -7.975575099999999
    longitude: 112.6366138
```

Figure 5.3 Event Collections

2.2.5. Attendance Collection

The ‘Attendance’ data collection is shown below.



attendance_datetime: 1654957044

attendance_lat: -7.9730404

attendance_long: 112.6656938

attendance_place: "Polinema"

event_id: "lE5l6tfNpK5D8cKbCHtC"

is_face_recognition: false

is_qr_code: true

participant_id: "1841720001"

Figure 5.4 Attendance Collection

5.1 UI Development

The development of the front-end system is done with Flutter 3.0.1 and Dart 2.17.1. The UI is developed based on the mockups that already been designed using Figma in the system design phase. The UI designs of the application is listed below.

5.2.1 Login and Register Page

The first thing that the user must do is log into their account or register a new account before proceeding to the system. The user can choose which role that they want to login, with each role has their own features. For the register page, the user can choose multiple roles to be assigned to the account.

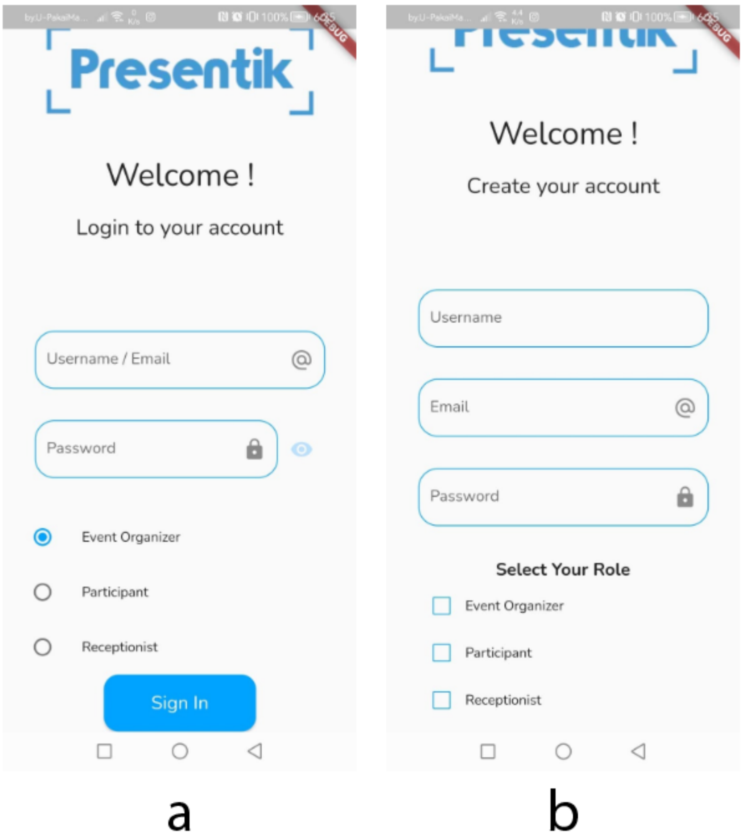
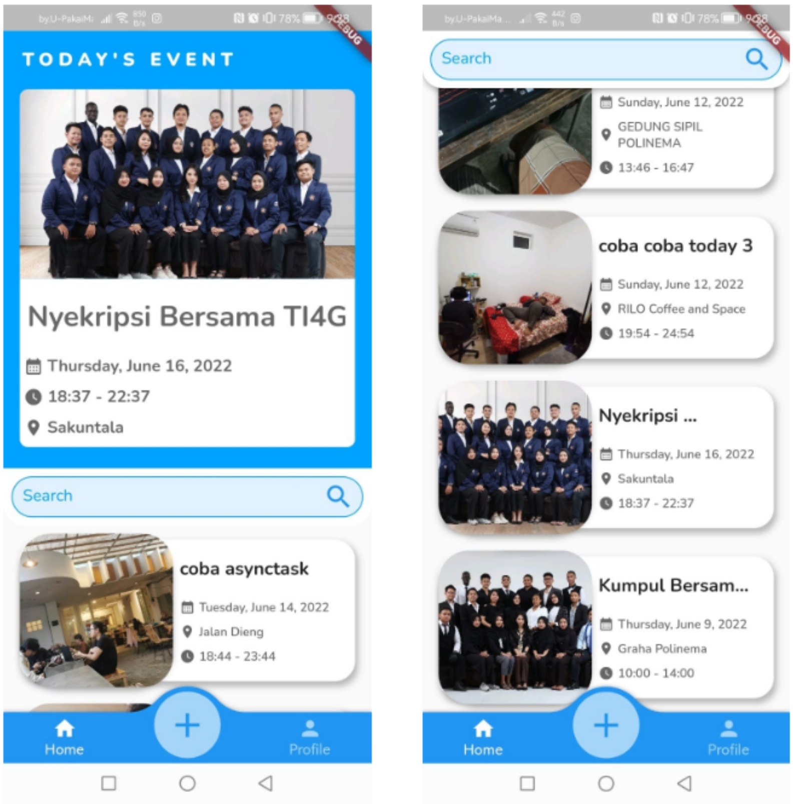


Figure 5.5 a) Login Page, b) Register Page

5.2.2 Home Page

After logging in, the user will be redirected to the main screen. The main screen displays the event that takes place today. The main screen also displays the events that the user organized.



TODAY'S EVENT

Nyekripsi Bersama TI4G

Thursday, June 16, 2022

18:37 - 22:37

Sakuntala

coba asynctask

Tuesday, June 14, 2022

Jalan Dieng

18:44 - 23:44

Sunday, June 12, 2022

GEDUNG SIPIL POLINEMA

13:46 - 16:47

coba coba today 3

Sunday, June 12, 2022

RILO Coffee and Space

19:54 - 24:54

Nyekripsi ...

Thursday, June 16, 2022

Sakuntala

18:37 - 22:37

Kumpul Bersam...

Thursday, June 9, 2022

Graha Polinema

10:00 - 14:00

Figure 5.6 Home Page

5.2.3 Add Event Page

User can register new events by clicking the '+' button at the bottom navigation bar. The user must fill all the information except the photo/media of the event. The user can add the exact location of the event by searching the place in the google maps.

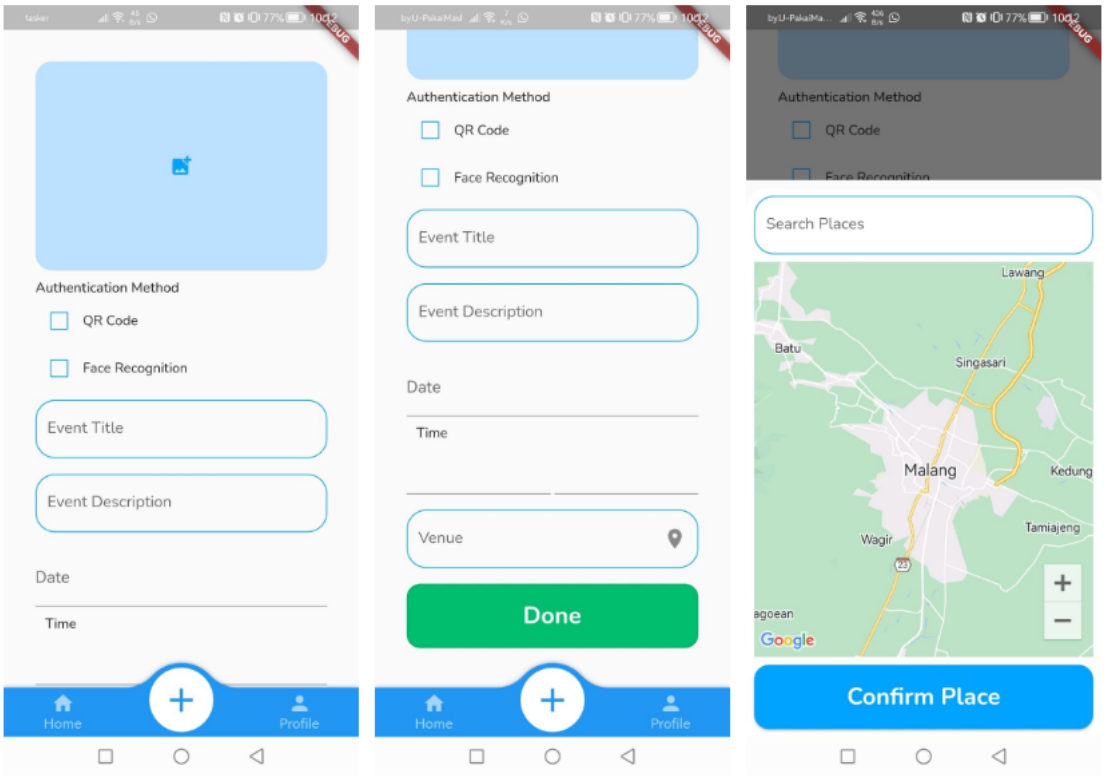


Figure 5.7 Add Event Page

5.2.4 Profile Page

In this page, the user can logout the current user

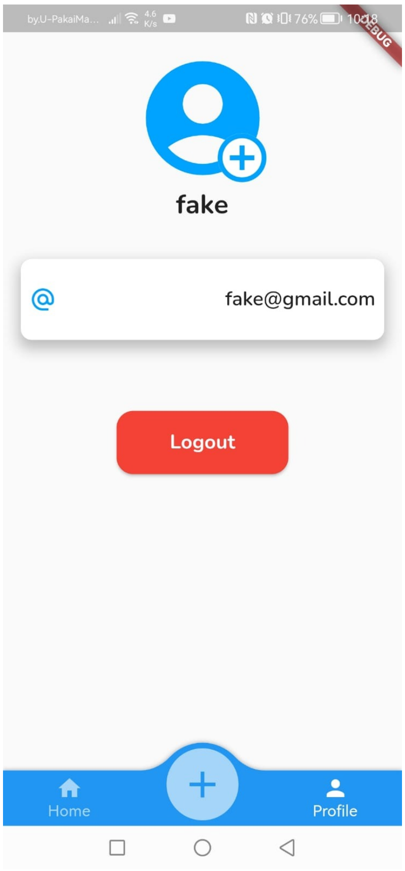
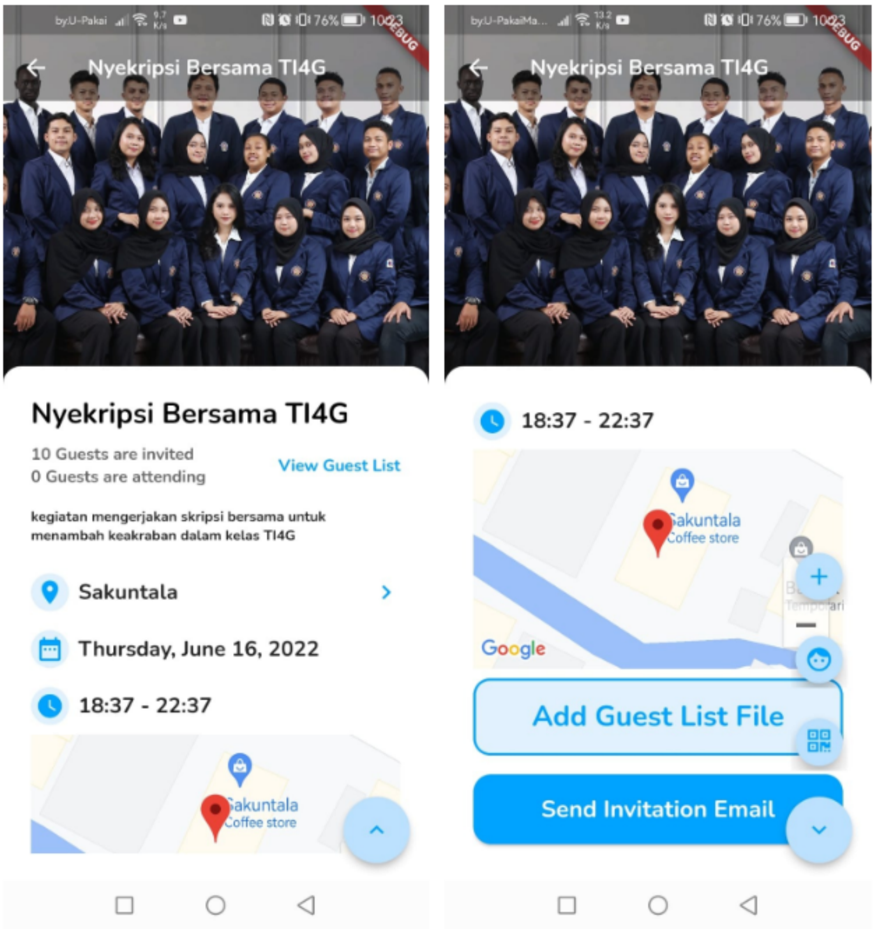


Figure 5.8 Profile Page

5.2.5 Event Detail

This page displays the detail of the event such as: title, description, location, date, time, and maps. This page displays the sum of the invited guests and the guests that already attends the event. After adding the guests, the invitation can be sent by clicking the ‘Send Email Invitation’ button.



Nyekripsi Bersama TI4G

Nyekripsi Bersama TI4G

10 Guests are invited

0 Guests are attending

View Guest List

kegiatan mengerjakan skripsi bersama untuk menambah keakraban dalam kelas TI4G

Sakuntala

Thursday, June 16, 2022

18:37 - 22:37

Nyekripsi Bersama TI4G

18:37 - 22:37

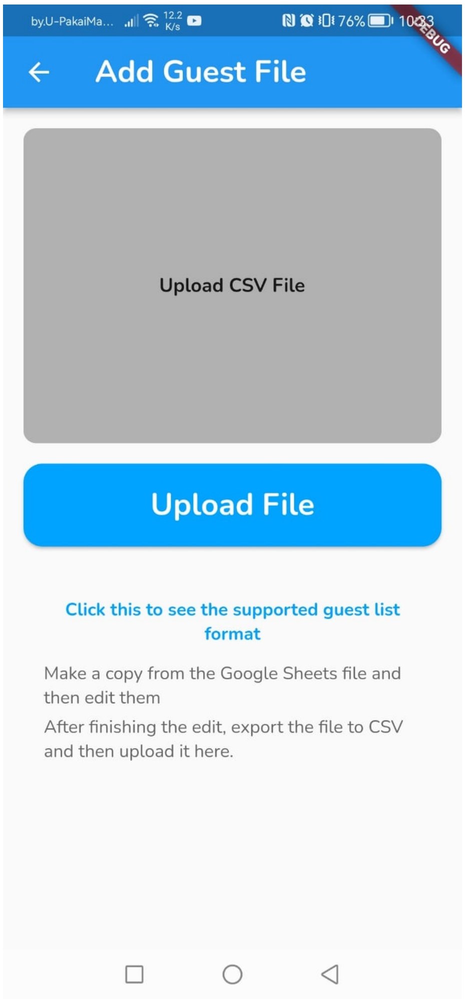
Add Guest List File

Send Invitation Email

Figure 5.9 Event Detail Page

5.2.6 Add Guest File

User can add the guests list by uploading the CSV file here. To choose the desired file, user can tap the grey rectangle on the screen. After adding the file, the user uploads them by clicking the 'Upload File' button.



Click this to see the supported guest list format

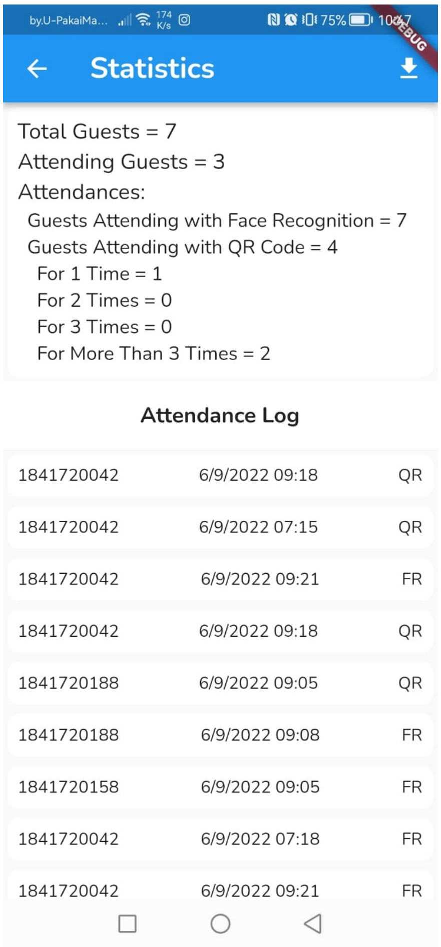
Make a copy from the Google Sheets file and then edit them

After finishing the edit, export the file to CSV and then upload it here.

Figure 5.10 Add Guest File Page

5.2.7 Statistics Page

This page displays the attendance statistics of the event. The statistics includes total guests invited; total guests already attend; guests that use QR code as the identification; etc. This page also displays the detailed attendance of the user, including their ID, the time of the attendance, and the attendance method.



Total Guests = 7
Attending Guests = 3
Attendances:
Guests Attending with Face Recognition = 7
Guests Attending with QR Code = 4
For 1 Time = 1
For 2 Times = 0
For 3 Times = 0
For More Than 3 Times = 2

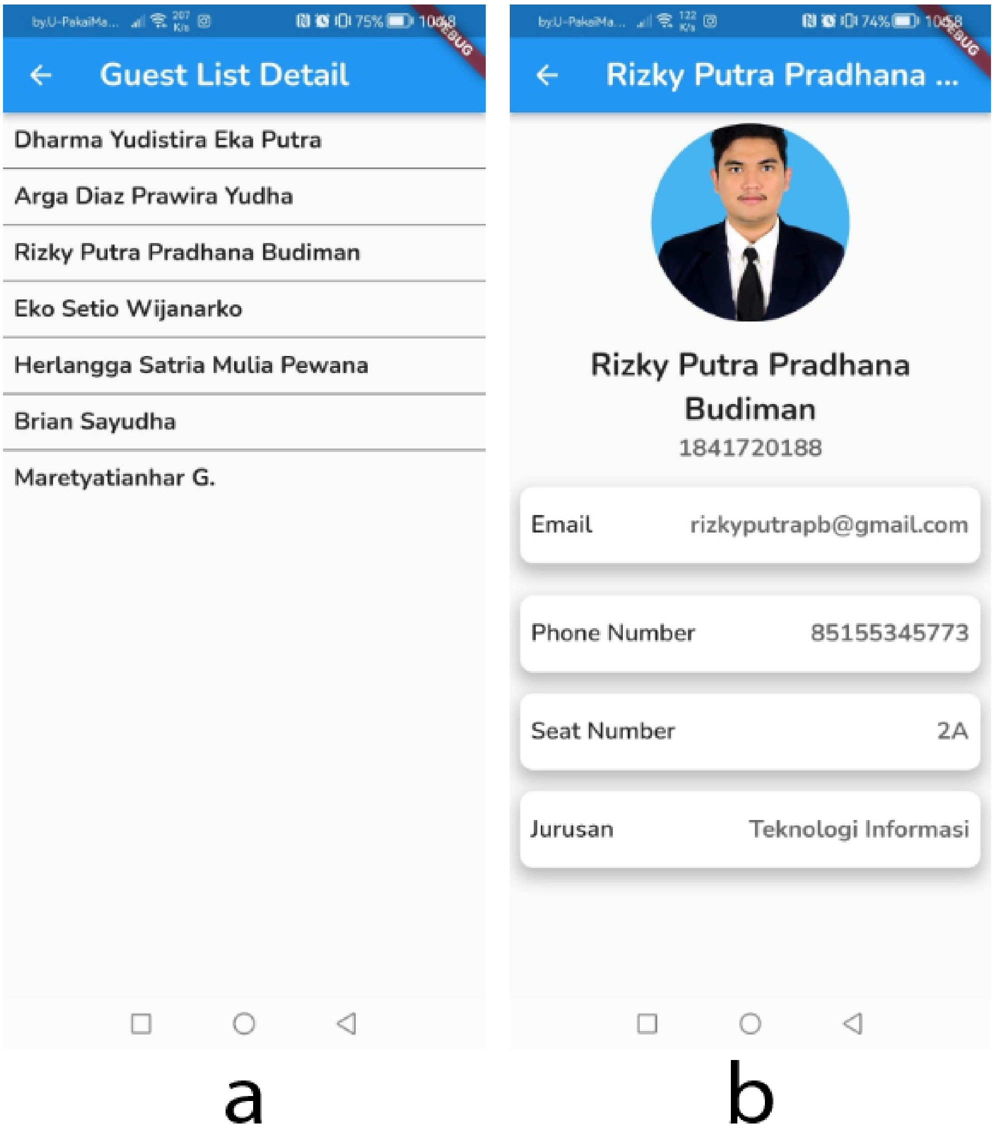
Attendance Log

1841720042	6/9/2022 09:18	QR
1841720042	6/9/2022 07:15	QR
1841720042	6/9/2022 09:21	FR
1841720042	6/9/2022 09:18	QR
1841720188	6/9/2022 09:05	QR
1841720188	6/9/2022 09:08	FR
1841720158	6/9/2022 09:05	FR
1841720042	6/9/2022 07:18	FR
1841720042	6/9/2022 09:21	FR

Figure 5.11 Statistics Page

5.2.8 Guest List and Detail Page

User can see the list of the guests added to the event. User can also see the details of the guests by clicking one of the users. The detailed page displays the guest info and the photo of the guests.



