~PROJECT PROPOSAL

(1) PROJECT PROFILE
Project Title: EZQR: An "Easy" Quick Response (QR) Code System for Hospital Efficiency
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(2) CATEGORY OF RESEARCH
_ Physical Science
_ Life Science
✔ Robotics and Intelligent Machines
_ Mathematics and Computational Sciences

(3)
_ Individual
✔ Team

(4) THEME
_ Food Safety
_ Water Conservation
_ Renewable Energy
_ Cyber Security
_ Traffic / Road Congestion
✔ Health
_ Disaster Mitigation
_ Agriculture and Environment
_ Others (please specify)
_____

(5) EXECUTIVE SUMMARY (not to exceed 200 words)

(6) INTRODUCTION

A tool that has recently become very popular in meeting fast information delivery demand while keeping the resource investment relatively low is the Quick Response code, more commonly known as the QR code. (Uzun, 2016) QR codes are everywhere: you can find them printed on the packaging of your latest gadgets, on business cards, included on presentations at conferences, and you can even see them painted on buildings. People and companies use them to store and distribute all kinds of information in a manner that is quickly

accessible to anyone with a QR code scanner. (Neagu, 2021) A familiar tool for scanning QR codes is smartphones.

The number of smartphone users is spreading quickly. In recent years there is increased adoption of smartphones by healthcare professionals as well as the general public. The smartphone is a new technology that combines mobile communication and computation in a handheld-sized device and facilitating mobile computing at the point of care. (Mosa & Yoo, 2012) The advancements of wireless and mobile computing and the diffusion of pervasive healthcare technologies are significantly changing our perception of healthcare. The everyday activities of our medical staff in every hospital can be better with an enhanced and customized healthcare system. (Coronato & Esposito, 2008) With an increasing number of online medical and health care consulting services, virtual hospital apps have made health care more accessible and fairer for all. (Wang et al.., 2020) From this information, research for developing a new system will be substantial to improve hospitalization time and clinical experience for our health center's efficiency and healthcare.

Patient identity management is crucial for any healthcare provider. Wrong identification can lead to serious consequences like improper diagnosis, patient risks, medication errors, testing errors, but sometimes, even death. Ultimately it can affect the patient outcome and reputation or the recognition of the healthcare institution. One study by Annals of Family medicine found that doctors spend more than half of their time on medical records. That means less time is available for patients, and doctors are more likely to face issues like burnout. (Sinhasne, 2019, Hedge, 2021) Another study conducted by Harvard Business Review; a platform must be accessible to reveal the patient's medical record to all parties

involved. (Hedge, 2021)

The implementation of the QR Code in healthcare serves as a powerful solution in enhancing information between healthcare providers and care patients. (Hedge, 2021) QR Codes can serve as an important tool in helping healthcare providers to keep the correct track of patients throughout their administration. Patient information from administration to discharge, medical prescriptions, and even their previous health history for doctors and caretakers to provide swift service can be accessed via QR Code. (Hedge, 2021) Doctors, nurses, and healthcare providers are already used to mobile devices and don't need any extra time or effort to use QR Codes, they only have to use a QR Code scanner app on the smartphone to get access to the patient's information. (Sinhasne, 2019)

This research sought to find the answers to a significant change in hospitalization time, hospital efficiency, and accessibility; by utilizing personalized QR codes and application systems. Peculiarly, the researcher sought answers to the following questions:

1. How can this system change the usual practices of a hospital such as data gathering, monitoring, & diagnosis?

2. How can this project help a hospital in terms of:

    2.1 accessibility;

    2.2 efficiency;

    2.3 storage; and

2.4 security?

3. What are the advantages and disadvantages of using a custom QR code system in a hospital?

4. What are the opinions and satisfaction rates of the doctors on this new system?

This research aims to develop an easy access and simplified patient information from administration to discharge, medical prescriptions, and to even their previous health history that can be accessed via QR Code.

