Mobile Digital Card Application

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Abstract :   Mobile phones, which are a device that we can use at any time and that everyone can access today, not only look bright, considering their processing power and market richness, but also builds the future. With the rapid digitalization in the 21st century, web pages have taken the place of paper. People have social media profiles. All documents and photographs were digitized, but business cards could not find a place in this digitalization trend. Today, a digitalized business card model that is based on a certain standard and can be used by everyone has not been created. Business cards made of paper are still used today. The aim of this paper is to provide a digitize business cards in a model that can be used by everyone. The study is also aim to create a digital business card system that is easy and fast to create and share.

IndexTerms – **Digitalization, QR Code, mobile application.**

I. INTRODUCTION

The business card originated in Europe in the 17th century. Its first use was to signal the arrival of nobles to their cities and even to their homes. Back then, business cards were the size of playing cards and had many embellishments. In the 18th and 19th centuries, business cards began to be used to be presented to the landlady when visiting a house. When the guests knocked on the door, a maid would appear with a tray, the guests would put their business cards on it, and the business cards would be taken to the hostess. Business cards as we know them first appeared in London in the 17th century; but not for today's use. Since there were no street numbers and a developed communication network at that time, business owners would put maps of their workplaces with their descriptions on these business cards. With the influence of the Industrial Revolution, business cards began to be used for the purpose we know. Emerging merchants in England began giving each other business cards to exchange information.

In the century we live in, the biggest purpose of technology is to make everyday life easier. Throughout human history, humanity first wrote the information they wanted to record or want to use on stones or animal skins, and then they wrote it on paper for a long time. With the coming of the information age, we have started to write this information to computer storage areas or servers. In short, we can call this digitalization. Thanks to digitalization, we can access or share the information we want from our mobile phone at any time. Cards or papers that we had to carry 10 years ago can now be contained in a small QR code. So, don't business cards have a place in this digitalization? Of course, there are projects on this subject, but do the projects meet the main objectives of digitalization?

The biggest problem of the software for information sharing developed today is that this software requires a certain ecosystem [1]. In order to use these software, the person in front of you must also have this software. For example, in order to send an e-mail, the person you want to send must also have an e-mail. Well, for a digital business card software, the person you want to give your business card to must also have a business card application. The purpose of the business card is to introduce yourself as soon as possible and to be easily remembered. It allows you to handle this job without tiring the person you give your business card to or taking a lot of time. In other words, it is against the purpose of the business card to download an application to the phone of the person you want to give your business card to. The biggest reason why the digital business card projects that exist in the market are not successful is that they act against the logic of digitalization.

Mobile phones, which are a device that we can use at any time and that everyone can access today, not only look bright, considering their processing power and market richness, but also builds the future. A QR code is a type of matrix barcode invented in 1994 by the Japanese automotive company Denso Wave [2]. A barcode is a machine-readable optical system that provides information about the item attached to it with a label. QR codes, on the other hand, are usually in a structure that leads to a website or application and contains more information. However, today it has also been used for the purpose of introducing objects. It has a structure that allows data to be stored more effectively and beneficially by using four standard coding Modes in a QR code content. Different variations are available. Since the system stores a lot of data and we can access this data quickly [3], it has been widely used in many sectors. It has become more and more popular. It is used in many different areas and places such as product tracking, routing, website content sharing, tags. QR code is also read by cameras and its usage areas are expanding [4]. Therefore, QR code reading feature is now available on most mobile phones. This feature can also be used on non-mobile phones by downloading a QR code reader application from the market. Mobile phone and QR code are two technologies suitable for the purpose of digitalization.

The goal of the study is to create a business card system that can be used by anyone at any time. It is to create a digital business card system that is easy and fast to create and share.

II. RELATED WORKS

Business people use websites and paper business cards to promote themselves or their companies at business meetings. Web pages contain mostly static data as content. With this data, companies present information about their business to people they meet. After this stage, the static website encounters problems, which are a cycle of expanding, changing and renewing it [5]. Business cards, on the other hand, contain narrower information on paper. However, paper business cards can be crushed, difficult to transport, and often thrown away. So it is not a very effective promotion method. On the other hand, it is difficult to reach easily when searched. When it increases in number, it becomes difficult for users to manage it. On the other hand, companies make great efforts to rank higher in advertising processes [6]. For example, the anchor to be made on google creates serious costs. Google also manages the process according to the principle of showing repeatedly in the field of advertising. On the other hand, business cards are less costly and more common to share one-to-one. However, one of the biggest problems with the use of printed business cards is the environmental damage they cause [7]. It also causes harm to the environment with the use of large amounts of paper or plastic. Studies have shown that approximately 10 billion business cards are printed annually. In an environment where smart phones have become so widespread in the digital world, the widespread use of business cards still raises questions.