Guest List Detail

Dharma Yudistira Eka Putra

Arga Diaz Prawira Yudha

Rizky Putra Pradhana Budiman

Eko Setio Wijanarko

Herlangga Satria Mulia Pewana

Brian Sayudha

Maretyatianhar G.

Rizky Putra Pradhana ...

Rizky Putra Pradhana Budiman

1841720188

Email	rizkyputrapb@gmail.com
Phone Number	85155345773
Seat Number	2A
Jurusan	Teknologi Informasi

Figure 5.12 a) Guest List Page, b) Guest Detail Page

5.2.9 QR Attendance Page

The main feature of this application is the QR attendance. The user can mark the attendance of the guests by scanning the guests QR code. If the QR code is valid, the system will automatically mark the attendance.

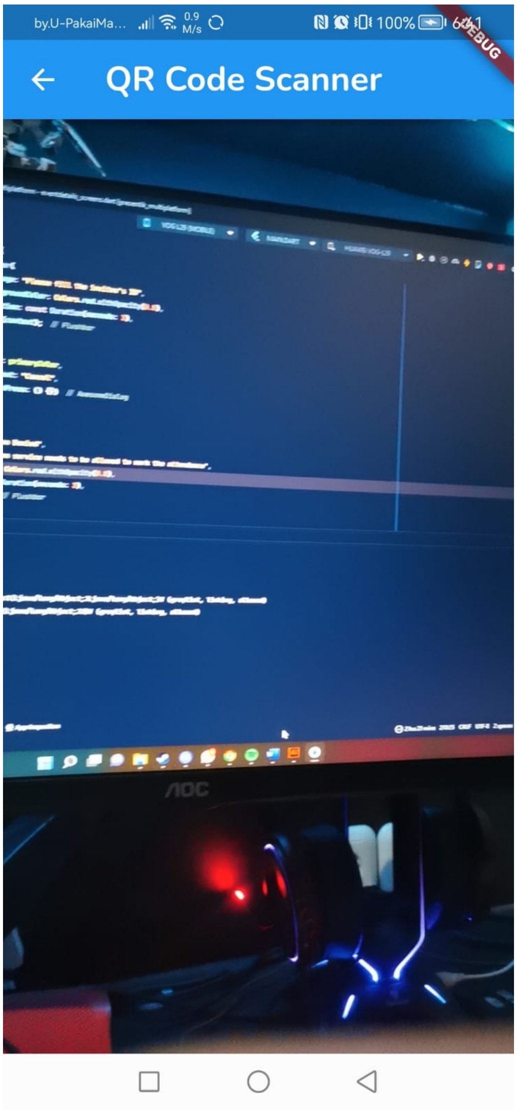


Figure 5.13 QR Code Scanner Page

5.2.10 Manual Attendance Dialog

Other than QR Code Attendance, the user can mark the attendance manually by inputting the guests ID.

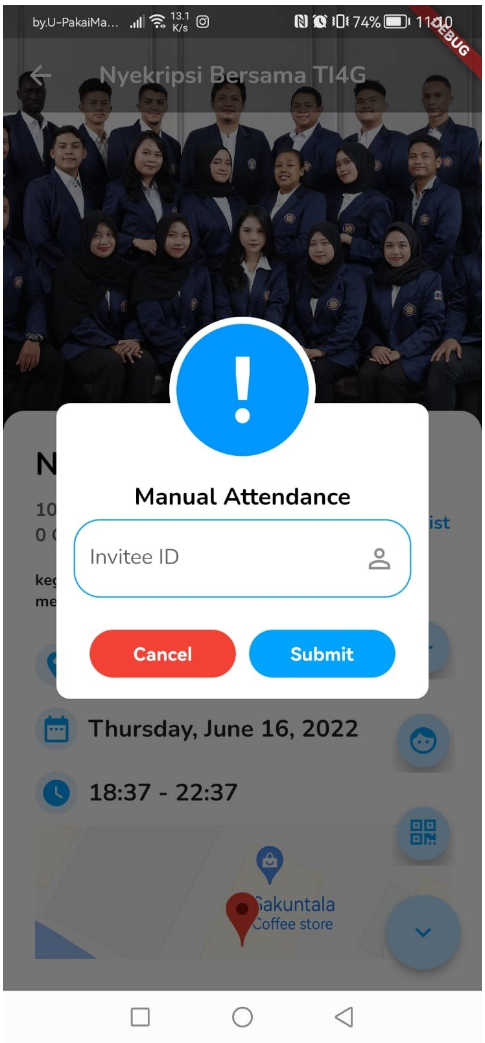
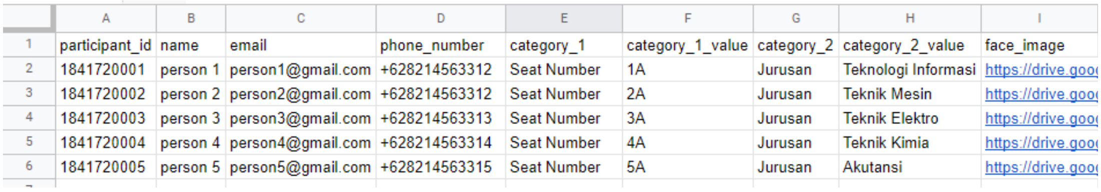


Figure 5.14 Manual Attendance Dialog

5.2 Guest File and Email Invitation Implementation

Before the user can scan the QR code, the guests' QR code must be generated first. The guests' QR code is generated from the ID of the guests. The guests' data are retrieved from the CSV files that are sent by the user with a particular format. The format of the CSV file can be seen by opening this link: https://docs.google.com/spreadsheets/d/1h5hAAewZNm7wj1abjFaFU6PXLYig0SoX6_v6FaRCMNE/edit?usp=sharing.

The picture below is the content of the link above:



	A	B	C	D	E	F	G	H	I
1	participant_id	name	email	phone_number	category_1	category_1_value	category_2	category_2_value	face_image
2	1841720001	person 1	person1@gmail.com	+628214563312	Seat Number	1A	Jurusan	Teknologi Informasi	https://drive.goo
3	1841720002	person 2	person2@gmail.com	+628214563312	Seat Number	2A	Jurusan	Teknik Mesin	https://drive.goo
4	1841720003	person 3	person3@gmail.com	+628214563313	Seat Number	3A	Jurusan	Teknik Elektro	https://drive.goo
5	1841720004	person 4	person4@gmail.com	+628214563314	Seat Number	4A	Jurusan	Teknik Kimia	https://drive.goo
6	1841720005	person 5	person5@gmail.com	+628214563315	Seat Number	5A	Jurusan	Akutansi	https://drive.goo

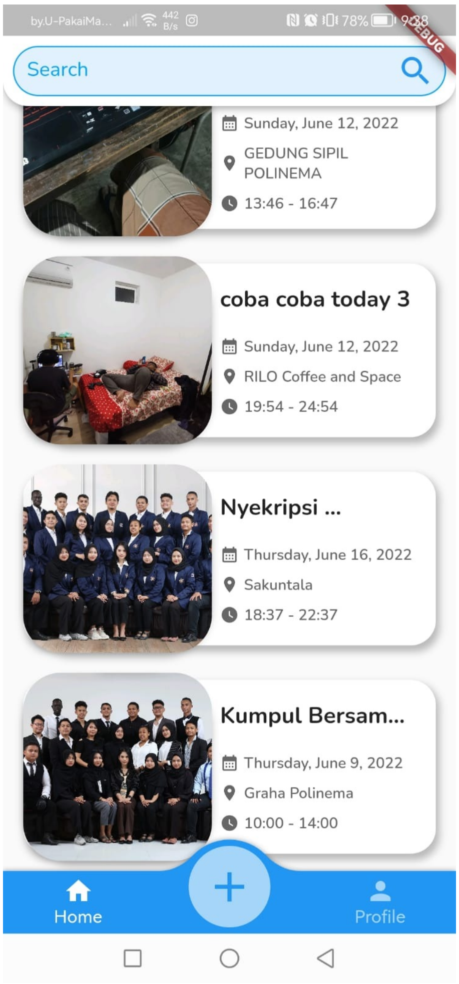
Figure 5.15 The CSV Format

The format contains 9 columns in which 5 of them must be filled. The mandatory fields are participant_id, name, email, phone_number, and face_image, while the rest of the fields can be left blank.

- Participant_id: This field is required as an identifier for each guest. This field shouldn't be filled with incremental numbers such as '1', '2', '3', and so on. Otherwise, this field should be filled with minimum 6 digits of numbers, unique to each guest. This field will be the data that we will be generated to a QR code that then will be scanned by the event organizer.
- Name: This field must be filled to identify one guest's name. This field should be filled with the name of the guests such as 'Rizky Putra' or 'Arga Diaz'
- Email: This field is required to send the invitation mail to the guests. This field should be filled with the guest's valid email, otherwise the invitation mail won't be delivered to the guest.
- Phone_number: This field is required to contact the guest if necessary. This field should be filled with the guest's valid phone number such as "+628155582267".

- Category_1: This field is optional. This field should be filled with the first name of the categories of the guest such as: ‘Department’, ‘Seat Number’, ‘Class’, etc.
- Category_1_value: This field is optional. This field should be filled in accordance with the Category_1. For example: if the Category_1 is ‘Department’, this field should be filled with ‘Teknologi Informasi’, ‘Teknik Elektro’, ‘Teknik Mesin’, etc.
- Category_2: This field is optional. This field should be filled with the second name of the categories of the guest such as: ‘Department’, ‘Seat Number’, ‘Class’, etc.
- Category_2_value: This field is optional. This field should be filled in accordance with the Category_2. For example: if the Category_2 is ‘Department’, this field should be filled with ‘Teknologi Informasi’, ‘Teknik Elektro’, ‘Teknik Mesin’, etc.
- Face_image: This field is required as an image identifier for the guest. This field should be filled with a link, directed to the image of the guest. If the image is in the Google Drive, the event organizer should make the link public so the system can open it.

After the CSV file is ready, the user can upload it to the system. To upload the CSV file, the user must choose which event that they wanted to add the guests list by clicking the desired events in the home page.



Sunday, June 12, 2022
GEDUNG SIPIL POLINEMA
13:46 - 16:47

coba coba today 3
Sunday, June 12, 2022
RILO Coffee and Space
19:54 - 24:54

Nyekripsi ...
Thursday, June 16, 2022
Sakuntala
18:37 - 22:37

Kumpul Bersam...
Thursday, June 9, 2022
Graha Polinema
10:00 - 14:00

Figure 5.16 Home Page

After clicking the desired event, the user will be redirected to the detail page. In the detail page, the user can click ‘Add Guest List File’ to redirect the user to the uploading page.

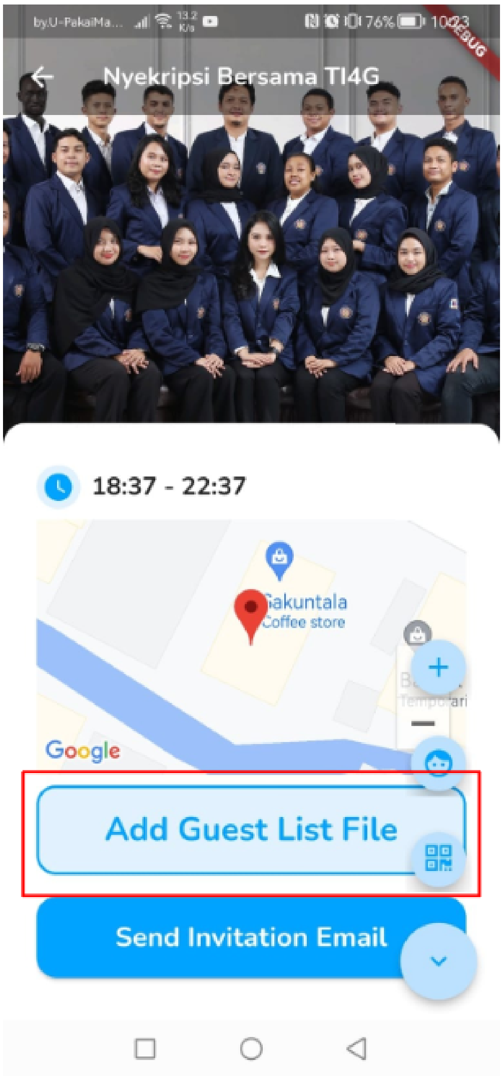
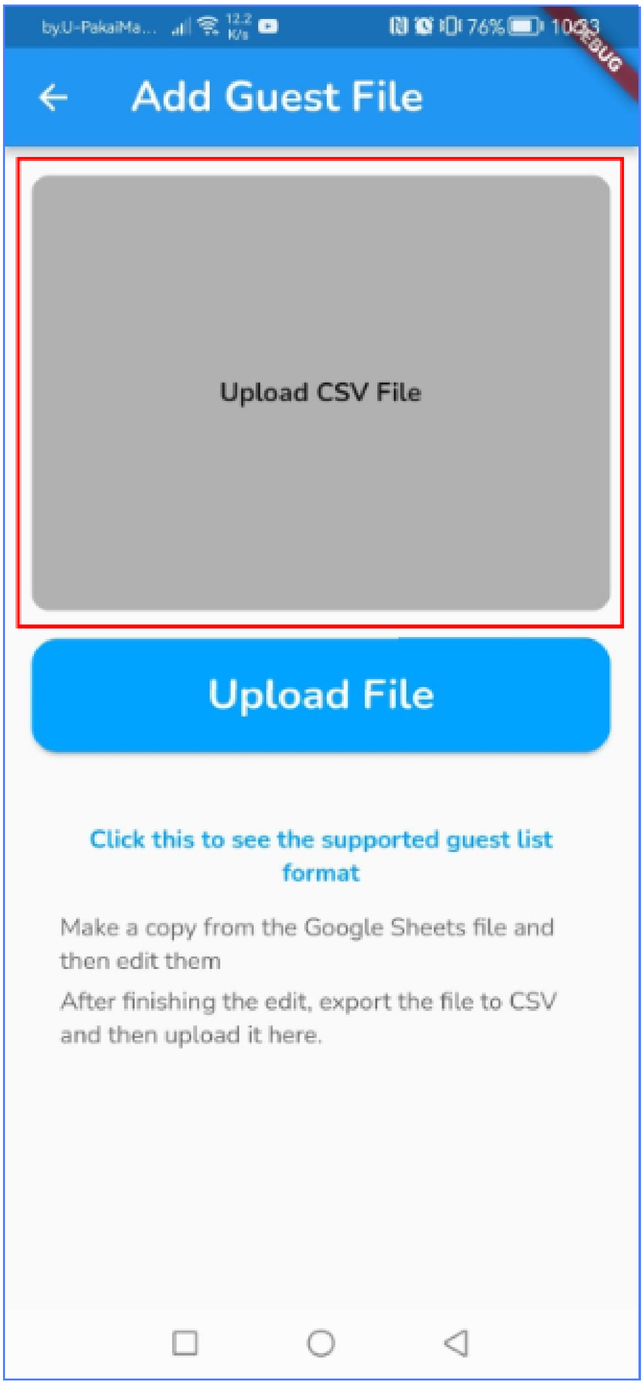


Figure 5.17 Add Guest List File Button

After being redirected to the uploading page, the user clicks the grey area to choose the desired CSV file.



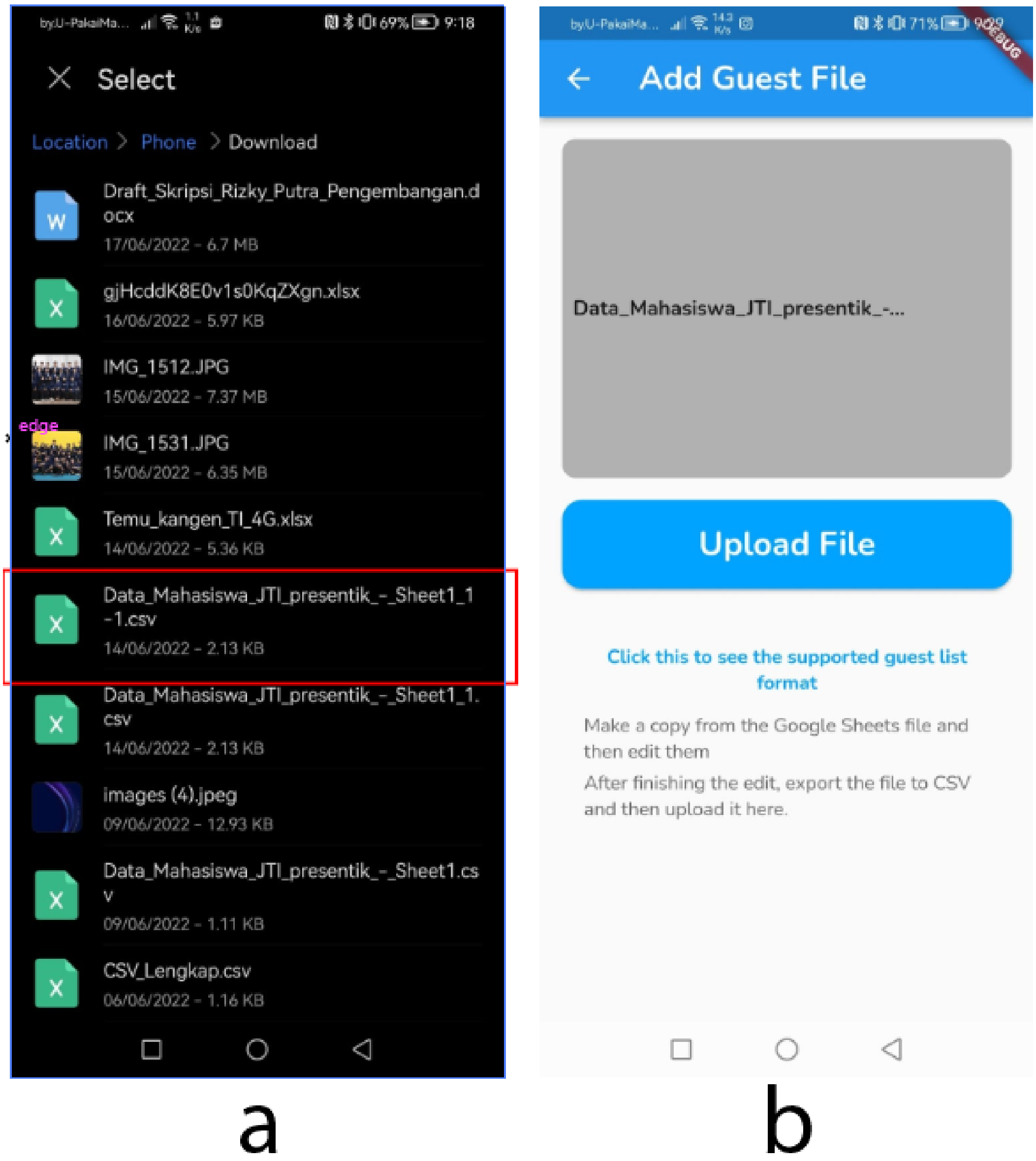
Click this to see the supported guest list format

Make a copy from the Google Sheets file and then edit them

After finishing the edit, export the file to CSV and then upload it here.

Figure 5.18 Choose CSV File Button

Then, the user will be redirected to the phone directory. The user search for the desired file, and then choose which file that the user wants to upload. For example, the chosen file is Data_Mahasiswa_JTI_presentik_-_Sheet1_1-1.csv



Draft_Skripsi_Rizky_Putra_Pengembangan.docx
17/06/2022 - 6.7 MB

gjHcddK8E0v1s0KqZXgn.xlsx
16/06/2022 - 5.97 KB

IMG_1512.JPG
15/06/2022 - 7.37 MB

IMG_1531.JPG
15/06/2022 - 6.35 MB

Temu_kangen_TI_4G.xlsx
14/06/2022 - 5.36 KB

Data_Mahasiswa_JTI_presentik_-_Sheet1_1-1.csv
14/06/2022 - 2.13 KB

Data_Mahasiswa_JTI_presentik_-_Sheet1_1.csv
14/06/2022 - 2.13 KB

images (4).jpeg
09/06/2022 - 12.93 KB

Data_Mahasiswa_JTI_presentik_-_Sheet1.csv
09/06/2022 - 1.11 KB

CSV_Lengkap.csv
06/06/2022 - 1.16 KB

Data_Mahasiswa_JTI_presentik_-...