Therefore, the integration of QR codes for each patient will expedite the process of hospitalization, simplify patient management, enhance patient outcomes, and will ease the workload of hospital staff.

(6.1) RATIONALE/SIGNIFICANCE (not to exceed 300 words)

- Application of QR codes is a valuable technique for increasing and improving communication between healthcare providers and patients. (Hedge, 2021). QR Codes can be a practical tool in supporting healthcare providers in keeping track of patients during their treatment. Medical QR codes can be utilized to collect patient information from administration to discharge, medical prescriptions, and even their previous health history, allowing doctors and caregivers to provide timely assistance. (Hedge, 2021).

(6.2) SCIENTIFIC BASIS/THEORETICAL FRAMEWORK/MATHEMATICAL THEORY INVOLVED

1. Activity Theory

This study bolstered the theoretical support of Activity theory by Engeström (1987) and the more recent, Roth and Lee. (2007) Where the activity of developing expertise, mediated by the

division of labor and social rules that structure interaction within a particular community, division of labor is when the separation of a work process into several tasks, with each task performed by a separate person or group of persons. (Britannica, 2017) The division of labor and rules are established and shift over a long time, serving collective motives that constitute the object or goal of the activity. These instruments may encompass concepts, material tools. Tools and elements of community shape how the subject(s) or learner(s) orient, think, and perform in and for a particular activity.

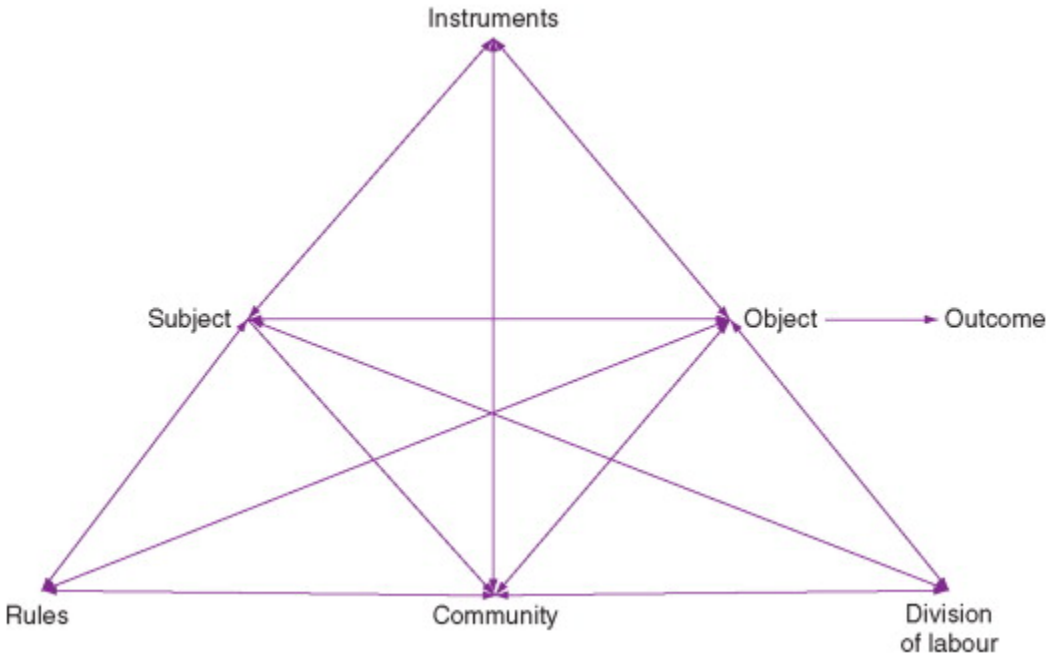

Figure 4. General Idea for Activity Theory

This theory applies to this research; the mobile app that the researchers will make will serve as an instrument. The QR Code will be the object. The subjects or the doctors will have their division of labor, and the hospital will serve as the community. With the definite rules that the researchers will provide, there will be a goal and an activity. Learning the process of this activity will make a positive outcome for the community.