A study conducted; showed that 88% of the business cards distributed were discarded within a week at most. Considering business cards printed on a weekly basis, this means a huge waste of paper. The damage we do to the environment is increasing. The Digital Business Card application has also been developed as a web application [8, 9]. Its main purpose is to allow the system administrator to manage the system and monitor incoming requests. Users can create business cards by creating a profile in the system and share their profile from the web application. Users are required to maintain their registered business card profiles. The system has different competencies. In this way, people can list the business cards, search and sort them according to the criteria they want. In this way, ease of access was created. It would be more beneficial if the system could work through a mobile application rather than a web application. In this way, people can be disseminated by providing access from the mobile application instead of the website. The main purpose of digital business card projects is to contribute to the paperless media project. It is aimed to increase the contribution to the environment by reducing the use of paper [10]. By expanding such practices, it is necessary to prevent waste of paper and increase its sensitivity. Similar goals are aimed in another digital business card application. Users can access the business cards of users registered in the system by searching from a general contact pool. By using the information here, access and communication opportunities are provided. It is also possible to communicate via e-mail as a means of communication. With short messages, fixed defined messages can be sent. With digital business cards, access to many detailed data of the digital card holder is also provided. Cardholders can easily access different features such as their website, map access or references. In addition, users can easily share their cards in the digital environment without paper. Sharing can be done easily with the people they want. In these systems, users will have completed the necessary preparation for communication after creating their accounts and editing the content. In this way, convenient and easy access will be created [11]. Users will not need to physically search or carry cards in different locations each time. It will be possible to search and customize according to the desired features. It will also be possible to limit sharing with access authorization. In another study [12], They worked on transferring business cards on paper to digital media using a mobile phone. With this application, the business card on the reading paper has been digitized. In this study, a technique focused on multi-resolution analysis of document images was used due to the large number of mobile devices and different resolution support. The main purpose here is to digitize the business cards on paper more sensitively against the deterioration that occurs over time. The separation of text data was carried out with the technique used. The system constitutes the first stage of detecting an image taken with a mobile phone and starting the processing. Then, the text is determined by image processing techniques and this text is processed and separated into special fields such as address, phone number and mail. With the study, the information on the paper was transferred to the computer environment.

The biggest problem in creating business cards is the waste of paper and the damage it causes to the environment. In the digital world, we now live in a time where everything is at our fingertips and we can access the information we want anytime, anywhere. With smartphones, tablets and computers, we can now access all kinds of information and data very easily. In a world where such possibilities exist, digitalization of business cards is inevitable. It is known that approximately 10 billion business cards are printed annually. The vast majority of these business cards go to waste in a very short time. Considering this whole cycle, it is seen how much of a waste there is. We need to make great efforts to prevent this loss. In addition, studies have been carried out on why business cards are thrown away. According to these studies, the reason for discarding the business cards; unnecessary, no need for service, digital access, transportation problems and others.

These study consist of two parts, the mobile application side and the server side. In the mobile application part, a native application will be written using java technology. Android QR code reading and creation libraries will be used, and the camera of the mobile device will be used as the device hardware. It is planned to use SQLite database to store the data. The mobile application, which will be developed using Android Studio, will support Android Lollipop (5.1.1) operating system and above. Jetpack will be used as the Android development package. Node.js JavaScript will be used for the server side. It is planned to use Google Firebase Cloud Functions for the cloud structure and Google Firebase FireStore for server-side storage. It has been deemed appropriate to use a NonSQL database within this structure.

III. SYSTEM DESIGN AND IMPLEMENTATION

3.1 Functional Requirements

3.1.1 Security

Security is one of the most important issues in the business card systems. In this study, the user is given the opportunity to choose what information the user will share through the mobile application. In addition, the generated QR code can be changed by the user at any time. In the basic operation of the study, the links created for users will be 32 characters long and encrypted. Since the links throughout the system will be meaningless, it will prevent unwanted people from accessing profile information.