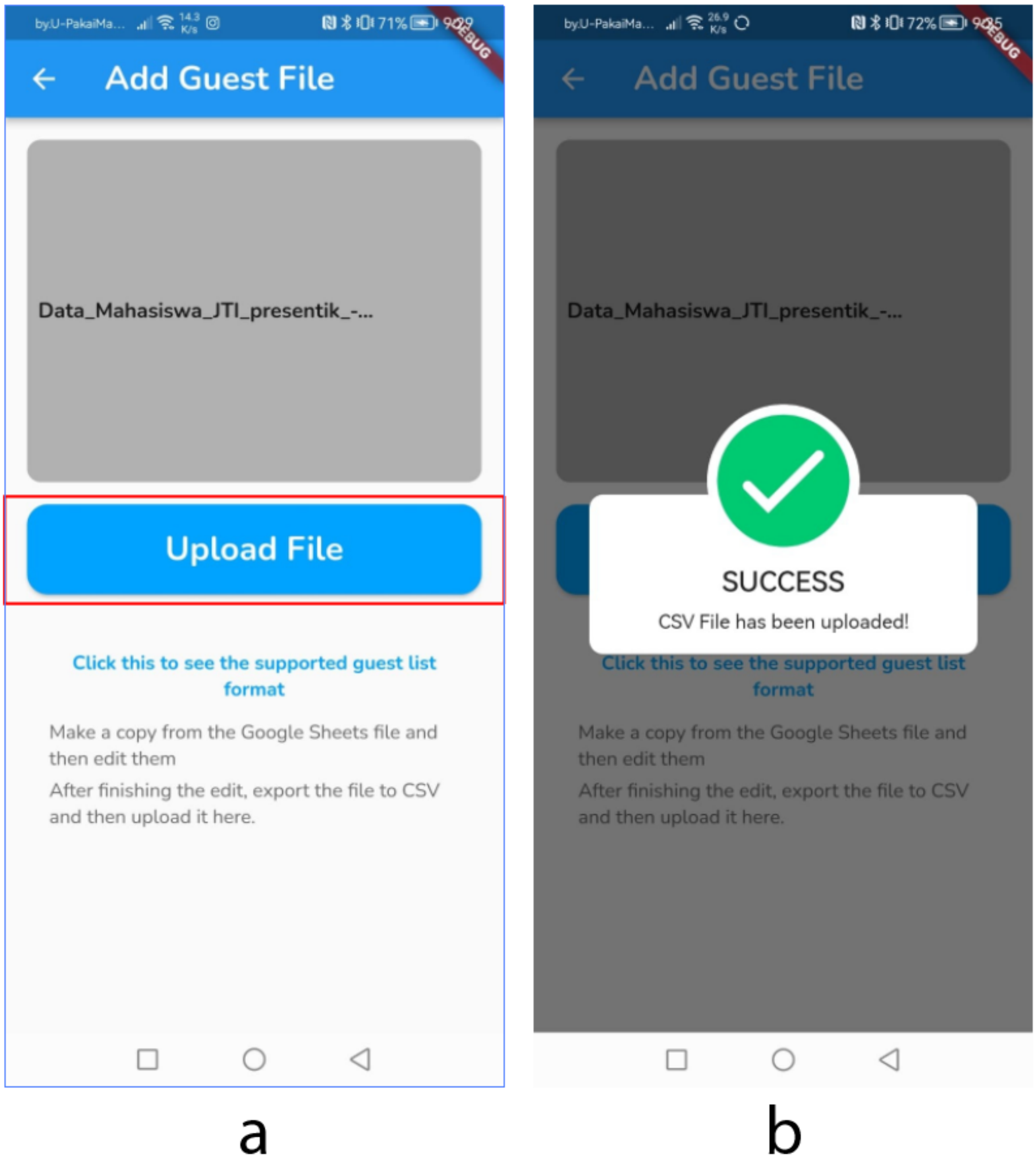
Click this to see the supported guest list format

Make a copy from the Google Sheets file and then edit them

After finishing the edit, export the file to CSV and then upload it here.

Figure 5.19 a) Example of Choosing a File, b) Upload Page After a File is Chosen

After the user is done picking the files, the user can click the upload button (shown on the Figure 5.20 below). The system will be beginning the upload process. The user will be prompted if the uploading process finished successfully.


Add Guest File
Data_Mahasiswa_JTI_presentik_-...
Upload File
Click this to see the supported guest list format
a
Add Guest File
Data_Mahasiswa_JTI_presentik_-...
SUCCESS
Click this to see the supported guest list format
b

Make a copy from the Google Sheets file and then edit them

After finishing the edit, export the file to CSV and then upload it here.

CSV File has been uploaded!

Figure 5.20 a) The Upload File Button, b) Pop-up Message for Successful Upload

5.3 Register Implementation

The first step of using the application is to register a new account. After opening the application, user can click on ’Sign up here!’ text to open the register page.

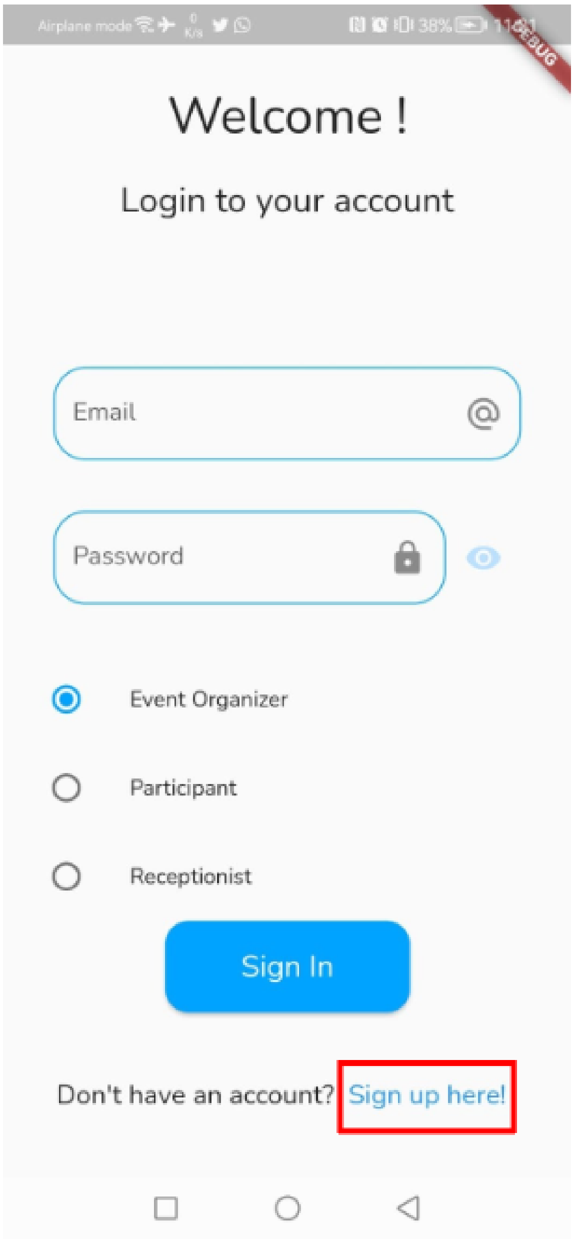


Figure 5.21 Sign Up Button

After being redirected to the register page, the user must fill all the required information such as username, password, and email. After filling the required information, the user chooses ‘Event Organizer’ as the role of the application. Finally, the user clicks ‘Sign up’ button to register.

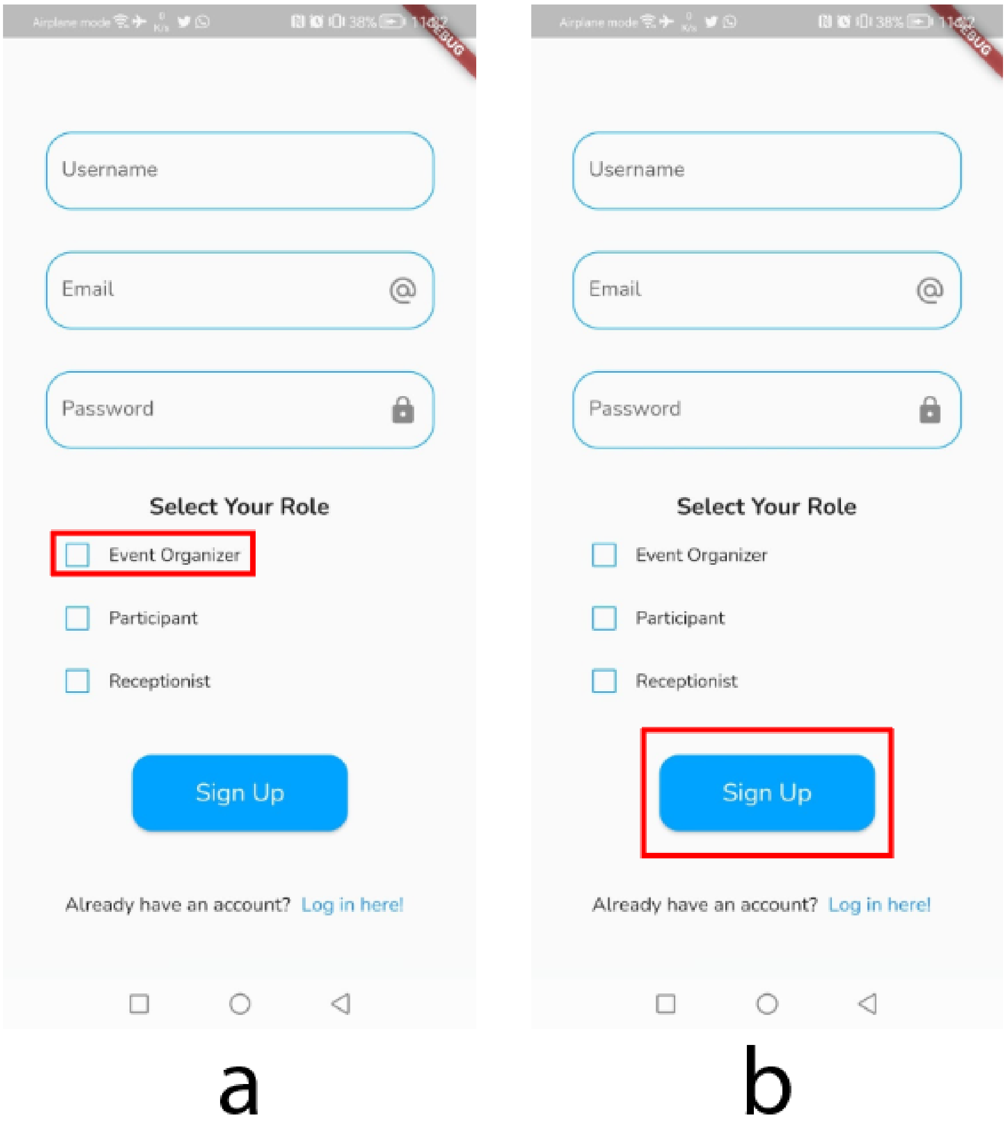


Figure 5.22 a) Event Organizer Checkbox, b) Sign Up Button

5.4 Login Implementation

After the user's account is being registered, the user can log in to enter the application. At the login page, the user fills their credentials such as email and password. Then, the user chooses 'Event Organizer' as the login role. Finally, the user clicks on 'Log In' button to enter the application.

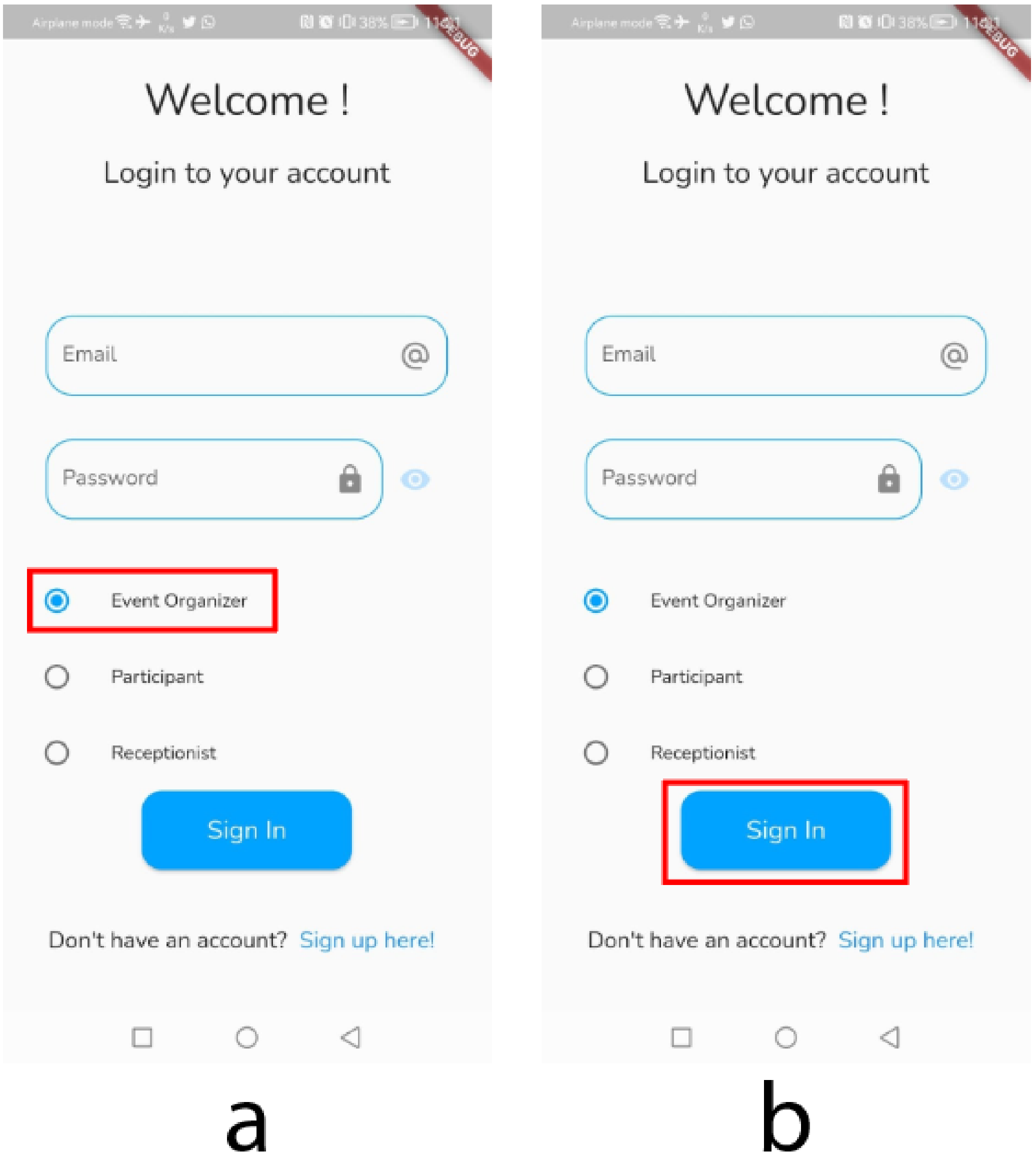
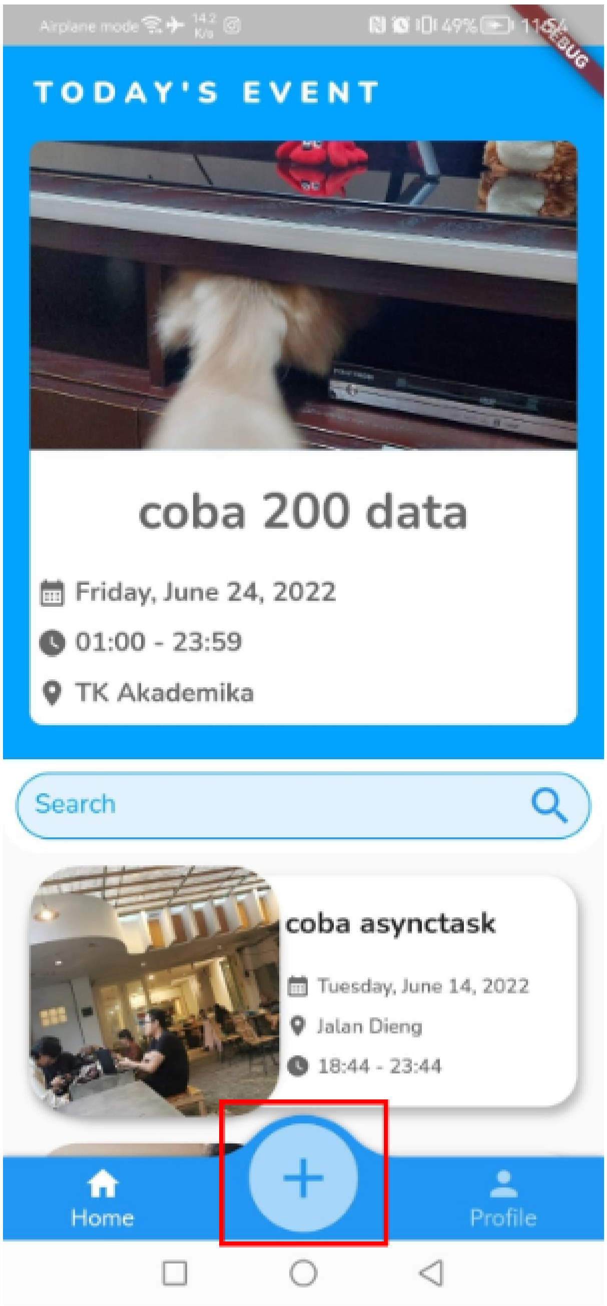


Figure 5.23 a) Event Organizer Radio Button, b) Sign In Button

5.5 Create Event Implementation

To create a new event, the user can click the '+' button in the bottom center of the 'Home' page to open the register page.



TODAY'S EVENT

coba 200 data

Friday, June 24, 2022

01:00 - 23:59

TK Akademika

coba asynctask

Tuesday, June 14, 2022

Jalan Dieng

18:44 - 23:44

Figure 5.24 Register Page Button

After being redirected to the event creation page, the user can choose the event media such as poster or banner by clicking the big square button. Next, the user can choose the desired photos and then the photo will be displayed at the register page. This step is optional so the user can choose to not to add the event media yet.

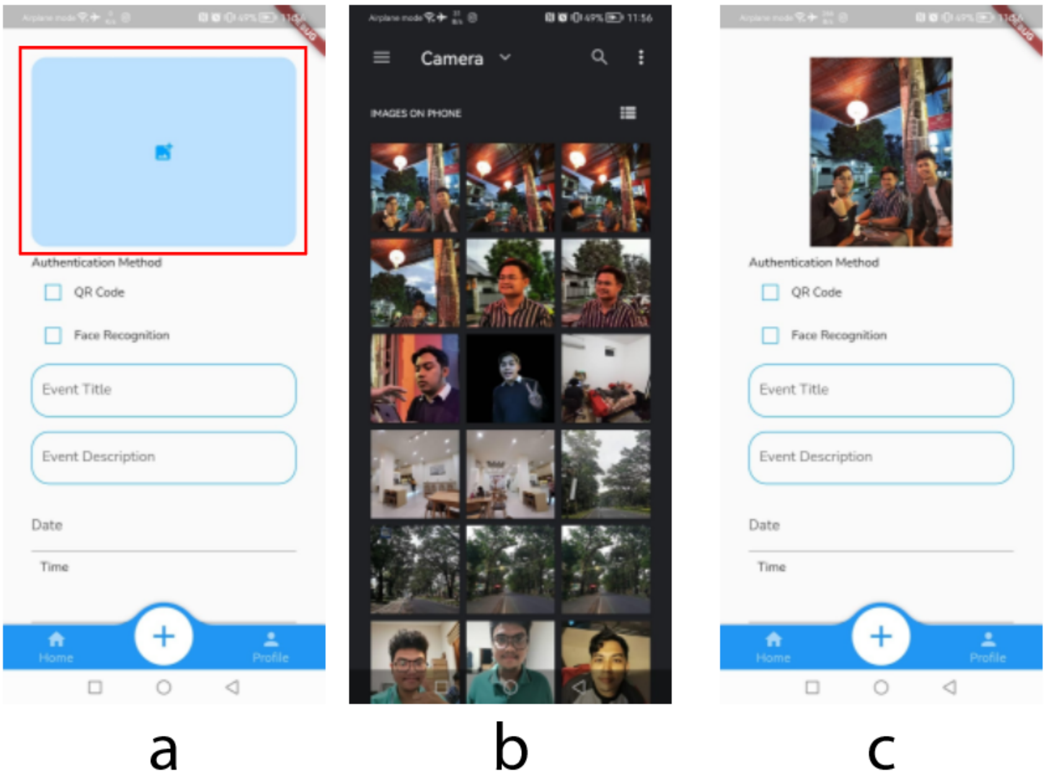
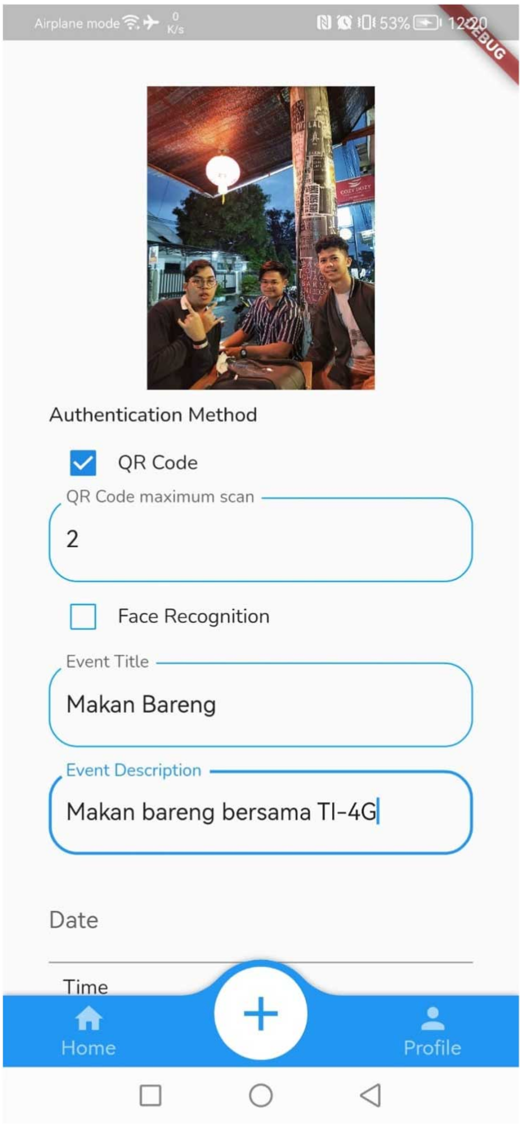


Figure 5.25 a) Add Image Button, b) Image Picker, c) Create Event Page

After adding the event media, the user can choose the QR code authentication method. The user can choose whether the QR code can be scanned repeatedly or not by filling the QR scan count. After that, the user can fill the event title and the description of the event.