2. Network Effect

The Network Effect is another theory that applies to this study, and the researchers' mobile app; is used as a tool. The object will be the QR Code. The hospital will be the

community, and the subjects of the physicians will have their division of work. There will be a goal and an activity based on the specific regulations that the researchers will supply. The community will benefit from learning about the process of this activity.

3. Dematerialization
4. Cognitive Learning of Theory

Cognitive learning is a type of active learning that focuses on teaching you how to maximize the potential of your brain. Cognition refers to the ability of the brain's mental processes to absorb and retain information through experience, senses, and thought. (CITATION) Exposing health workers to cognitive training through the app can help them become more familiar with the system. Employees with strong cognitive abilities are more likely to contribute to an organization's success. (CITATION) This theory assists the study in resolving the problem and concerns about ease of use. One of the fundamental aspects of cognitive learning is application. (CITATION) Regular use and application of the system to health workers' day-to-day jobs may help them become more familiar with the technology as the application is implemented in hospitals.

5. Complexity

"All software construction involves essential tasks: the fashioning of the complex conceptual structures that compose the abstract software entity, and accidental tasks: the representation of these abstract entities in programming languages and the mapping of these onto machine languages within space and speed constraints." (Brooks, 1987). Fred Brooks, a computer architect, published a book titled "No Silver Bullet" in 1986, in which he recognized that software engineering was not yielding the same productivity increases as hardware engineering. Brooks stated that there are two central obstacles to overcome when creating software: essential complexity and accidental complexity. (Sardone, 2022).

The problem to be solved is of essential complexity, or in other words, the nature of the beast you're attempting to tame is essential complexity. Brooks cites the example that if users require

a program to accomplish 30 things, then those 30 things are necessary; you can't simply remove a few to make the software less difficult. There are some areas of complexity that simply cannot be reduced while fixing an issue. (Sardone, 2022).

On the other hand, accidental complexity refers to difficulties that developers unknowingly create when attempting to solve an issue. (Sardone, 2022). Although we can reduce and fix this type of complexity, the identical problem may be more challenging to solve in one language than another – but there is no silver bullet. There will always be some accidental complexity. (Smith, 2017).

Theoretical Framework

(6.3) OBJECTIVES

- This study aims to create a system that makes patient information accessible and easy to obtain, from administration to discharge, medical prescriptions, and even past health history, all of which can be acquired by a QR code.

(7) REVIEW OF LITERATURE

(8) METHODOLOGY

A. Materials

The materials that we will be using in this research are a computer or laptop, smartphone, server, Quick Response Codes (QR codes), and an internet connection. The laptop will be the primary tool that the researcher will use to make personalized QR Codes together with the codes for the server and the smartphone application. The smartphone used in this study is to test the compatibility of this project, and it will be the primary item to scan the QR

codes. The QR Code is the crucial material for this experiment. It will serve as the ID used by the patient. The server is another material used in this study. The identification and data of the patient saved are in the server's database. This database is then connected to QR codes.

B. Control & Experimental Groups

The control group for this project is the conventional way of hospitals administering standard procedures given to their patients. Upon the arrival of the victim or patient in the hospital, the information section will check if the subject registered is in the hospital system; then inspect to approve the subject Health Maintenance Organization (HMO) or the Letter of Guarantee (LOG) from the health insurance. Once the HMO of the patient becomes approved, he/she will proceed to the secretary or nurse specialist for listing, weighing, checking of height, etc.

Following is the medical diagnosis or the cross-examination of the doctor. If the patient needs a follow-up meeting or a test in the medical laboratory, he will then give an appointment and a prescription from the doctor if required.

The QR Codes will be the experimental group for this research project. Firstly, the physician will perform a clinical evaluation of the patient. After the clinical assessment, the physician will evaluate the examination results if there is a need for further laboratory analysis. If the patient needs more laboratory tests, the physician will issue a referral following the transformation of the referral to the QR Code. If the results don’t need laboratory examinations, the physician should update the Electronic Patient Record (EPR) that the doctor can access through the QR Code.