3.1.2 Capacity and Compatibility

In this study, no storage is used on the user's device, except for the size of the application itself. User information is kept in the cloud system. It only requires an internet connection while the user's own code is being created or while another QR code is being scanned. All the storage of the project is on firebase. User profiles reach users via links created over the cloud system. No data is kept on local devices.

The operating system of the user's device must be Android 5.1.1 (Lollipop). It only requires an internet connection while the user's own code is being created or while another QR code is being scanned. The project works by data transfer (API) over internet connection. Therefore, it does not need any storage. All work is done on the server side.

3.1.3 Manageability and Scalability

Users will be able to manage the customize business card pages created for them as they wish and in a simple way to use. Thanks to the mobile application, they will have a control panel. Although the basic management system of the project is controlled via the mobile application, in fact, all the work is done on the server side. The mobile app is actually the remote control in this study. Since the cloud system is used, system features can be increased when necessary so that more users can use this project without any problems. Since the project is working with a web-based system, it can use the scability opportunities it provides to the fullest. In order to add new features to the system, major changes can be made in the project without uploading it to the user by only updating the UI on the mobile application side.

3.2 Non-Functional Requirements
3.2.1 Sign with Google

The user can register to the system using the existing Google account without having to deal with creating a new account. A new row is created for the user in the database using the user's Google ID and the data is saved there. The link created for the user is also encrypted over this ID. Thanks to Google sign, the user's account stays within the secure area provided by Google. In addition, it does not waste time creating a user from scratch. It does not encounter a situation such as forgetting information such as password and user name. In addition to these, it also provides great convenience on the coding side of the study.

3.2.2 Create Business Card

The main purpose of the user, the business card creation function, is realized here. The user fills in the row in the database created for him by entering the personal information requested from him in the specified fields. If you do not want to share the desired data, there is also the option to leave this field blank. The user creates a customized business card. It is the section where it determines how to give a business card to the people whose business card it wants to share. Things like what information to share and what kind of design it will determine are handled in this function.

3.2.3 Create / Scan QR Code

QR code is created by using the link of the created business card is embedded, so that the user can share this business card with any mobile phone user after creating a customized business card. After the user fills in the database line reserved for him with his own information, his card is ready. The next important action is to share your profile with other users or those who do not use the system. There are two ways to do this. The first is the possibility of creating a QR code for the user and having other users read this QR code. The other way is direct profile link sharing for remote users. Scan QR Code is a function that exists for users to save other users' business cards within the application. QR code business cards scanned by the user are saved in the history in the application. This function is actually a natural guide. The mentioned function ensures that the records of profile sharing among registered users in the system are kept. At the same time, it provides this service from within the application for mobile devices that do not have a QR code scanner. After scanning the QR codes of other users, they are saved in the directory and the page of the user with the QR code is opened.

3.3 System Design
3.3.1 Use Case Diagram

Use Case diagram depicts how the system works according to the user's usage. As seen in Figure 1, the user first registers to the system. Then designs his own business card and creates a QR code. It then shares this QR code with other users. Target users can see the business card designed by the user on a web page thanks to the QR code.
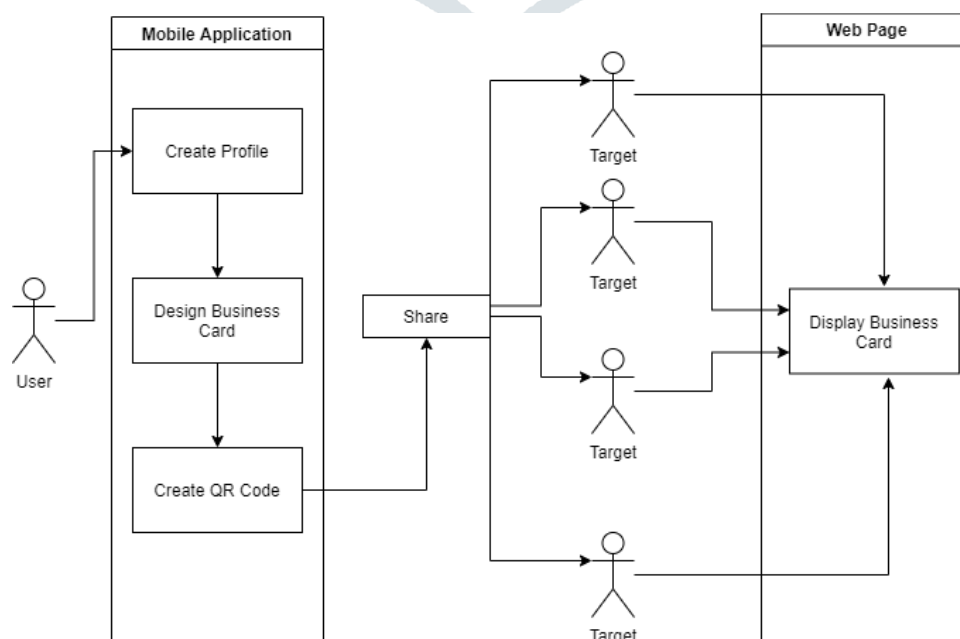