Authentication Method

☑ QR Code

QR Code maximum scan: 2

□ Face Recognition

Event Title: Makan Bareng

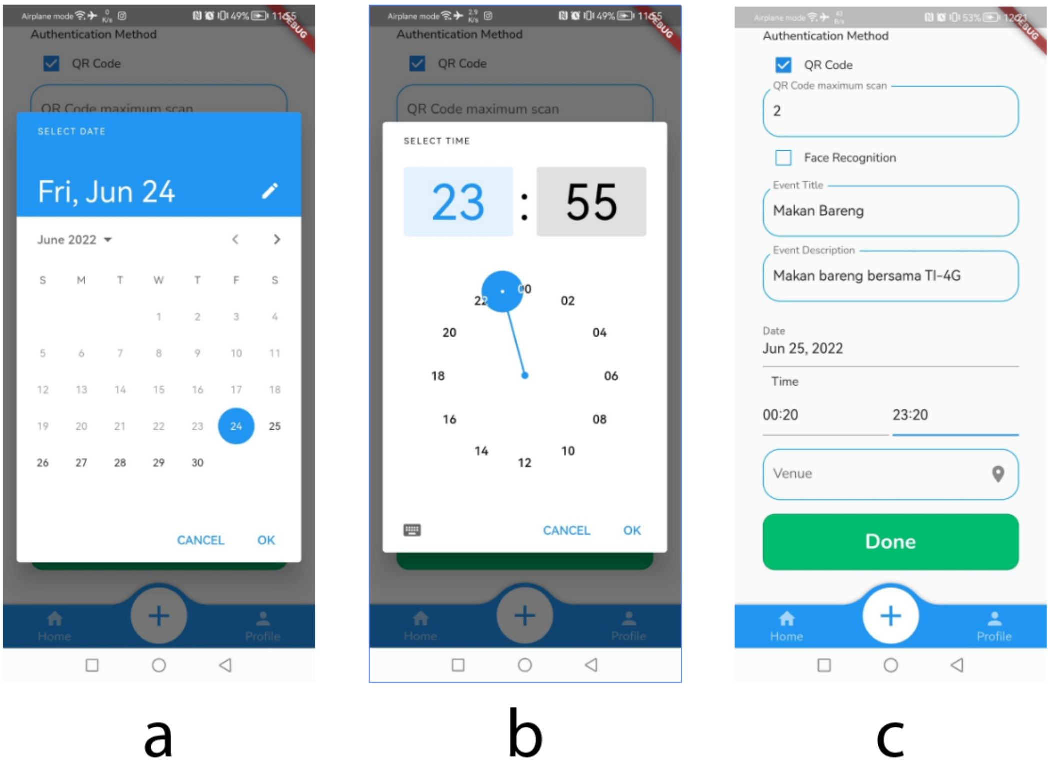
Event Description: Makan bareng bersama TI-4G

Date

Time

Figure 5.26 Filled Forms

After the title and description is added, the user can add the date, start time, and end time of the event. For adding the date, click the date field and then a calendar will pop up. The user clicks the desired date and then click ‘OK’ to confirm. To add the start and end time of the event, the user can click the ‘Start Time’ and ‘End Time’ to display the clock. To configure the time, the user can manually type the desired time in the clock UI or by rotating the clock.



SELECT DATE

Fri, Jun 24

June 2022

SELECT TIME

23 : 55

Authentication Method

☑ QR Code

QR Code maximum scan: 2

☐ Face Recognition

Event Title: Makan Bareng

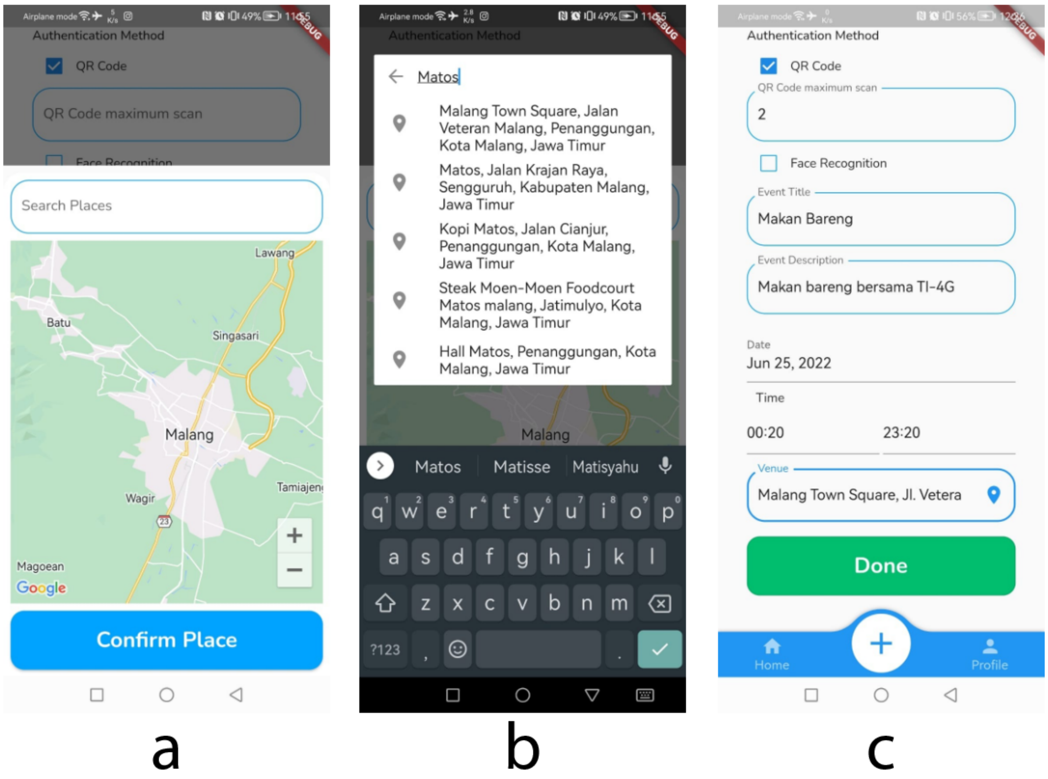
Event Description: Makan bareng bersama TI-4G

Date: Jun 25, 2022

Time: 00:20 23:20

Figure 5.27 a) Date Calendar, b) Time Clock, c) Filled Event Date and Time

The last step of creating an event is to add the location. To add the location, the user can click the venue form to open a map and search form. The user types the desired location or the nearest landmark of the event. Next, the user clicks the desired place. Finally, the user confirms the place by clicking the 'Confirm' button.



Malang Town Square, Jalan Veteran Malang, Penanggungan, Kota Malang, Jawa Timur

Matos, Jalan Krajan Raya, Sengguruh, Kabupaten Malang, Jawa Timur

Kopi Matos, Jalan Cianjur, Penanggungan, Kota Malang, Jawa Timur

Steak Moen-Moen Foodcourt Matos malang, Jatimulyo, Kota Malang, Jawa Timur

Hall Matos, Penanggungan, Kota Malang, Jawa Timur

Authentication Method

☑ QR Code

QR Code maximum scan: 2

☐ Face Recognition

Event Title: Makan Bareng

Event Description: Makan bareng bersama TI-4G

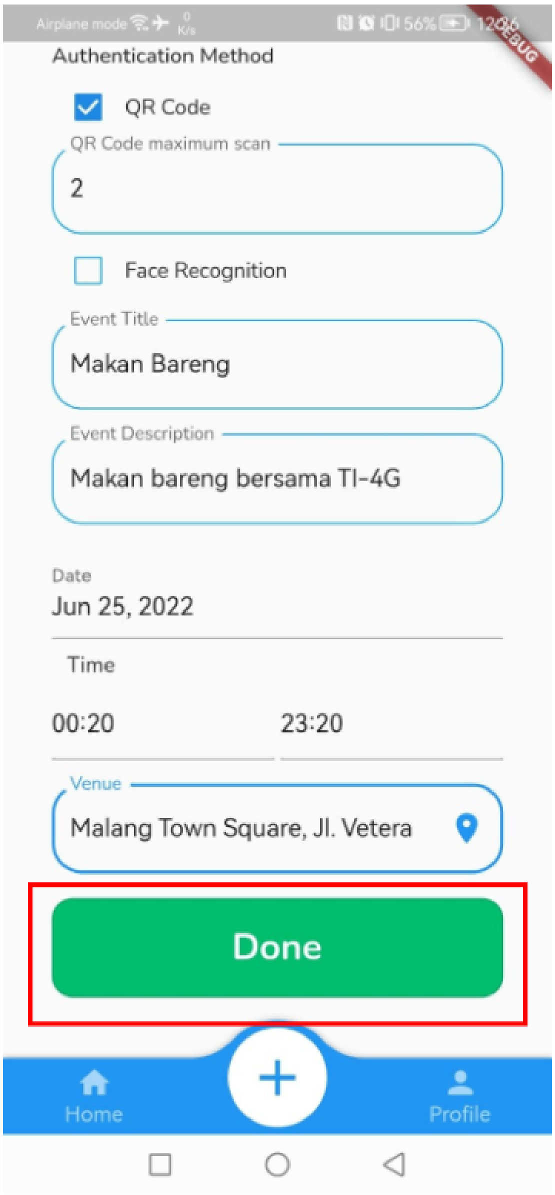
Date: Jun 25, 2022

Time: 00:20 23:20

Venue: Malang Town Square, Jl. Vetera

Figure 5.28 a) Event Place Map, b) Place Search, c) Filled Event Venue

After all of the information is filled, the user can click ‘Done’ button to add the event to the system.


Authentication Method

☑ QR Code

QR Code maximum scan: 2

□ Face Recognition

Event Title: Makan Bareng

Event Description: Makan bareng bersama TI-4G

Date: Jun 25, 2022

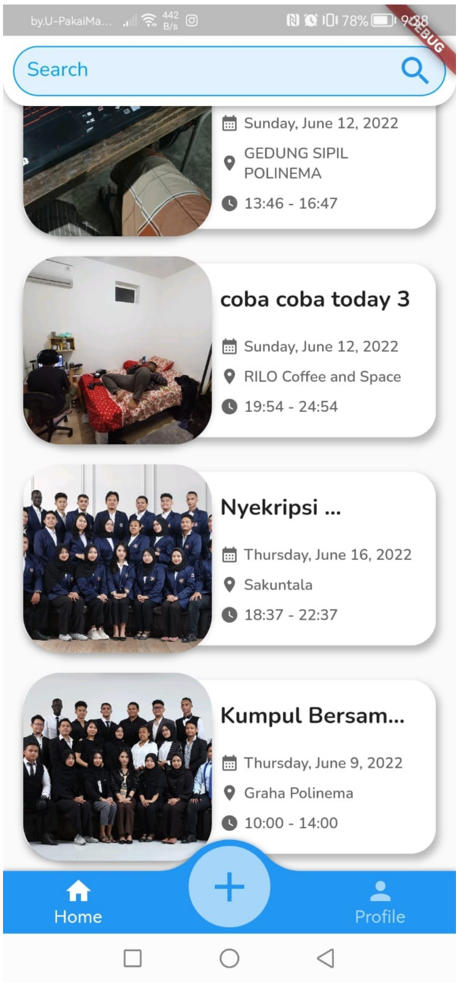
Time: 00:20 23:20

Venue: Malang Town Square, Jl. Vetera

Figure 5.29 Done Button

5.6 Email Delivery Implementation

The user can send the invitation through the email of the guests that the user already provided through the CSV file. In order to send the invitation mail, the user can choose the event that they want to deliver its invitation on the home page.



Sunday, June 12, 2022
GEDUNG SIPIL POLINEMA
13:46 - 16:47

coba coba today 3
Sunday, June 12, 2022
RILO Coffee and Space
19:54 - 24:54

Nyekripsi ...
Thursday, June 16, 2022
Sakuntala
18:37 - 22:37

Kumpul Bersam...
Thursday, June 9, 2022
Graha Polinema
10:00 - 14:00

Figure 5.30 Home Page

After choosing the desired event, the user will be redirected to the event detail page. In this page, the user can click the ‘Send Email Invitation’ button to send the invitation mail.

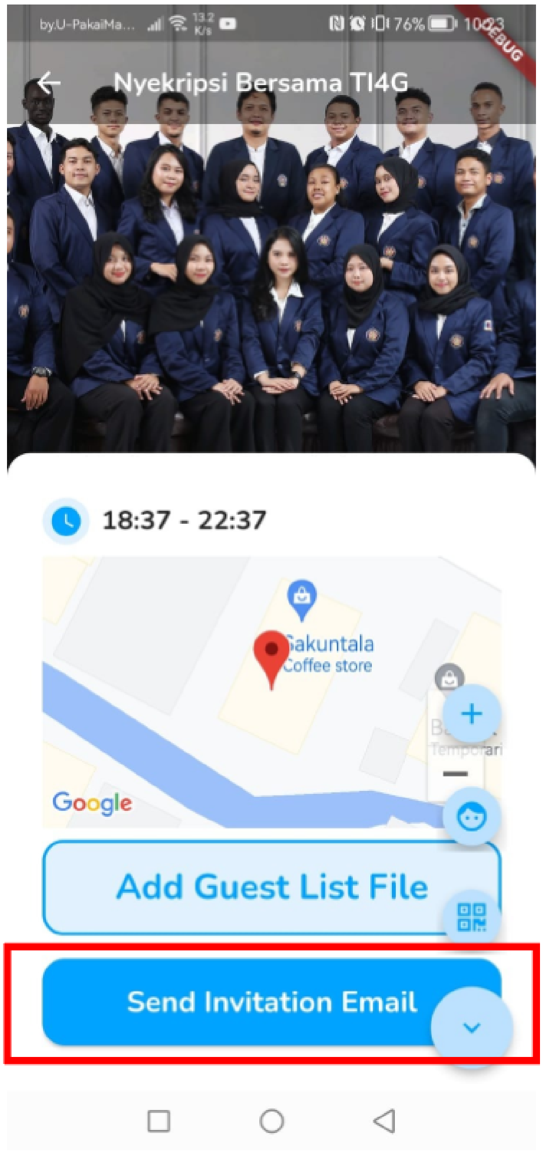
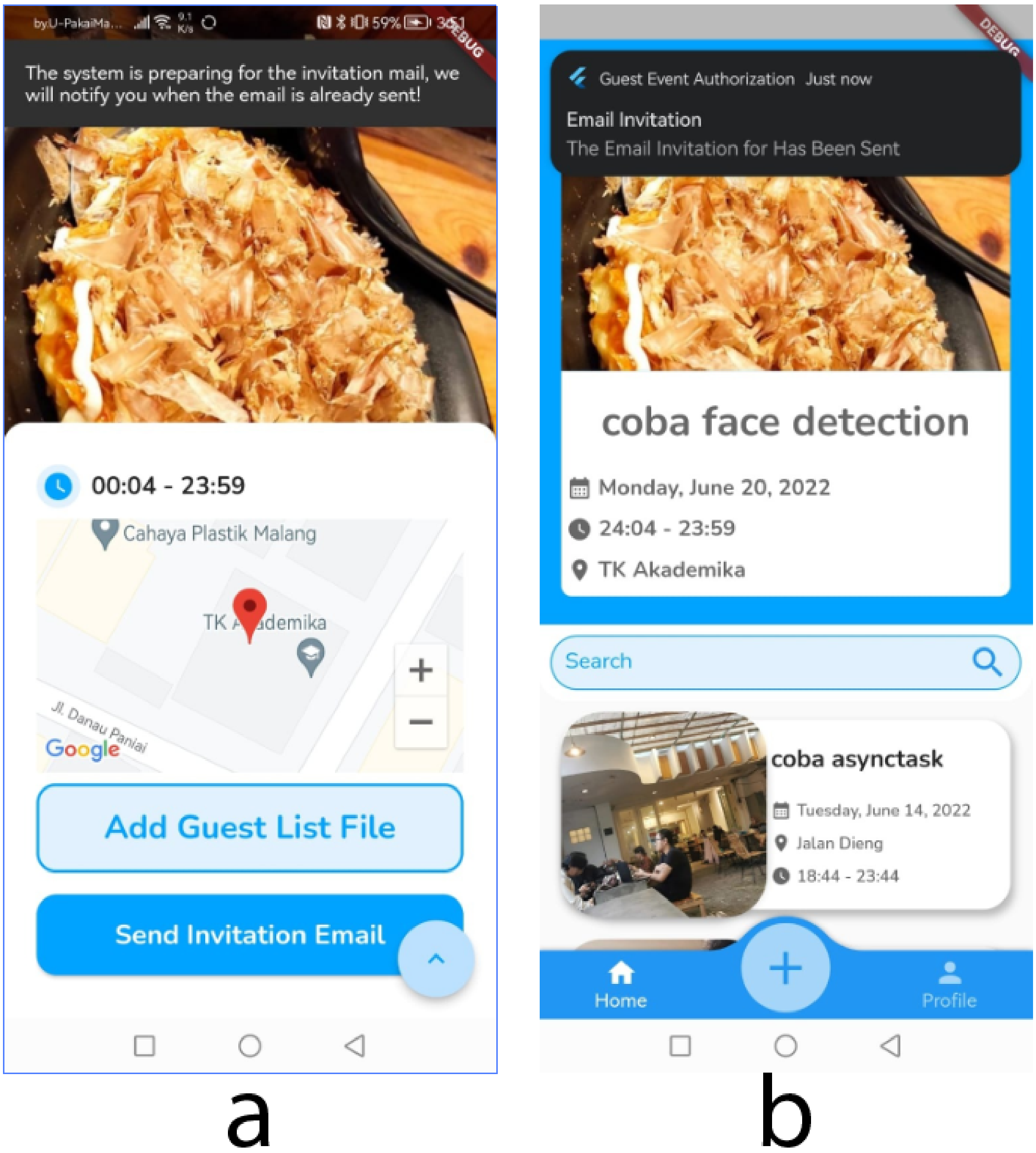


Figure 5.31 Send Invitation Mail Button

The process will be done in the background. This means the user can do any other tasks while waiting for the email to be sent. After the email is already sent, the user will be notified.



The system is preparing for the invitation mail, we will notify you when the email is already sent!

Guest Event Authorization Just now

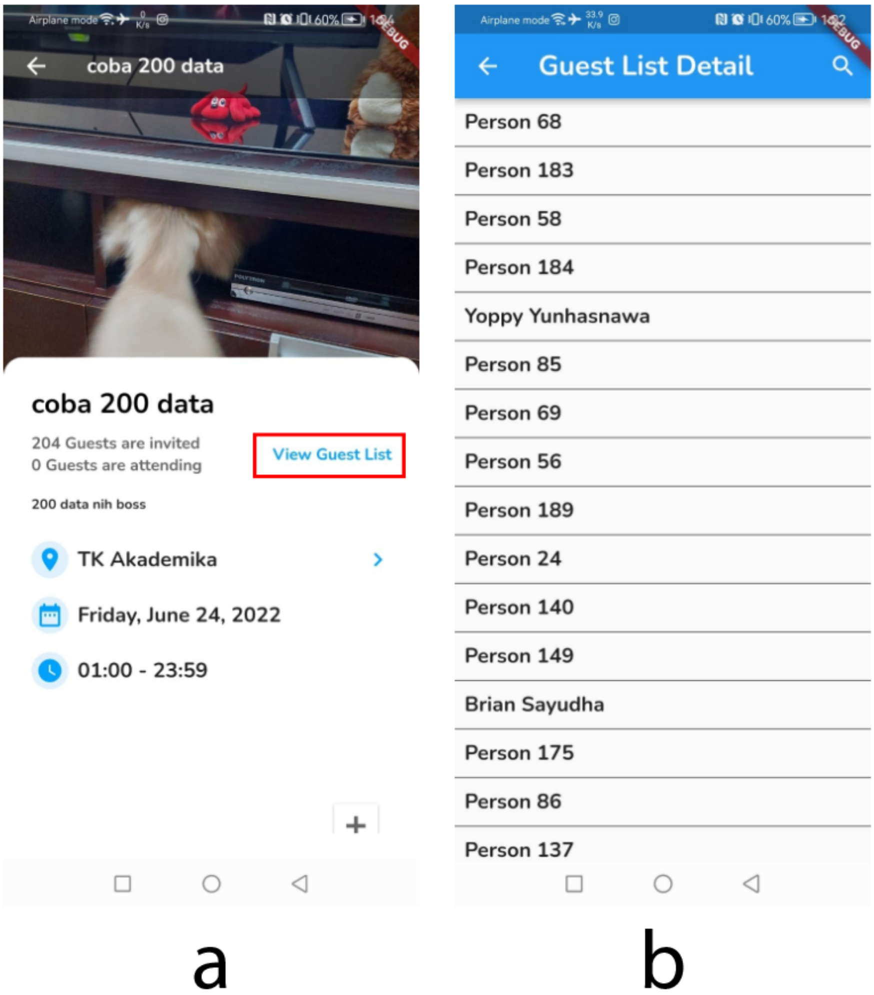
Email Invitation

The Email Invitation for Has Been Sent

Figure 5.32 a) Notification for Email Processing b) Notification for Finished Email Delivery

5.7 Guest Detail Implementation

To open the guest list and the detail of the guests, the user can click on the ‘View Guest List’ text in the event detail page.



coba 200 data

coba 200 data

204 Guests are invited
0 Guests are attending

View Guest List

200 data nih boss

TK Akademika

Friday, June 24, 2022

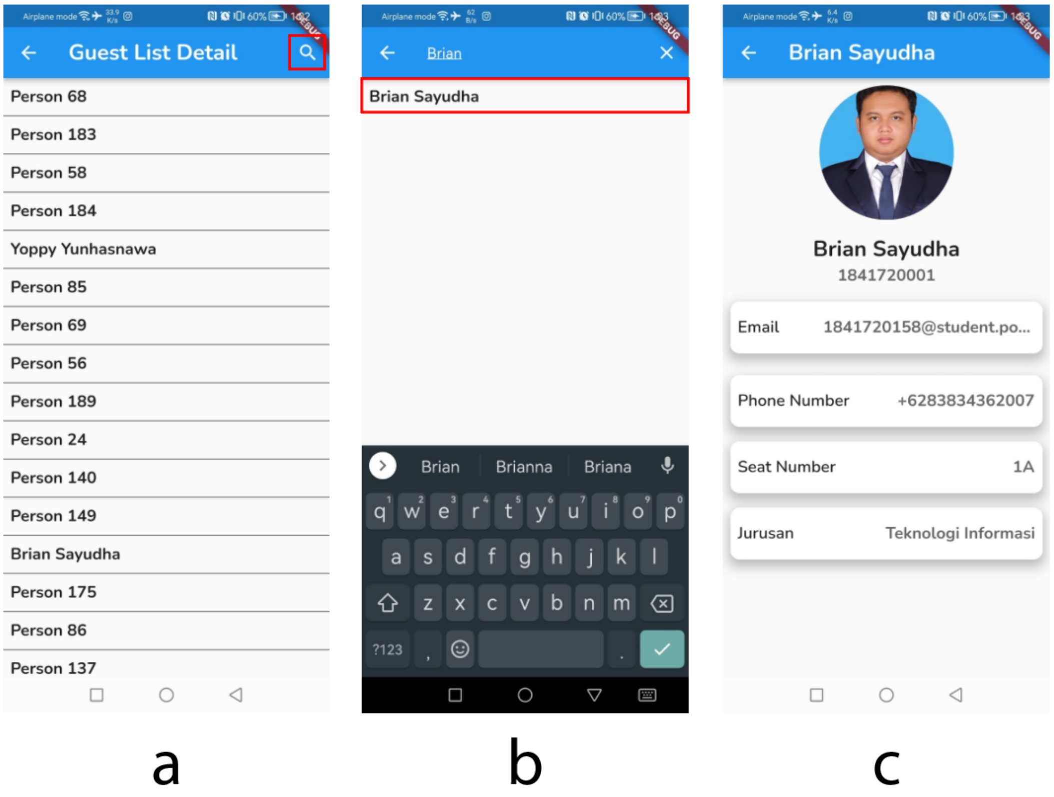
01:00 - 23:59

Guest List Detail

Person 68
Person 183
Person 58
Person 184
Yoppy Yunhasnawa
Person 85
Person 69
Person 56
Person 189
Person 24
Person 140
Person 149
Brian Sayudha
Person 175
Person 86
Person 137

Figure 5.33 a) View Guest List Button, b) Guest List Page

To search a particular guest, the user can click on the search icon on the top right of the page to open a field. After that, the user can type on the desired guest name. The potential searched guest will appear on the page.



a

Guest List Detail

Person 68
Person 183
Person 58
Person 184
Yoppy Yunhasnawa
Person 85
Person 69
Person 56
Person 189
Person 24
Person 140
Person 149
Brian Sayudha
Person 175
Person 86
Person 137

b

Brian

Brian Sayudha

c

Brian Sayudha

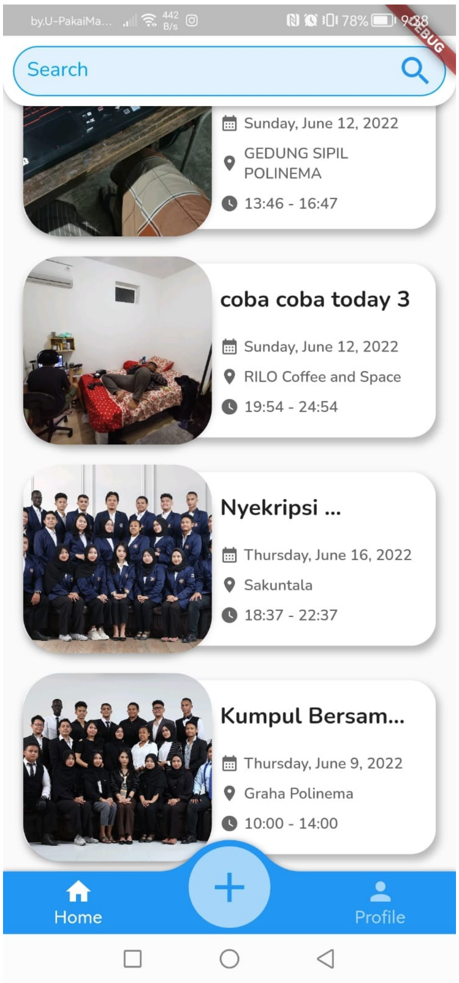
Brian Sayudha
1841720001

Email	1841720158@student.po...
Phone Number	+6283834362007
Seat Number	1A
Jurusan	Teknologi Informasi

Figure 5.34 a) Search Icon, b) Selected Guest, c) Guest Detail Page

5.8 QR Scan Implementation

The guests' QR must be scanned in order to mark the guests' attendance at the event. The attendance can only be marked if the guest is within 100 meters from the location of the event. The attendance also can only be marked while the event lasts. To scan the guests' QR code, the user can choose the event that they want to mark the attendance on the home page.



Sunday, June 12, 2022
GEDUNG SIPIL POLINEMA
13:46 - 16:47

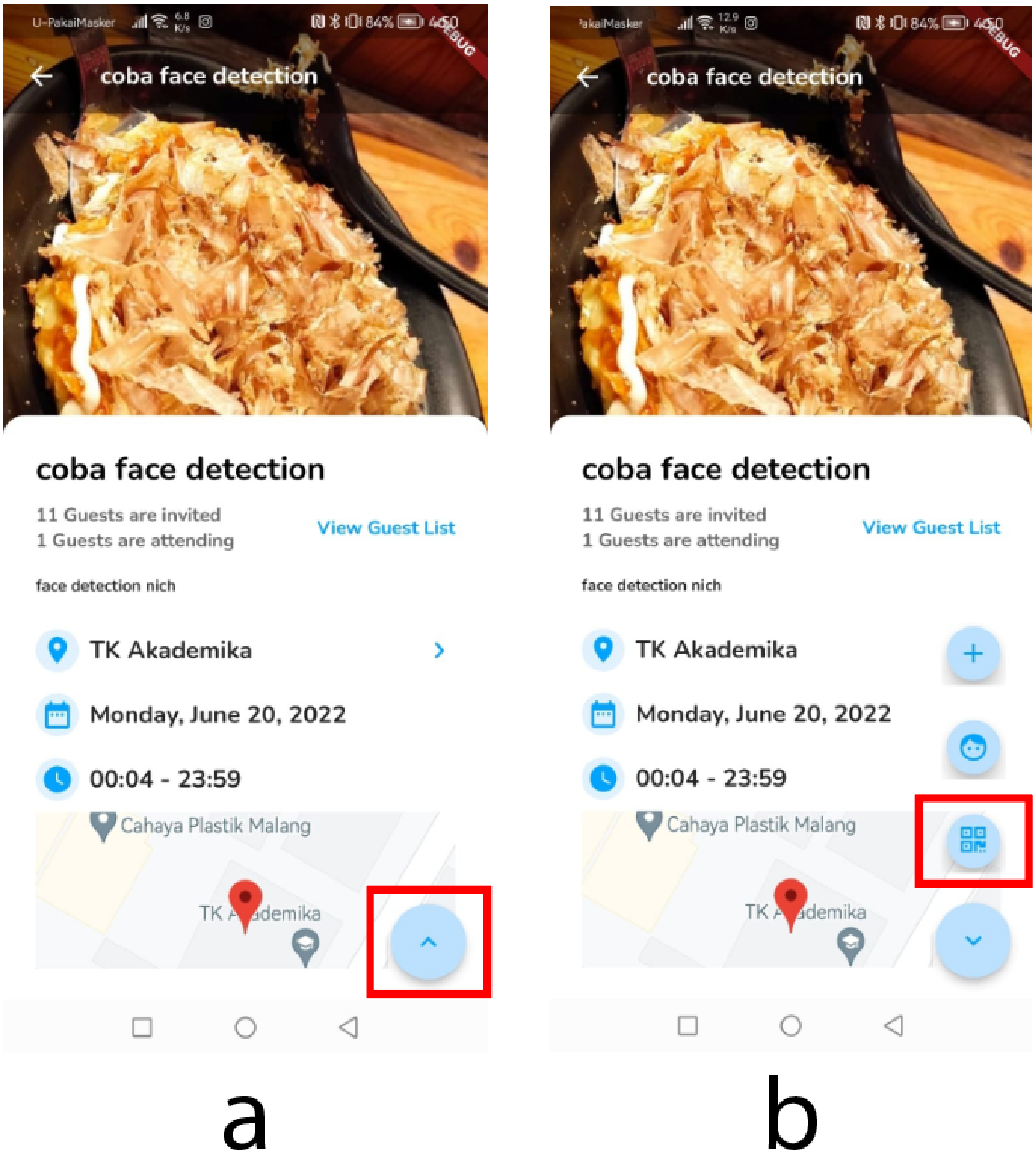
coba coba today 3
Sunday, June 12, 2022
RILO Coffee and Space
19:54 - 24:54

Nyekripsi ...
Thursday, June 16, 2022
Sakuntala
18:37 - 22:37

Kumpul Bersam...
Thursday, June 9, 2022
Graha Polinema
10:00 - 14:00

Figure 5.35 Home Page

After being redirected to the event detail page, the user can click the circle button on the bottom right corner of the screen to show the available attendance method. Click the QR code icon to choose QR scan as the attendance marking method.



coba face detection

11 Guests are invited
1 Guests are attending

View Guest List

face detection nich

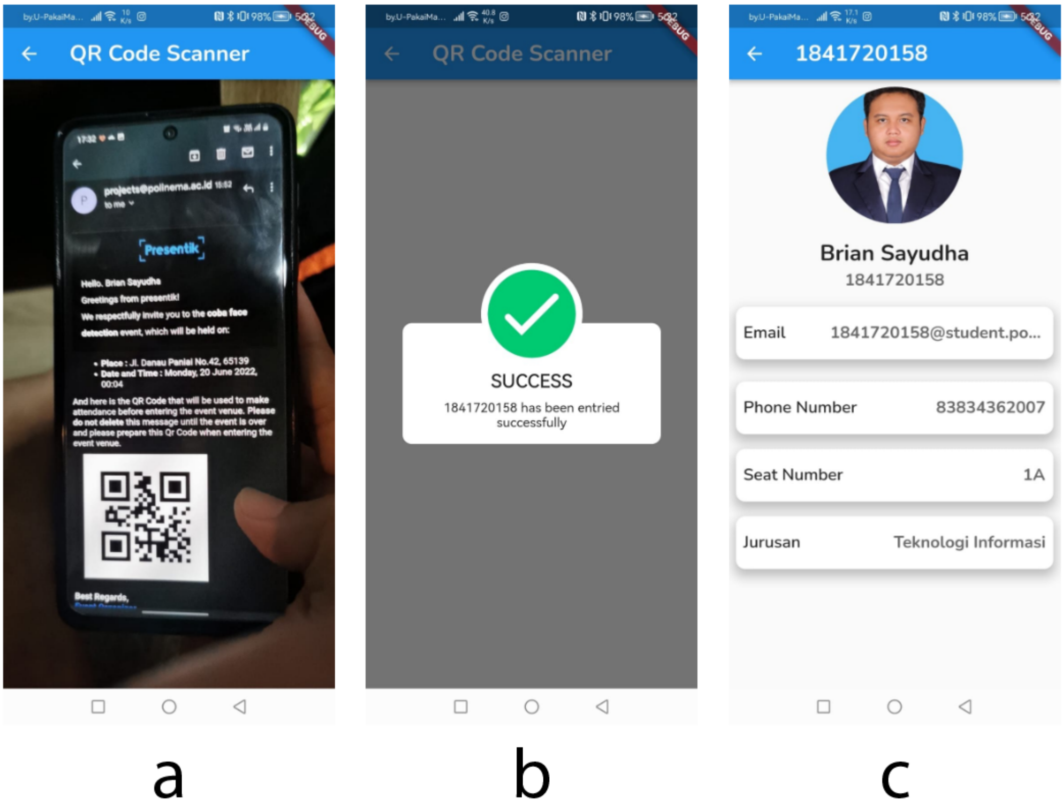
TK Akademika

Monday, June 20, 2022

00:04 - 23:59

Figure 5.36 a) Button to Show Available Attendance Method, b) QR Code Attendance Method Button

After pressing the QR code button, the user will be redirected to a camera page. In this page, the user directs the camera to the guest's QR code to scan them. If the QR code is valid, the guest's attendance will be automatically marked. Otherwise, the user will be prompted if the QR code is invalid. After the guest's attendance is already marked, the user will be redirected to the detail page of the marked guest.



projects@polinema.ac.id 15:52
to me

Hello. Brian Sayudha
Greetings from presentik!
We respectfully invite you to the **coba face detection** event, which will be held on:

- **Place :** Jl. Danau Paniai No.42, 65139
- **Date and Time :** Monday, 20 June 2022, 00:04

And here is the QR Code that will be used to make attendance before entering the event venue. Please **do not delete** this message until the event is over and please prepare this Qr Code when entering the event venue.

Best Regards,

SUCCESS

1841720158 has been entried successfully

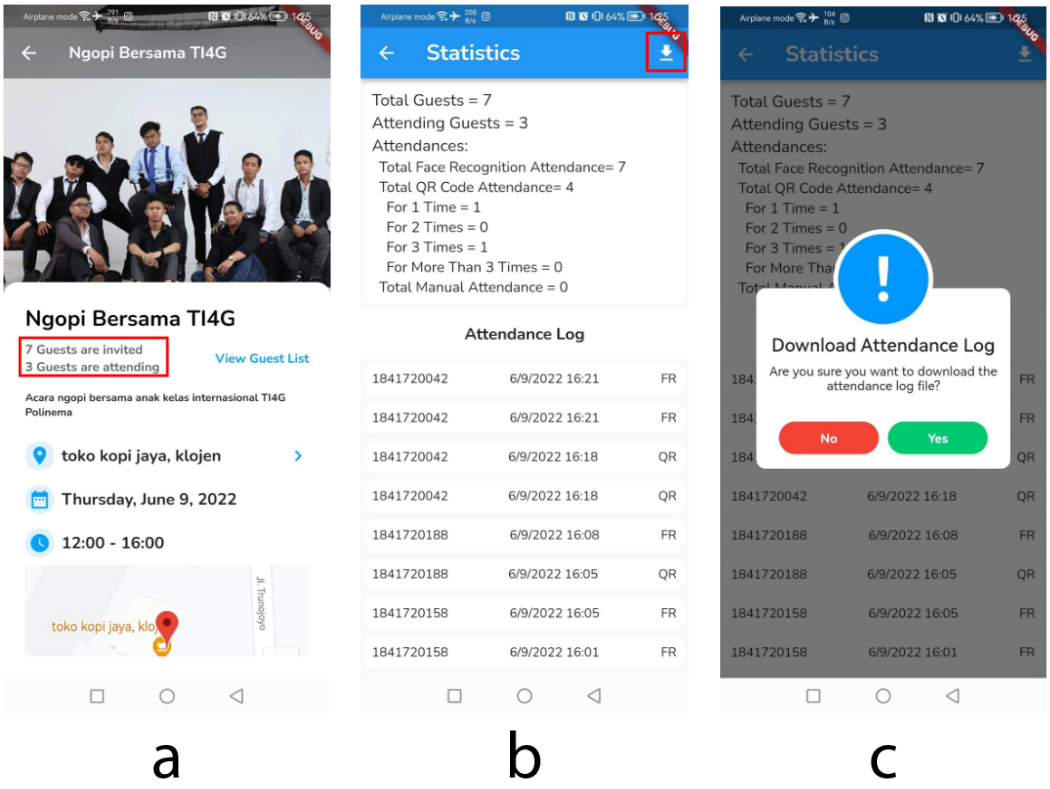
Brian Sayudha
1841720158

Email	1841720158@student.po...
Phone Number	83834362007
Seat Number	1A
Jurusan	Teknologi Informasi

Figure 5.37 a) QR Code Scanning, b) Result of Valid QR Code, c) Guest Detail Page.

5.9 Attendance Log Implementation

User can take a look at the attendance log by clicking the statistics button in the event detail page. To download the attendance log, the user can click the download icon on the right corner of the page, and then click 'Yes' on the confirm dialog.



Ngopi Bersama TI4G

7 Guests are invited
3 Guests are attending

View Guest List

Acara ngopi bersama anak kelas internasional TI4G Polinema

toko kopi jaya, klojen

Thursday, June 9, 2022

12:00 - 16:00

Statistics

Total Guests = 7
Attending Guests = 3
Attendances:
Total Face Recognition Attendance= 7
Total QR Code Attendance= 4
For 1 Time = 1
For 2 Times = 0
For 3 Times = 1
For More Than 3 Times = 0
Total Manual Attendance = 0

Attendance Log

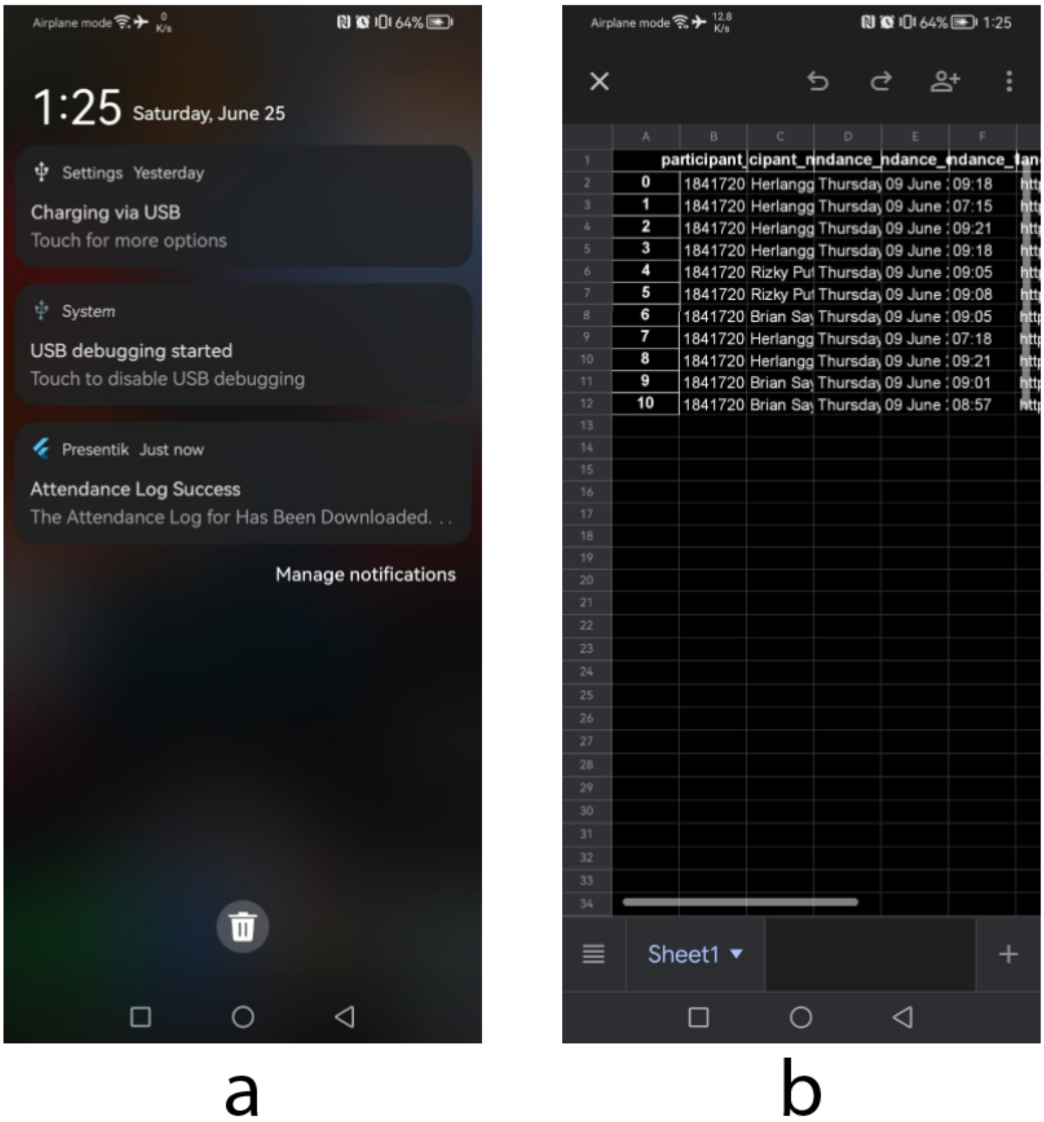
1841720042	6/9/2022 16:21	FR
1841720042	6/9/2022 16:21	FR
1841720042	6/9/2022 16:18	QR
1841720042	6/9/2022 16:18	QR
1841720188	6/9/2022 16:08	FR
1841720188	6/9/2022 16:05	QR
1841720158	6/9/2022 16:05	FR
1841720158	6/9/2022 16:01	FR

Download Attendance Log

Are you sure you want to download the attendance log file?