Figure 1. Use Case Diagram

3.3.2 Activity Diagram

Activity diagram is seen in which business layer the user's activities take place. As seen in Figure 2, create profile, design business card, create QR Code and share functions are handled on the mobile application side, while database operations and display functions are performed on the web side.
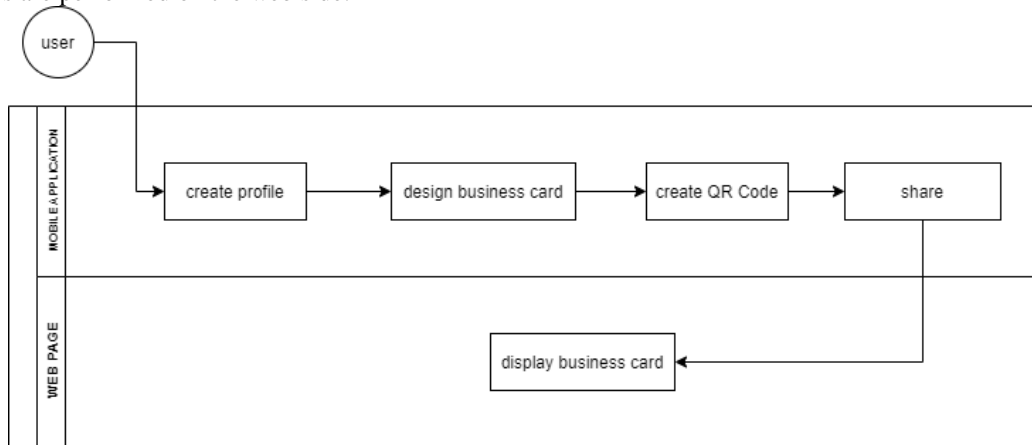

Figure 2. Activity Diagram

3.3.3 Mobile Application Design

Mobile Application diagram in Figure 3 shows the UX structure of the mobile application. According to this structure, the mobile application consists of 5 main pages. These pages are basically Login page, Scan QR Code page, Business Card Page, History page and share page.
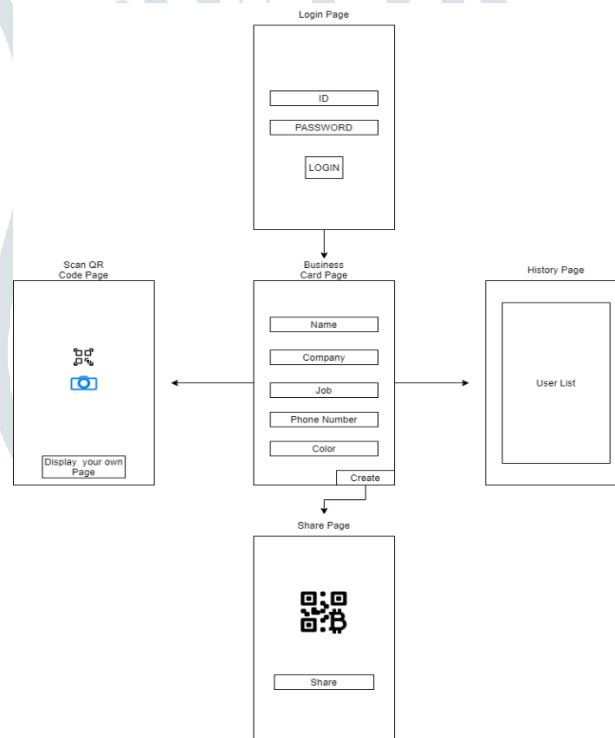