Figure 5.38 a) Statistics Button, b) Attendance Log Page and Download Button, c) Download Confirm Dialog

After confirming to download the log file, the user waits for the log file to be generated and then downloaded. After the download is complete, the user will be notified and then they can click the notification to open the file.



Settings Yesterday
Charging via USB
Touch for more options

System
USB debugging started
Touch to disable USB debugging

Presentik Just now
Attendance Log Success
The Attendance Log for Has Been Downloaded. . .

	A	B	C	D	E	F	
1		participant_	cipant_n	ndance_	ndance_	ndance_t	an
2	0	1841720	Herlangg	Thursday	09 June :	09:18	htt
3	1	1841720	Herlangg	Thursday	09 June :	07:15	htt
4	2	1841720	Herlangg	Thursday	09 June :	09:21	htt
5	3	1841720	Herlangg	Thursday	09 June :	09:18	htt
6	4	1841720	Rizky Put	Thursday	09 June :	09:05	htt
7	5	1841720	Rizky Put	Thursday	09 June :	09:08	htt
8	6	1841720	Brian Say	Thursday	09 June :	09:05	http
9	7	1841720	Herlangg	Thursday	09 June :	07:18	http
10	8	1841720	Herlangg	Thursday	09 June :	09:21	http
11	9	1841720	Brian Say	Thursday	09 June :	09:01	http
12	10	1841720	Brian Say	Thursday	09 June :	08:57	http

Figure 5.39 a) Attendance Log Notification, b) Attendance Log Excel

5.10 QR Code Testing

QR code testing is done to measure the QR code scanner, especially mobile_scanner package, capabilities under various angle and light condition. The scenarios of this testing are:

1. Finding the optimal brightness to scan the QR code from 2 medias, phone screen and paper, which each media have 9 different angles.
2. Finding the maximum distance of scanning. The QR code will be displayed from a smartphone and printed to a paper. There will be 4 different distance levels.

5.11.1 First Scenario Test

The test is initialized by finding the best angle of attack to scan the QR code with various phone brightness levels and lighting. There are 2 medias that the QR code will is displayed, each media has 4 different brightness levels and 9 scan angles. The device that is being used to scan the QR code is Huawei P30 Pro with 40 MP, f/1.6 main camera. The phone being used to display the QR code is Apple iPhone X with Super Retina OLED, 625 nits peak brightness. For the paper media, the QR code is printed by printing the email invitation to an A4 size paper.

The following are the results of the experiment carried out in the application.

1. Phone – Brightness 25%, Natural Light

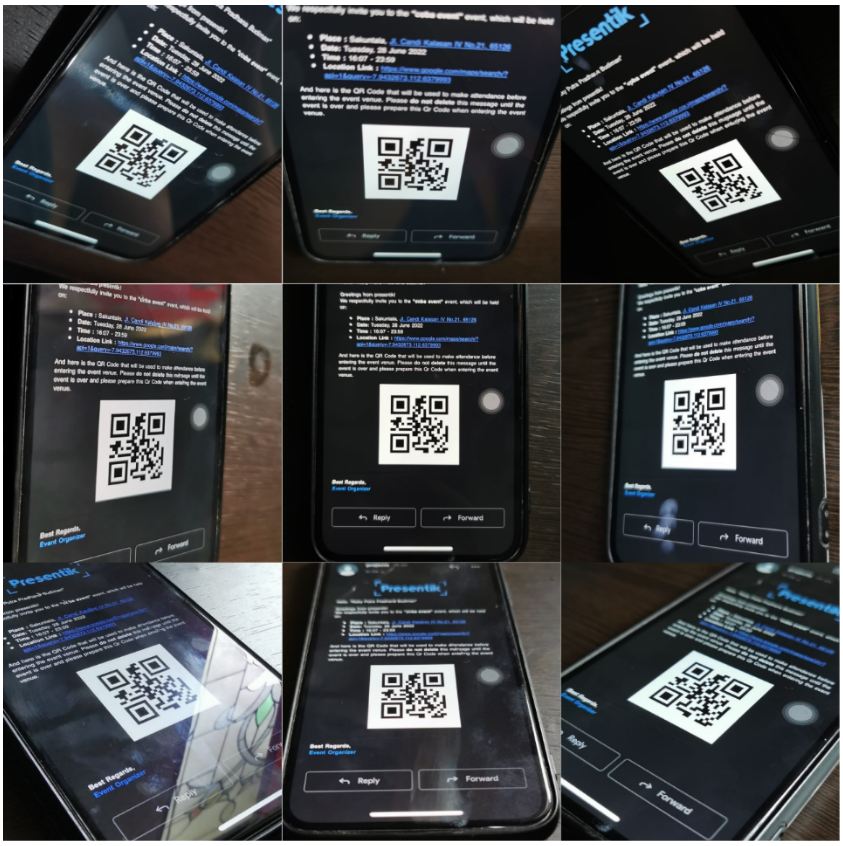


Figure 5.40 Different Angles of Scanning the QR Code with Phone Brightness Turned to 25%

Table 5.1 Angle Test Smartphone with 25% Brightness Test Result

Angle	Success
Top Left Corner	✔
Top Middle	✔
Top Right Corner	✔
Left Side 45 degree	✔
Straight Middle	✔
Right Side 45 degree	✔
Bottom Left Corner	✔
Bottom Middle	▯
Bottom Right Corner	✔
Total	8/9

2. Phone – Brightness 50%, Natural Light

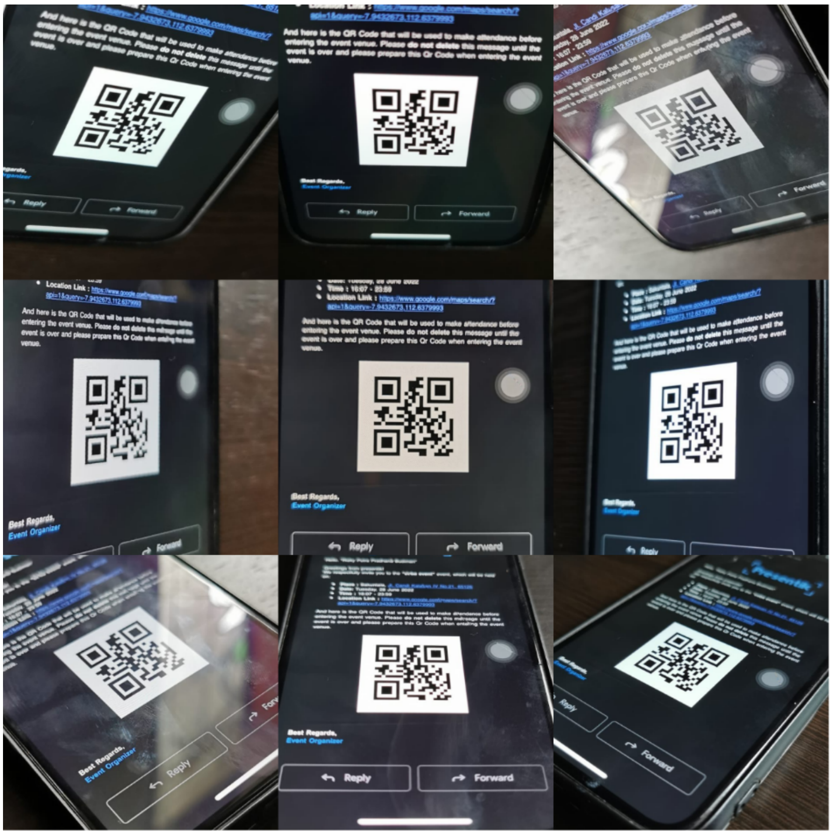


Figure 5.41 Different Angles of Scanning the QR Code with Phone Brightness Turned to 50%

Table 5.2 Angle Test Smartphone with 50% Brightness Test Result

Angle	Success
Top Left Corner	✔
Top Middle	✔
Top Right Corner	✔
Left Side 45 degree	✔
Straight Middle	✔
Right Side 45 degree	✔
Bottom Left Corner	✔
Bottom Middle	▯

Bottom Right Corner	✔
Total	8/9

3. Phone – Brightness 75%, Natural Light

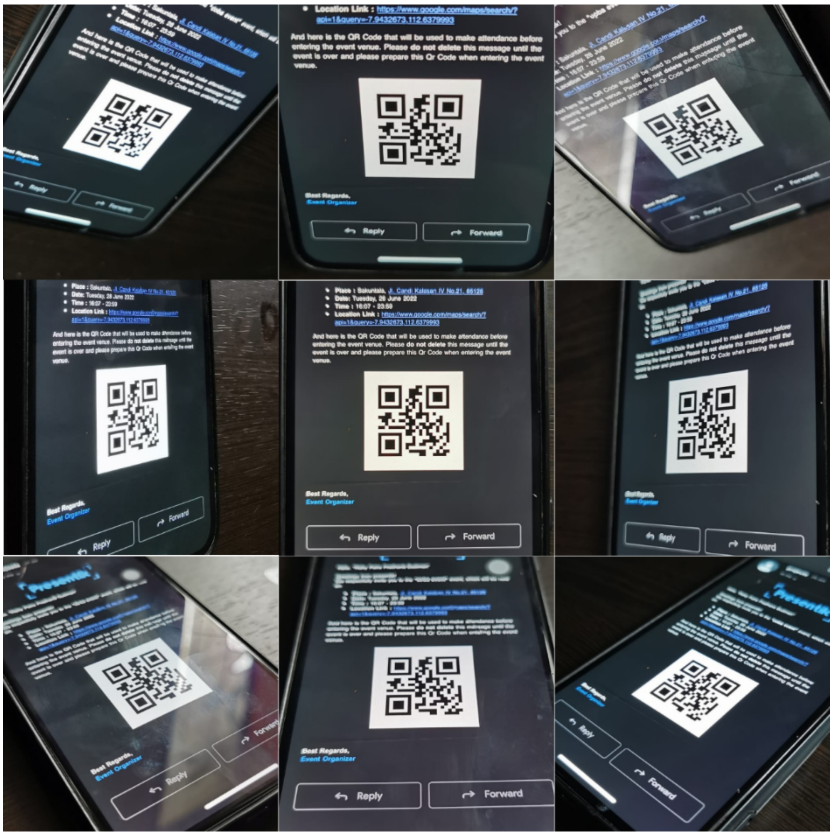


Figure 5.42 Different Angles of Scanning the QR Code with Phone Brightness Turned to 75%

Table 5.3 Angle Test Smartphone with 75% Brightness Test Result

Angle	Success
Top Left Corner	✔
Top Middle	✔
Top Right Corner	✔
Left Side 45 degree	□
Straight Middle	✔
Right Side 45 degree	✔
Bottom Left Corner	□
Bottom Middle	□
Bottom Right Corner	✔
Total	6/9

4. Phone – Brightness 100%, Natural Light

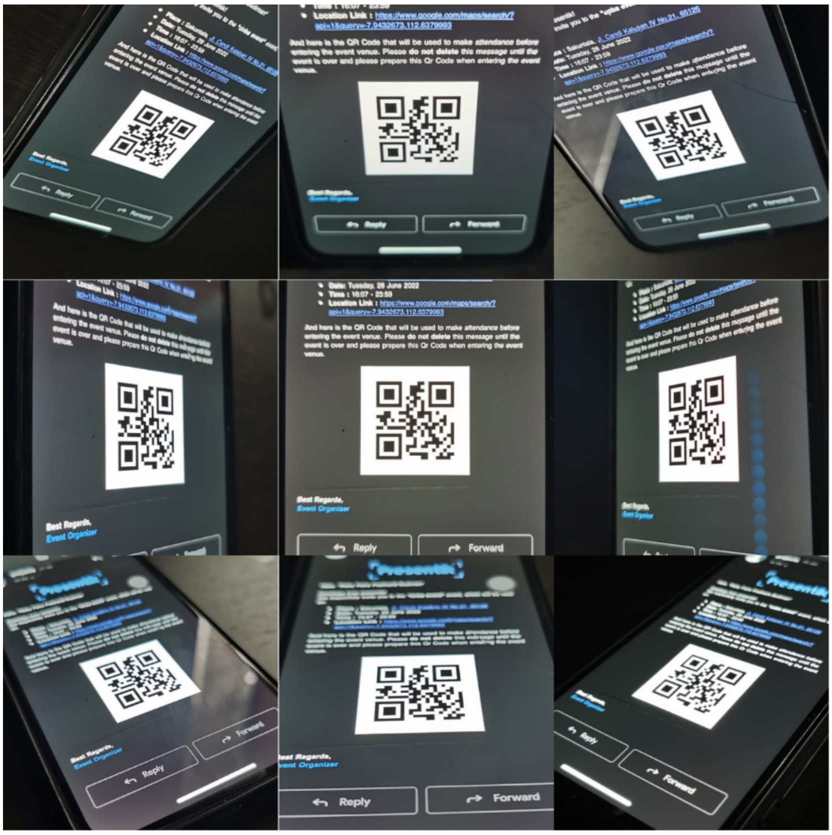

And here is the QR Code that will be used to make attendance before entering the event venue. Please do not delete this message until the event is over and please prepare this Qr Code when entering the event venue.
Best Regards,
Event Organizer
Reply
Forward

Figure 5.43 Different Angles of Scanning the QR Code with Phone Brightness Turned to 100%

Table 5.4 Angle Test Smartphone with 100% Brightness Test Result

Angle	Success
Top Left Corner	□
Top Middle	✔
Top Right Corner	✔
Left Side 45 degree	□
Straight Middle	✔
Right Side 45 degree	✔
Bottom Left Corner	□
Bottom Middle	□

Bottom Right Corner	✔
Total	5/9

5. Paper, Warm Ambient Light 25%

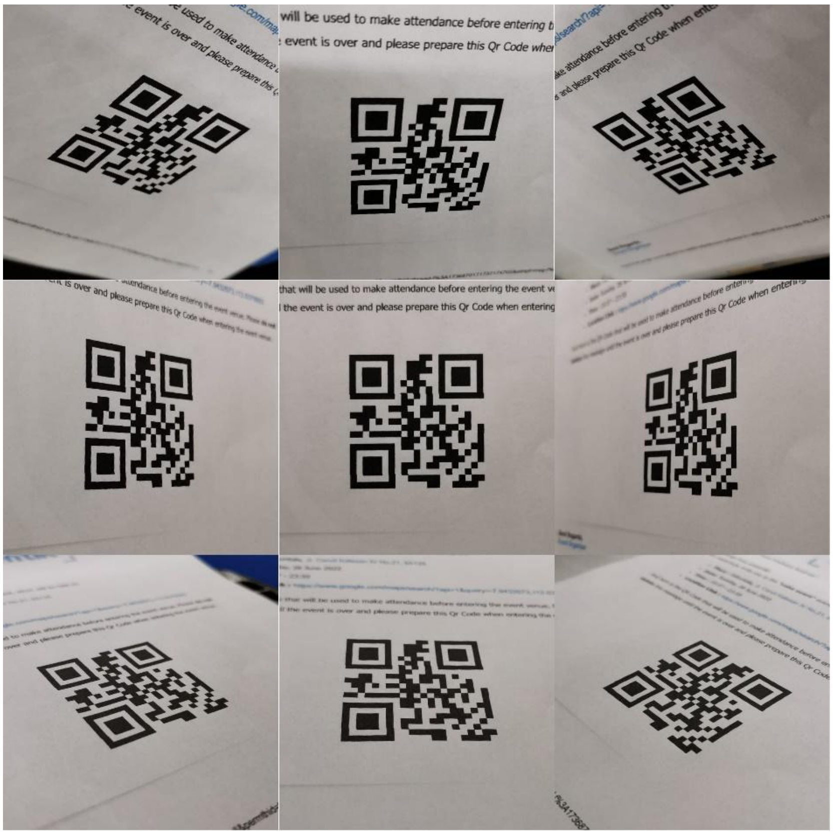


Figure 5.44 Different Angles of Scanning the Printed QR Code with Warm Ambient Light Turned to 25%

Table 5.5 Angle Test Paper Printed with 25% Ambient Light Brightness Test Result

Angle	**Success**
Top Left Corner	✔
Top Middle	✔
Top Right Corner	✔
Left Side 45 degree	▯
Straight Middle	✔
Right Side 45 degree	✔

Bottom Left Corner	✔
Bottom Middle	▯
Bottom Right Corner	✔
Total	7/9

6. Paper, Warm Ambient Light 50%

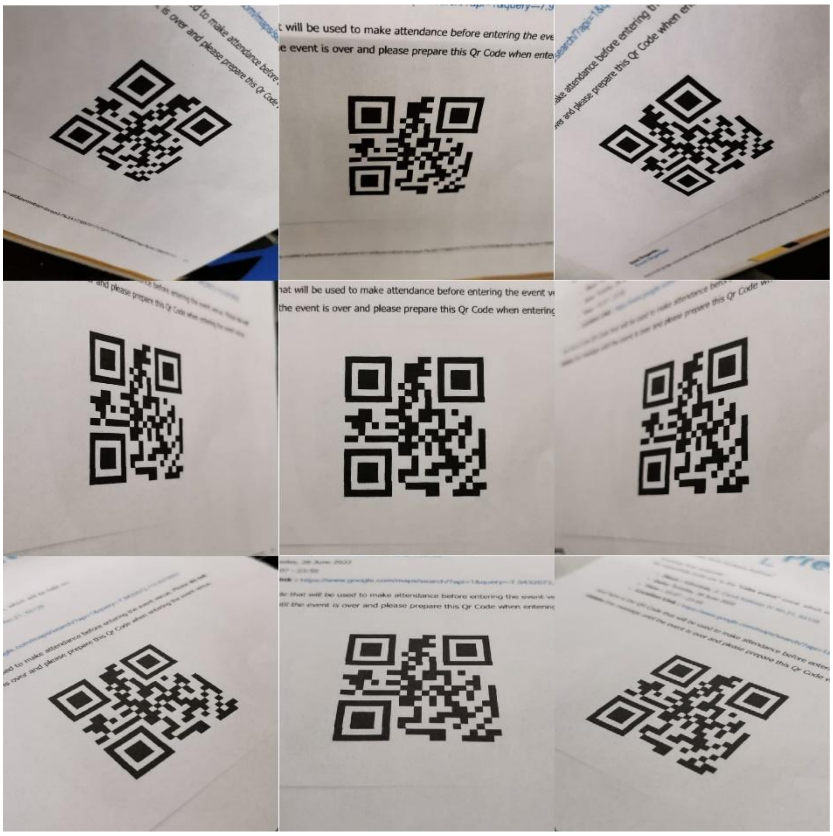


Figure 5.45 Different Angles of Scanning the Printed QR Code with Warm Ambient Light Turned to 50%

Table 5.6 Angle Test Paper Printed with 50% Ambient Light Brightness Test Result

Angle	Success
Top Left Corner	✔
Top Middle	✔
Top Right Corner	✔
Left Side 45 degree	▯
Straight Middle	✔

Right Side 45 degree	✔
Bottom Left Corner	✔
Bottom Middle	□
Bottom Right Corner	✔
Total	7/9

7. Paper, Warm Ambient Light 75%

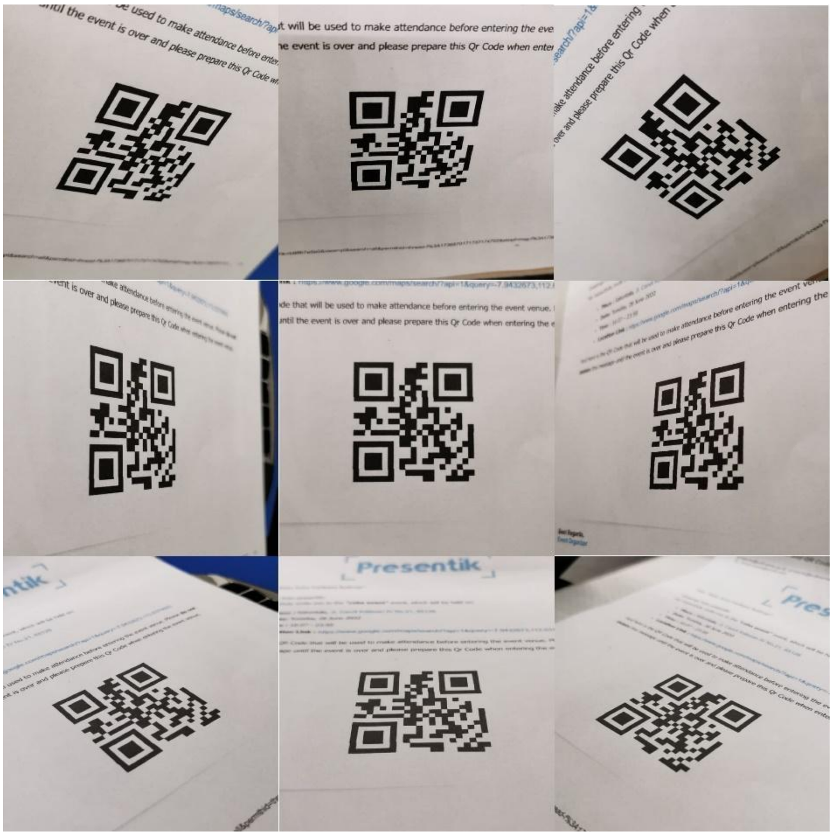


Figure 5.46 Different Angles of Scanning the Printed QR Code with Warm Ambient Light Turned to 75%

Table 5.7 Angle Test Paper Printed with 75% Ambient Light Brightness Test Result

Angle	**Success**
Top Left Corner	✔
Top Middle	✔
Top Right Corner	✔
Left Side 45 degree	□

Straight Middle	✔
Right Side 45 degree	✔
Bottom Left Corner	✔
Bottom Middle	□
Bottom Right Corner	✔
Total	7/9

8. Paper, Ambient Light 100%

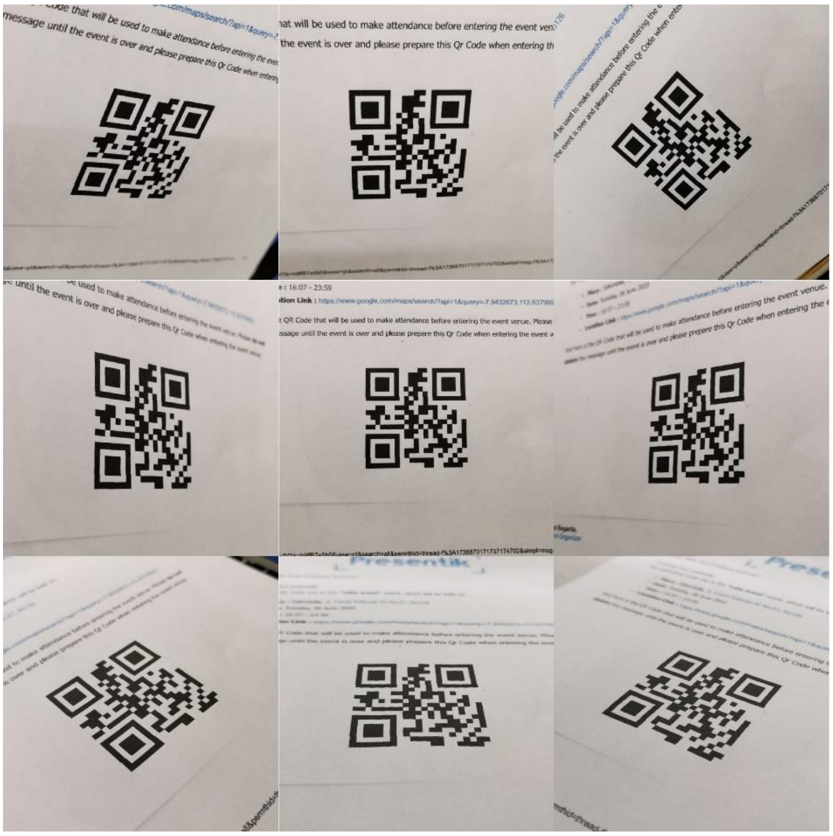


Figure 5.47 Different Angles of Scanning the Printed QR Code with Warm Ambient Light Turned to 100%

Table 5.8 Angle Test Paper Printed with 100% Ambient Light Brightness Test Result

Angle	Success
Top Left Corner	✔
Top Middle	✔
Top Right Corner	✔

Left Side 45 degree	□
Straight Middle	✔
Right Side 45 degree	✔
Bottom Left Corner	✔
Bottom Middle	□
Bottom Right Corner	✔
Total	7/9

Thus, it can be concluded that the phone's brightness can affect the accuracy of the QR code scanner. Otherwise, the ambient light brightness doesn't affect much for the paper printed QR code. Although the paper printed QR code failed on 2 angles, but the accuracy remains stagnant even there is ambient light changes. Finally, the optimal phone screen brightness is between 25-50%, but the results may vary since different phones have different display specifications.

5.11.2 Second Scenario Test

The objective of the second scenario is to find the maximum distance of scanning the QR code from 2 different medias: displayed on a smartphone screen and paper printed QR code. Each media has 4 levels of brightness and 4 levels of distance with interval of 10cm. The device that is being used to scan the QR code is Huawei P30 Pro with 40 MP, f/1.6 main camera. The phone being used to display the QR code is Apple iPhone X with Super Retina OLED, 625 nits peak brightness. For the paper media, the QR code is printed by printing the email invitation to an A4 size paper.

The result of the experiment carried out in the application is as follows.

1. Phone – Brightness 25%, Natural Light, Distance 10-40cm

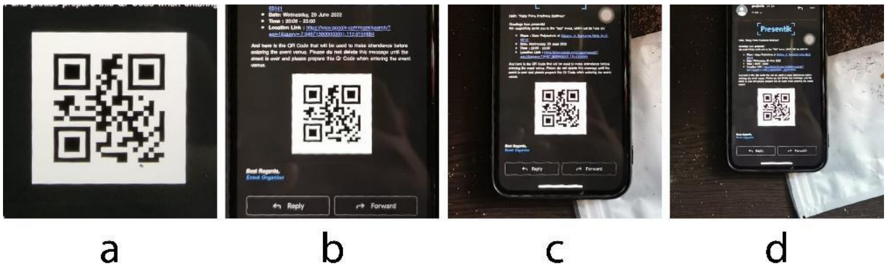


Figure 5.48 Different Distances from 25% Phone Brightness, a) 10cm, b) 20cm, c) 30cm, d) 40cm

Table 5.9 Distance Test Smartphone with 25% Brightness

Distance	Success
10cm	✔
20cm	✔
30cm	✔
40cm	▯
Total	3/4

2. Phone – Brightness 50%, Natural Light, Distance 10-40cm

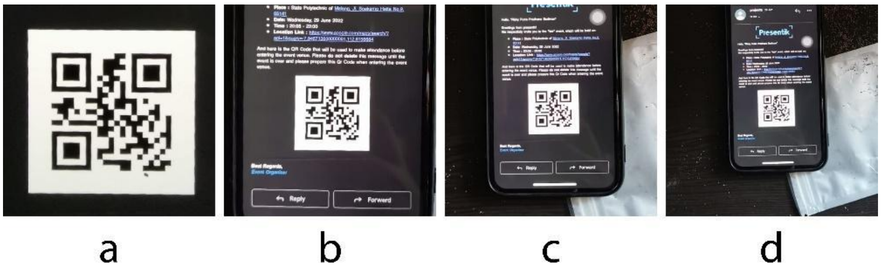


Figure 5.49 Different Distances from 50% Phone Brightness, a) 10cm, b) 20cm, c) 30cm, d) 40cm

Table 5.10 Distance Test Smartphone with 50% Brightness

Distance	Success
10cm	✔
20cm	✔
30cm	✔
40cm	▯
Total	3/4

3. Phone – Brightness 75%, Natural Light, Distance 10-40cm

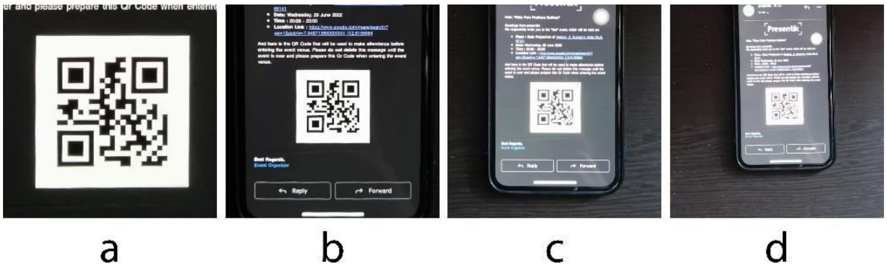


Figure 5.50 Different Distances from 75% Phone Brightness, a) 10cm, b) 20cm, c) 30cm, d) 40cm

Table 5.11 Distance Test Smartphone with 75% Brightness

Distance	Success
10cm	✔
20cm	✔
30cm	✔
40cm	▯
Total	3/4

4. Phone – Brightness 100%, Natural Light, Distance 10-40cm

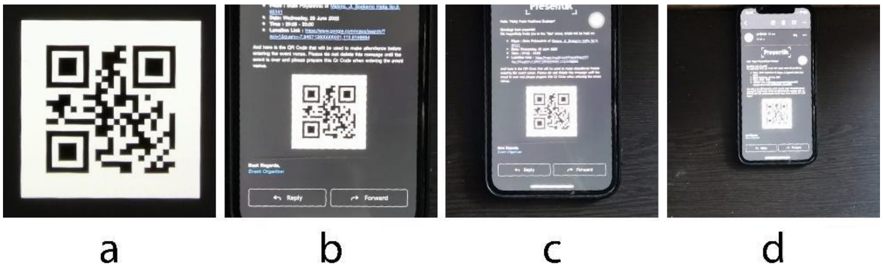


Figure 5.51 Different Distances from 100% Phone Brightness, a) 10cm, b) 20cm, c) 30cm, d) 40cm

Table 5.12 Distance Test Smartphone with 100% Brightness

Distance	Success
10cm	✔
20cm	✔
30cm	✔
40cm	▯

Total	3/4

5. Paper, 25% Warm Ambient Light Brightness, Distance 10-40cm

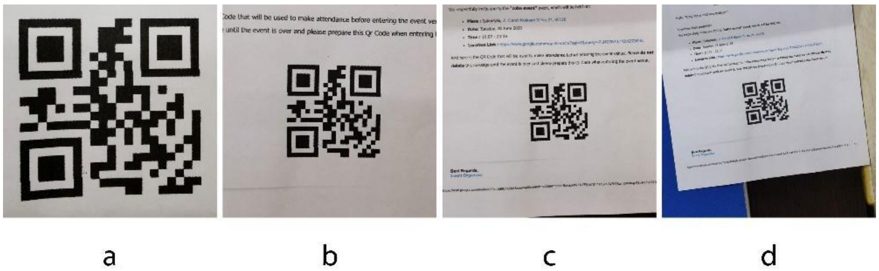


Figure 5.52 Different Distances from 25% Warm Ambient Light, a) 10cm, b) 20cm, c) 30cm, d) 40cm

Table 5.13 Distance Test Printed QR Code with 25% Ambient Light Brightness

Distance	Success
10cm	✔
20cm	✔
30cm	✔
40cm	✔
Total	4/4

6. Paper, 50% Warm Ambient Light Brightness, Distance 10-40cm

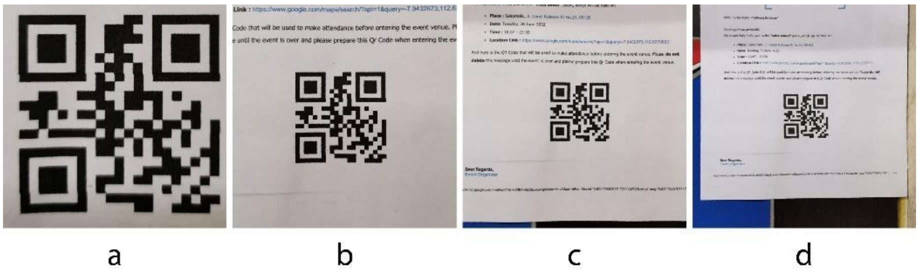


Figure 5.53 Different Distances from 50% Warm Ambient Light, a) 10cm, b) 20cm, c) 30cm, d) 40cm

Table 5.14 Distance Test Printed QR Code with 50% Ambient Light Brightness

Distance	Success
10cm	✔
20cm	✔
30cm	✔
40cm	✔
Total	4/4

7. Paper, 75% Warm Ambient Light Brightness, Distance 10-40cm

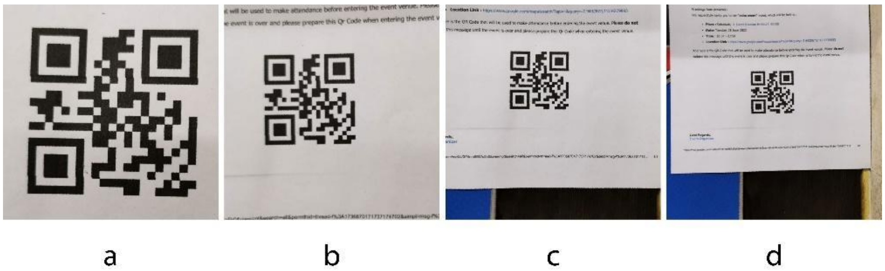


Figure 5.54 Different Distances from 75% Warm Ambient Light, a) 10cm, b) 20cm, c) 30cm, d) 40cm

Table 5.15 Distance Test Printed QR Code with 75% Ambient Light Brightness

Distance	Success
10cm	✔
20cm	✔
30cm	✔
40cm	✔
Total	4/4

8. Paper, 100% Warm Ambient Light Brightness, Distance 10-40cm

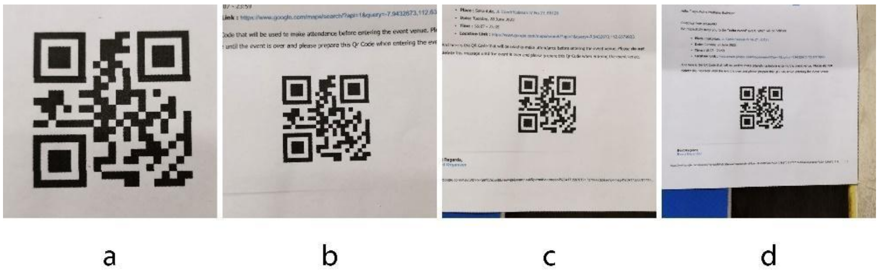


Figure 5.55 Different Distances from 100% Warm Ambient Light, a) 10cm, b) 20cm, c) 30cm, d) 40cm

Table 5.16 Distance Test Printed QR Code with 100% Ambient Light Brightness

Distance	Success
10cm	✔
20cm	✔
30cm	✔
40cm	✔
Total	4/4

The second scenario test concludes that the maximum scan distance for smartphone is 30cm. In the other hand, the paper printed QR code can still be scanned even as far as 40cm, in which the smartphone failed to do so. The brightness of the phone screen doesn't affect much for the scanning process, neither the ambient light brightness did to the paper printed QR code.

5.11 Usability Testing

Usability testing is done to ensure the compatibility of this application on various Android versions and devices. This testing also important to uncover bugs that are missed on the development process. The usability testing is done to 10 participants from various backgrounds. The participants are given 8 tasks to test 8 main features of the application. The results of the testing are displayed as follows.

5.12.1 Register Test

This test is performed to make sure that the register feature works well.

Table 5.17 First Test Case of Register Test Scenario

Participant	Given Task	Expected Result	Actual Result	Pass/Fail
Participant 1	Open Application	Application opens	Application opens	Pass
Participant 2			Application opens	Pass
Participant 3			Application opens	Pass
Participant 4			Application opens	Pass
Participant 5			Application opens	Pass
Participant 6			Application opens	Pass
Participant 7			Application opens	Pass
Participant 8			Application opens	Pass
Participant 9			Application opens	Pass
Participant 10			Application opens	Pass

Table 5.18 Second Test Case of Register Test Scenario

Participant	Given Task	Expected Result	Actual Result	Pass/Fail
Participant 1	Open Register Page	Register Page opens	Register Page opens	Pass
Participant 2			Register Page opens	Pass
Participant 3			Register Page opens	Pass
Participant 4			Register Page opens	Pass
Participant 5			Register Page opens	Pass
Participant 6			Register Page opens	Pass
Participant 7			Register Page opens	Pass
Participant 8			Register Page opens	Pass
Participant 9			Register Page opens	Pass
Participant 10			Register Page opens	Pass

Table 5.19 Third Test Case of Register Test Scenario

Participant	Given Task	Expected Result	Actual Result	Pass/Fail
Participant 1	Register new account on Register page	User successfully registered	User successfully registered	Pass
Participant 2			User successfully registered	Pass
Participant 3			User successfully registered	Pass
Participant 4			User successfully registered	Pass
Participant 5			User successfully registered	Pass
Participant 6			Loading screen not going away after a while, must restart the app	Fail
Participant 7			User successfully registered	Pass
Participant 8			User successfully registered	Pass

Participant 9			User successfully registered	Pass
Participant 10			User successfully registered	Pass

5.12.2 Login Test

This test is done to make user the login process works well.

Table 5.20 First Test Case of Login Test Scenario

Participant	Given Task	Expected Result	Actual Result	Pass/Fail
Participant 1	Opens the login page and then log in with the registered account	User logged in successfully and directed to the home page	User logged in successfully and directed to the home page	Pass
Participant 2			User logged in successfully and directed to the home page	Pass
Participant 3			User logged in successfully and directed to the home page	Pass
Participant 4			User logged in successfully and directed to the home page	Pass
Participant 5			User logged in successfully and directed to the home page	Pass
Participant 6			User logged in successfully and directed to the home page	Fail
Participant 7			User logged in successfully and directed to the home page	Pass
Participant 8			User logged in successfully and directed to the home page	Pass
Participant 9			User logged in successfully and directed to the home page	Pass
Participant 10			User logged in successfully and directed to the home page	Pass

5.12.3 Add New Event Test

This test is done to make sure that the create event process works well.

Table 5.21 First Test Case of Add New Event Test Scenario

Participant	Given Task	Expected Result	Actual Result	Pass/Fail
Participant 1	Open the create event page	User opens the create event page	User opens the create event page	Pass
Participant 2			User opens the create event page	Pass
Participant 3			User opens the create event page	Pass
Participant 4			User opens the create event page	Pass
Participant 5			User opens the create event page	Pass
Participant 6			User opens the create event page	Pass
Participant 7			User opens the create event page	Pass
Participant 8			User opens the create event page	Pass
Participant 9			User opens the create event page	Pass
Participant 10			User opens the create event page	Pass

Table 5.22 Second Test Case of Add New Event Test Scenario

Participant	Given Task	Expected Result	Actual Result	Pass/Fail
Participant 1	Create an event	Event created and displayed in the main screen	Event created and displayed in the main screen	Pass
Participant 2			Event created and displayed in the main screen	Pass
Participant 3			Event created and displayed in the main screen	Pass
Participant 4			Event created and displayed in the main screen	Pass
Participant 5			Event created and displayed in the main screen	Pass
Participant 6			Event created and displayed in the main screen	Pass
Participant 7			Event created and displayed in the main screen	Pass
Participant 8			Event created and displayed in the main screen e	Pass
Participant 9			Error on creating an event without filling event venue (Error and cannot go back)	Fail
Participant 10			Event created and displayed in the main screen	Pass

5.12.4 Upload Guest List File Test

This test is performed to make sure that the process of uploading the guest list file is done successfully. Before the task begins, the participant must fill the guest list template with their name, email, and photo so the following test can be performed.

Table 5.23 First Test Case of Upload Guest List File Test Scenario

Participant	Given Task	Expected Result	Actual Result	Pass/Fail
Participant 1	Open the created event page	The user redirected to the event detail page	The user redirected to the event detail page	Pass
Participant 2			The user redirected to the event detail page	Pass
Participant 3			The user redirected to the event detail page	Pass
Participant 4			The user redirected to the event detail page	Pass
Participant 5			The user redirected to the event detail page	Pass
Participant 6			The user redirected to the event detail page	Pass
Participant 7			The user redirected to the event detail page	Pass
Participant 8			The user redirected to the event detail page	Pass
Participant 9			The user redirected to the event detail page	Pass
Participant 10			The user redirected to the event detail page	Pass

Table 5.24 Second Test Case of Upload Guest List File Test Scenario

Participant	Given Task	Expected Result	Actual Result	Pass/Fail
Participant 1	Upload the guest file to the system	The guest file is uploaded and the guest's data is recorded in the system	The guest file is uploaded, and the guest's data is recorded in the system	Pass
Participant 2			Cannot use .xlsx file format.	Fail
Participant 3			The guest file is uploaded, and the guest's data is recorded in the system	Pass
Participant 4			Error while uploading the file, the error not handled correctly	Fail
Participant 5			Error while uploading the file	Fail
Participant 6			The guest file is uploaded, and the guest's	Pass

			data is recorded in the system	
Participant 7			The guest file is uploaded, and the guest's data is recorded in the system	Pass
Participant 8			The guest file is uploaded, and the guest's data is recorded in the system	Pass
Participant 9			The guest file is uploaded, and the guest's data is recorded in the system	Pass
Participant 10			The guest file is uploaded, and the guest's data is recorded in the system	Pass

5.12.5 Send Email Invitation Test

This test carried out to ensure the email invitation is delivered correctly.