Figure 3. Mobile Application Design

3.4 Implementation

3.4.1 Mobile Application Implementation

The mobile application will be a native application for the android operating system in this study. Android Studio was preferred as the IDE and Java as the software language. Supported SDK version is minimum 26 and target 31 preferred. MVP structure and Single activity approach have been decided in the mobile application. Support will be provided for 5 sizes of screen resolution (mdpi, hdpi, xhdpi, xxhdpi, xxxhdpi). With the server side, data transfer and communication will be provided through APIs. Support will be obtained from Firebase libraries for data processing operations. Android QR Code libraries are also available for QR Code transactions. User permissions are two as data storage permission and camera usage permission. The application will consist of 5 fragments working on the basis of 1 activity in the class structure. Transitions between fragments will be provided with finger swipes and buttons. Content descriptions will also be added to the application for visually impaired users. It is intended to use GitHub as Git. It is planned to use open source images for icons and buttons. In addition, the splash screen will also be designed. Google infrastructure was used for user profiles in the study. With the Google Sign-in method, users do not need to create a new profile. The phone's camera is used for the QR code scanning feature. In addition, CodeScannerView library was used for QR Code scanning. Firestore is used for all database operations. Operations such as database creation, data insertion and receive data are easily handled. Thanks to the database being kept in the cloud, there is no need to keep any data in the mobile device. The library provided by the Android operating system was used to generate the QR code, and the link created for the user

was embedded in the QR code. Business card information is created according to a determined data model and integrated into the database. In the application, the transitions between the pages are designed in a way that users are accustomed to due to applications such as Instagram, Facebook, Twitter.

3.4.2 Server Side Implementation

Server side operations are completed using node.js technology. Firebase Storage is used for the database and it is implemented in the android application. Firebase Hosting was also used for hosting operations. Html CSS and JavaScript are preferred for the interface that appears in the browser. Vue was also used as the UI framework. Domain works are done with the help of Firebase. A certain domain is defined and the profiles of the users are displayed on this domain. Google was used for the sign-in provider and the necessary integrations were made through Firebase. Finally, the user's profile is created and shown to other users via browsers. Various functions are working by clicking on the user's information. For example, you can call the user by clicking on the phone number or send a message by clicking on WhatsApp. You can click the Download Button and save it to your directory.

IV. RESULTS AND CONCLUSION

The application was tested with a four-stage test process and the results were evaluated. Test processes includes the following stages;
- application tests
- compatibility tests
- browser part tests
- user tests

tests were made according to these processes, and a general evaluation of the system and improvements were made.

The first testing phase was for the application part. There were API errors in this section and these errors were fixed. In the second stage of the test, a compatibility test was performed with the devices. The application was tested on 4 different resolution devices used and the placement problems were fixed. Required user permissions checked. Application test devices and test functions are given in Figure 4.

	(Android 10) Samsung Galaxy s20	(Android 9.0) Xiaomi Redmi Note 7	(Android 10 Q) Oppo C21	(Android 8) Sony Xperia XA1
Screen placement	Success	Success	Success	Success
CPU utilization	%6	%22	%5	%40
Process memory	63MB	52MB	41MB	50MB
QR Code Scan	Success	Success	Success	Success
Response API time	1.24 sec	2.13 sec	1.62 sec	3.3 sec
User Permissions	Ask user	Ask user	Auto cancel	Ask user

Figure 4. Test Table

In the third stage of the test, the browser part of the project was tested. Resolution and version tests were performed and no problems were encountered. In the 4th stage of the test, library controls were made. License types and requirements of all libraries used were checked. At the last stage of the test, it was the section about users. The application was made available to business card users and asked to be tested. The feedback received corresponded exactly to the purpose of the project.