Table 5.25 First Test Case of Send Email Invitation Test Scenario

Participant	Given Task	Expected Result	Actual Result	Pass/Fail
Participant 1	Open the created event page	The user redirected to the event detail page	The user redirected to the event detail page	Pass
Participant 2			The user redirected to the event detail page	Pass
Participant 3			The user redirected to the event detail page	Pass
Participant 4			The user redirected to the event detail page	Pass
Participant 5			The user redirected to the event detail page	Pass
Participant 6			The user redirected to the event detail page	Pass
Participant 7			The user redirected to the event detail page	Pass
Participant 8			The user redirected to the event detail page	Pass
Participant 9			The user redirected to the event detail page	Pass

Participant 10			The user redirected to the event detail page	Pass

Table 5.26 Second Test Case of Send Email Invitation Test Scenario

Participant	Given Task	Expected Result	Actual Result	Pass/Fail
Participant 1	Click on the 'Send Email Invitation' button	The participant is notified when the email is delivered. 1 email will be delivered to the participant's mailbox.	The participant is notified when the email is delivered. 1 email will be delivered to the participant's mailbox	Pass
Participant 2			The participant is notified when the email is delivered. 1 email will be delivered to the participant's mailbox	Pass
Participant 3			The participant is notified when the email is delivered. 1 email will be delivered to the participant's mailbox	Pass
Participant 4			The participant is notified when the email is delivered. 1 email will be delivered to the participant's mailbox	Pass
Participant 5			Error on uploading the excel	Fail
Participant 6			The participant is notified when the email is delivered. 1 email will be delivered to the participant's mailbox	Pass
Participant 7			The participant is notified when the email is delivered. 1 email will be delivered to the participant's mailbox	Pass
Participant 8			The participant is notified when the email is delivered. 1 email will be delivered to the participant's mailbox	Pass
Participant 9			The participant is notified when the email is delivered. 1 email will be	Pass

			delivered to the participant's mailbox	
Participant 10			The participant is notified when the email is delivered. 1 email will be delivered to the participant's mailbox	Pass

5.12.6 QR Code Attendance Test

This test is performed to ensure that the QR code attendance system functions as it should.

Table 5.27 First Test Case of QR Code Attendance Test Scenario

Participant	Given Task	Expected Result	Actual Result	Pass/Fail
Participant 1	Open the created event page	The user redirected to the event detail page	The user redirected to the event detail page	Pass
Participant 2			The user redirected to the event detail page	Pass
Participant 3			The user redirected to the event detail page	Pass
Participant 4			The user redirected to the event detail page	Pass
Participant 5			The user redirected to the event detail page	Pass
Participant 6			The user redirected to the event detail page	Pass
Participant 7			The user redirected to the event detail page	Pass
Participant 8			The user redirected to the event detail page	Pass
Participant 9			The user redirected to the event detail page	Pass
Participant 10			The user redirected to the event detail page	Pass

Table 5.28 Second Test Case of QR Code Attendance Test Scenario

Participant	Given Task	Expected Result	Actual Result	Pass/Fail
Participant 1	Scan the QR code delivered with the invitation mail	The QR code can be scanned, and the system marks the participant attendance.	The QR code can be scanned, and the system marks the participant attendance.	Pass
Participant 2			The QR code can be scanned, and the system marks the participant attendance.	Pass
Participant 3			The QR code can be scanned, and the system marks the participant attendance.	Pass
Participant 4			The QR code can be scanned, and the system marks the participant attendance.	Pass
Participant 5			Error on uploading the excel file	Fail
Participant 6			The QR code can be scanned, and the system marks the participant attendance.	Pass
Participant 7			The QR code can be scanned, and the system marks the participant attendance.	Pass
Participant 8			The QR code can be scanned, and the system marks the participant attendance.	Pass
Participant 9			The QR code can be scanned, and the system marks the participant attendance.	Pass
Participant 10			The QR code can be scanned, and the system marks the participant attendance.	Pass

5.12.7 Attendance Log Download Test

This test is carried out to ensure the attendance log can be downloaded without any issues.

Table 5.29 First Test Case of Attendance Log Download Test Scenario

Participant	Given Task	Expected Result	Actual Result	Pass/Fail
Participant 1	Open the created event page	The user redirected to the event detail page	The user redirected to the event detail page	Pass
Participant 2			The user redirected to the event detail page	Pass
Participant 3			The user redirected to the event detail page	Pass
Participant 4			The user redirected to the event detail page	Pass
Participant 5			The user redirected to the event detail page	Pass
Participant 6			The user redirected to the event detail page	Pass
Participant 7			The user redirected to the event detail page	Pass
Participant 8			The user redirected to the event detail page	Pass
Participant 9			The user redirected to the event detail page	Pass
Participant 10			The user redirected to the event detail page	Pass

Table 5.30 Second Test Case of Attendance Log Download Test Scenario

Participant	Given Task	Expected Result	Actual Result	Pass/Fail
Participant 1	Download the attendance log file	The participant is notified when the download is complete. The file can be opened	The participant is notified when the download is complete. The file can be opened	Pass
Participant 2			Log file not downloaded, notification shows that the log is failed to download	Pass
Participant 3			The participant is notified when the download is complete. The file can be opened	Pass
Participant 4			The participant is notified when the download is complete. The file can be opened	Pass
Participant 5			Error on uploading excel file	Pass

Participant 6			The participant is notified when the download is complete. The file can be opened	Pass
Participant 7			The participant is notified when the download is complete. The file can be opened	Pass
Participant 8			The participant is notified when the download is complete. The file can be opened	Pass
Participant 9			The participant is notified when the download is complete. The file can be opened	Pass
Participant 10			The participant is notified when the download is complete. The file can be opened	Pass

CHAPTER VI. RESULT AND DISCUSSION

6.1 Result

Based on the tests that are carried out on the previous chapter and the system analysis and design, the output of this thesis is an attendance/presence marking system called 'PRESENTIK'. 'PRESENTIK' currently developed for an Android user with minimum Android version 6.0.0 (Marshmallow) and with several security measures to prevent early and late attendance marking and false attendance. The system features email invitation delivery for instant invitation.

This system utilizes Google Cloud Platform as the back end/cloud management tool. This system also utilizes Cloud Firestore for the NoSQL database. Google Maps API is also have been integrated to this application. Google Cloud Run is enabled for the back-end system deployment.

The front-end part of the system features Flutter 3.0.1 with its Dart 2.17.1 programming language. This system also utilizes various libraries such as: Requests for cookie management; Date Time Picker for choosing the date and time of the event; Google Maps Flutter and Flutter Google Places for implementing the Google Maps API to the front-end; Geolocator and Geocoding to retrieve users' location; Mobile Scanner for the QR code scanner; etc.

The QR code angle scanning tests that are performed from the chapter V concludes that the brightness of the smartphone affects the accuracy of the QR code scanner. Otherwise, the ambient light brightness doesn't affect much for the paper printed QR code. Although the paper printed QR code failed on 2 angles, but the accuracy remains stagnant even there is ambient light changes. Finally, the optimal phone screen brightness is between 25-50%, but the results may vary since different phones have different display specifications. The QR code can be scanned in multiple angles successfully, except the below and left side, 45 degrees of the QR code, which are mostly failed on the test of both smartphone screen and printed QR code.

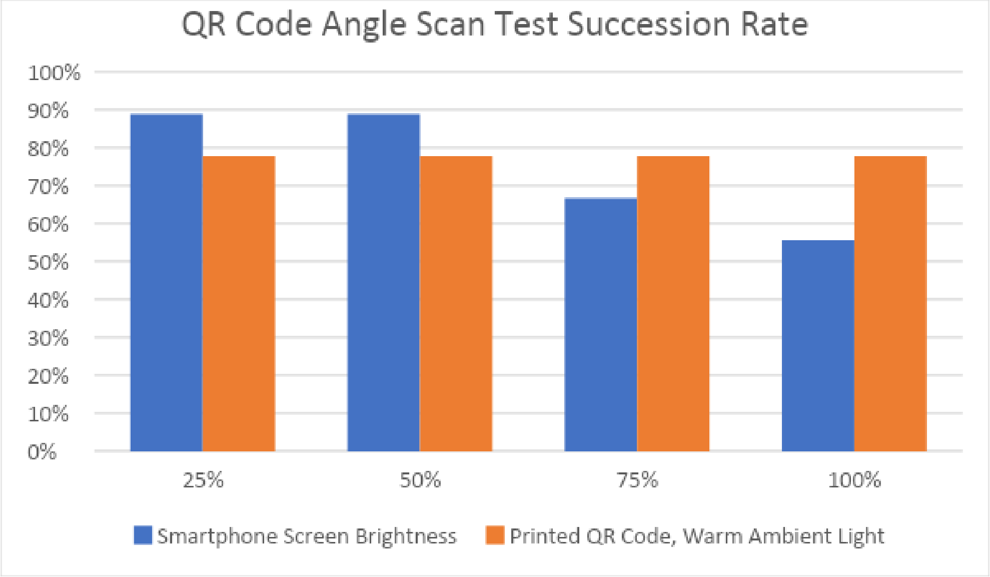


Figure 6.1 QR Code Angle Scan Test Succession Rate of 2 Different Medias

Furthermore, the QR code distance scan test shows that the maximum scan distance for the QR code displayed on the smartphone screen is 30cm, regardless on the brightness level of the phone screen. On the other hand, the printed QR code still can be scanned even it is as far as 40cm, which the displayed QR code failed to do so. Surprisingly, the brightness level of the smartphone screen and the ambient light on the printed QR code doesn’t affect much on the accuracy, unlike the angle scan test.

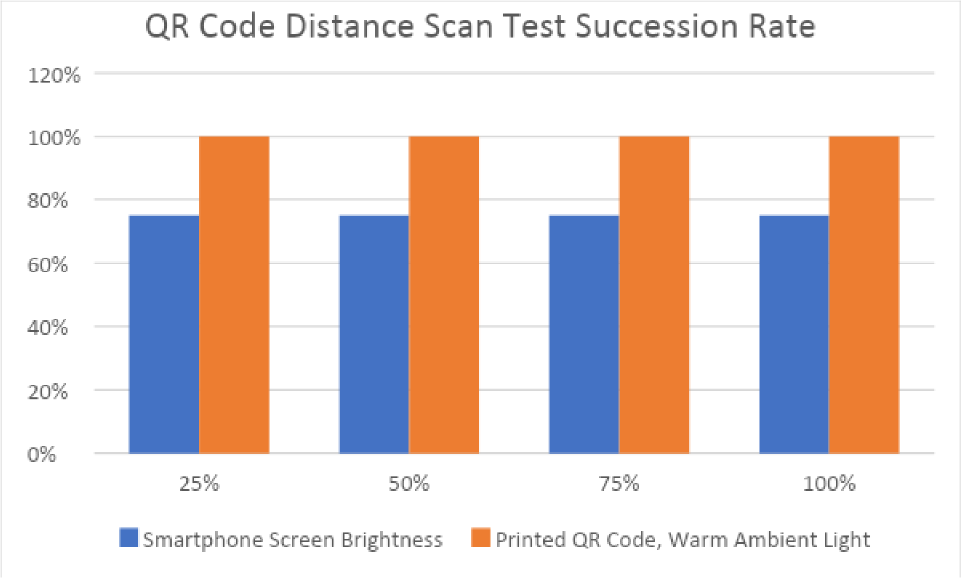


Figure 6.2 QR Code Distance Scan Test Succession Rate of 2 Different Medias

Moreover, the usability test indicates that there are several minor bugs that should be fixed in order to smoothen the experience and the performance of the application. 6 out of 10 participants consider using this application on their future events, while the rest of the participants willing to use this application for their upcoming events. 7 out of 10 participants agree that this application does make it easier to manage the guest's attendance on an event, while the other three participants still unsure about it. Almost all of the participants agree that this application can be used on various occasions and events, one of them even states that this application needs to be implemented to track students' attendance on LMS. 7 out of 10 participants also admits that this application can reduce the attendance fraud and attendance abuse practice, while one of the 10 participants refuse to agree to the idea of this application can reduce attendance fraud/attendance abuse by stating that this application still has several holes that can be abused. The participant explains that the attendance can be exploited by sending the non-attending guest's QR code to the attending guest's QR code, and then scan them.

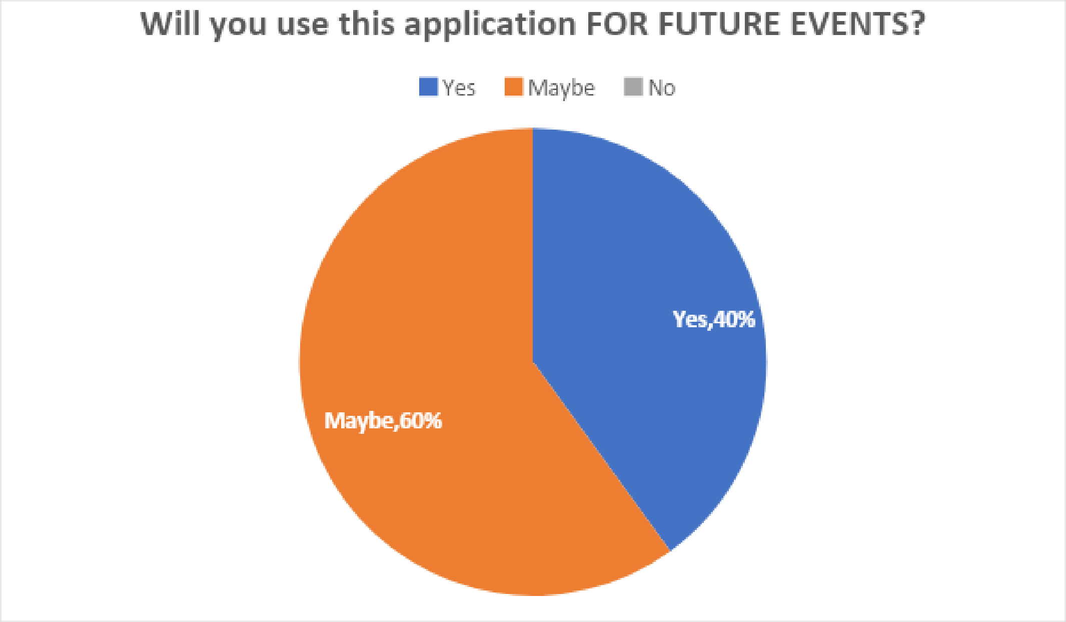


Figure 6.3 Chart of The Answer to The Question ‘Will You Use This Application For Future Events?’

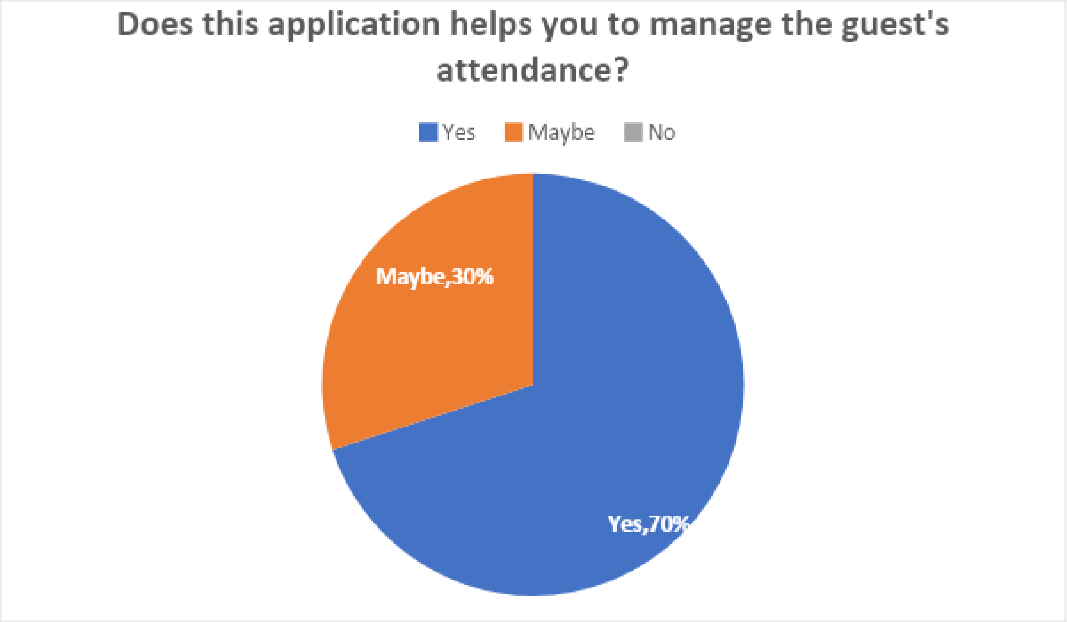


Figure 6.4 Chart of The Answer to The Question ‘Does This Application Helps You to Manage the Guest’s Attendance?’

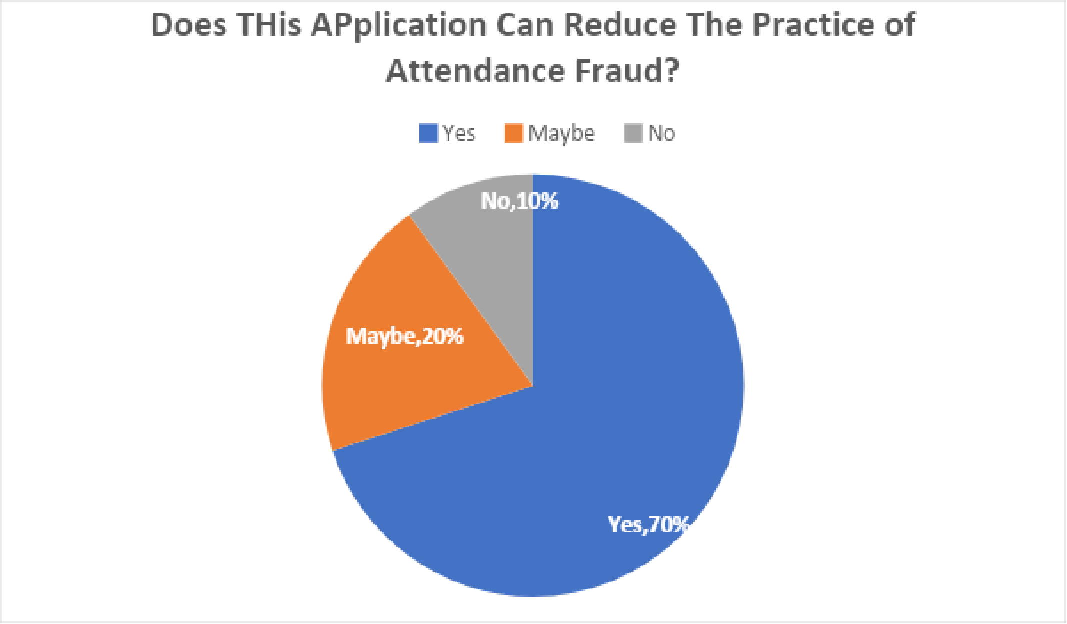


Figure 6.5 Chart of The Answer to The Question ‘Does This Application Can Reduce the Practice of Attendance Fraud?’

6.2 Discussion

From the results explained above, the result of the discussion is explained as follows.

1. The QR code is used to identify the guests from their ID.
2. The application utilizes mobile_scanner package as the QR code scanner package.
3. The application is developed with Flutter frameworks using Dart programming language and Google Cloud Platform as the back-end management/cloud management systems.
4. The brightness of the smartphone screen that displays the QR code affects the accuracy of the QR code scanner.
5. The 45 degrees left side and the bottom middle side of the QR code is the hardest side to scan since the scanner mostly failed to scan the QR code from those angles regardless the brightness level.
6. The maximum scan distance between the smartphone screen and the QR code scanner camera is 30cm. But this may vary with various phone screen size and specifications.
7. Most of the participants agree that the application helps to organize or manage the guests' attendance and considering using the application for their future events.

CHAPTER VII. CONCLUSIONS AND SUGGESTION

7.1 Conclusion

Based on the results of the tests and development from Mobile Based QR Code Attendance System, it can be concluded that almost all the usability testing participants agree that this application can be implemented in various occasions and events, supporting the objective of this thesis. Most of the participant from the usability testing agree that the application helps to organize or manage the guests' attendance and considering using the application for their future events. 7 out of 10 participants agree that this application helps to reduce the possibility of attendance fraud and attendance abuse, 2 out of 10 still unsure about it, and 1 out of 10 denies the statement. There are several bugs that happened when the usability testing takes place, and they are immediately fixed, resolved, and deployed the new patch.

It can also be concluded that the optimal brightness for the smartphone screen that is used to display the QR code is between 25% to 50%. Moreover, the optimal distance of the scan for the smartphone screen that is used to display the QR code is between 10cm to 30cm. In the other hand, the ambient light brightness within the printed QR code doesn't affect the accuracy of the scanning process. The printed QR code also succeed to pass the 40cm distance, meaning that the printed QR code is proven to be more scannable that the QR code displayed using smartphone screen.

7.2 Suggestion

There are suggestions that can be developed or implemented on the future research, such as:

1. Integrate and develop the website side of the project.
2. Implement a better QR code scanning module to increase the accuracy of the QR code scan, especially on various angle.

3. The event location can be inputted on user input, not the search query. This will allow the user to pinpoint the location of the event more accurately.
4. The event location can be set to area, so the user will have more flexibility on adjusting the location.
5. Add ‘admin’ role to prevent abuse on creating events/spamming.

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