As seen in the table (Figure 4), the load given by the mobile application to the system and the duration of the responses vary from device to device. Some devices have issues with user permissions being automatically denied. There is no visible problem in terms of system load. The data in the table also confirms this. When the mobile application works with the browser, the load on the system is given in the utilization graphics depicted in Figure 5.
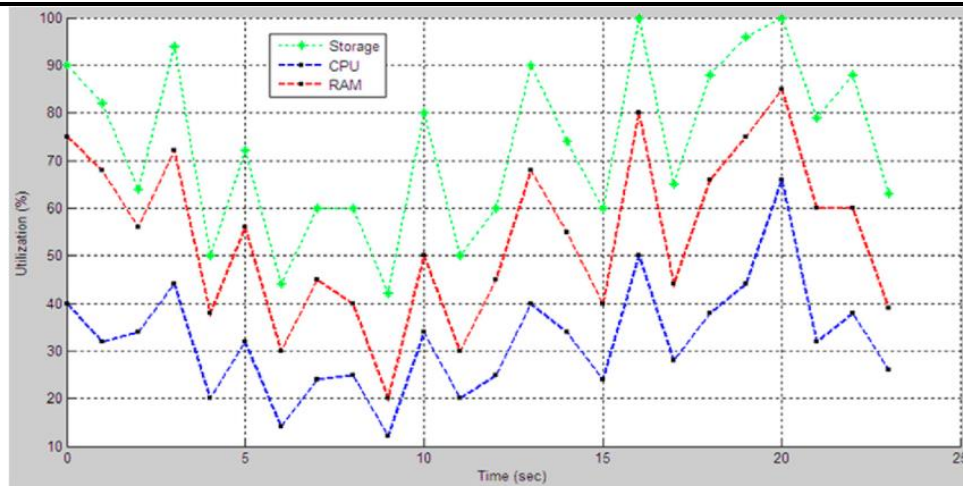
Figure 5. Utilization

In the long-term system load test, there is no threat to the system. The outputs of the long test results are given in Figure 6.
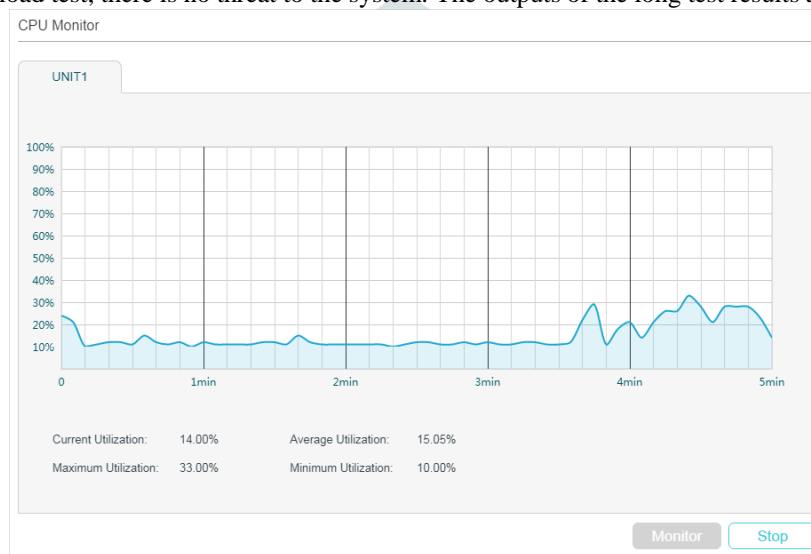

Figure 6. CPU Monitor

The system performance obtained at the end of the tests shows that the application has effective CPU usage and different devices support. Tests on five different devices show that no error was encountered that contradicts the main purpose of the study. It has been seen that QR code scanning with the camera, which is one of the indispensable equipment of mobile devices, enables the project to work fully functionally in a large device population. During the test, it can be said that the internet browsers supported by the devices' own operating systems do not create a significant processing load on the devices, and thus the application is a device-friendly way of working. As a result of the tests for the web side, some placement problems and access problems were encountered. After solving these problems, retests were made and it was determined that these problems disappeared. During the test, an error was encountered in the button to save the contact to the directory on the web page on a mobile device with memory deficiency. No problems were encountered as a result of the QR code scanning performed on devices where the application was not installed and the tests performed for the web page that should be opened afterwards. It is seen that the project is problem-free for users who do not have the application, which is the largest user base, to pass this test without any problems. The main purpose was to establish a system that can work on all mobile devices. The main reason for using QR code was to solve this problem. After the completion of the study, we reach our study targets. During the unit test, a problem was encountered, such as the inability to read the text on devices with a large screen, and to solve this problem, the size of the fonts was enlarged. In tests on Oppo devices, user permissions pop-up screens were not seen when the application was first opened. For this reason, user permissions could not be obtained. The device camera and device storage could not be used. According to preliminary investigations, it turned out that the requested user permissions were automatically denied. It is estimated that it is caused by an action that the user has taken before.

At the same time, the feature that distinguishes this study from other digital business card projects is that it can share business cards without having to use the application. When the study is wholly completed, this feature works, so this purpose has been achieved. In the later stages of the study, some new features can be added and the requirements of the study can be strengthened.

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