Below conveys the Patient Clinical Evaluation (PCE) without the use of a QR Code (Figure 1) and the PCE with the application of QR codes (Figure 2).

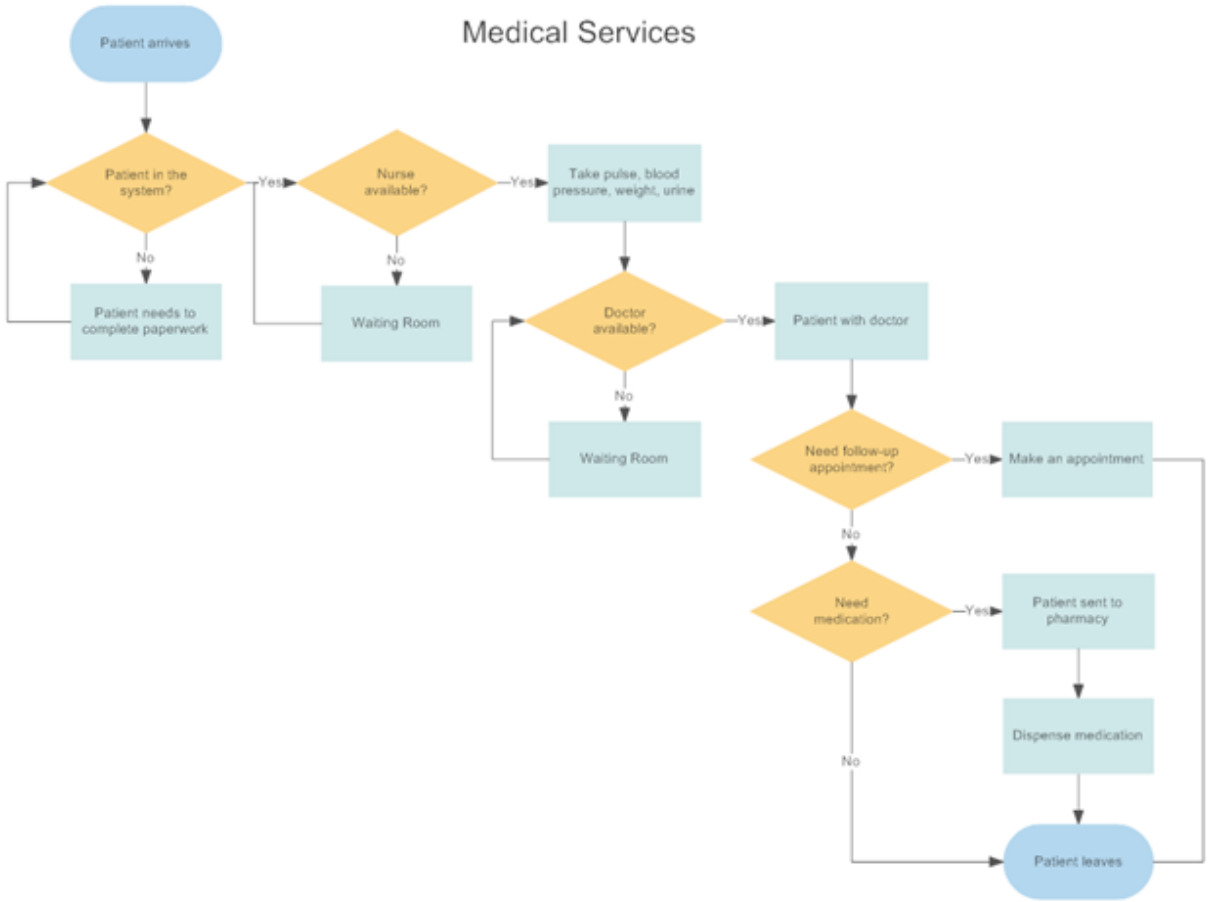

Figure 1. Patient Clinical Evaluation w/o QR Codes

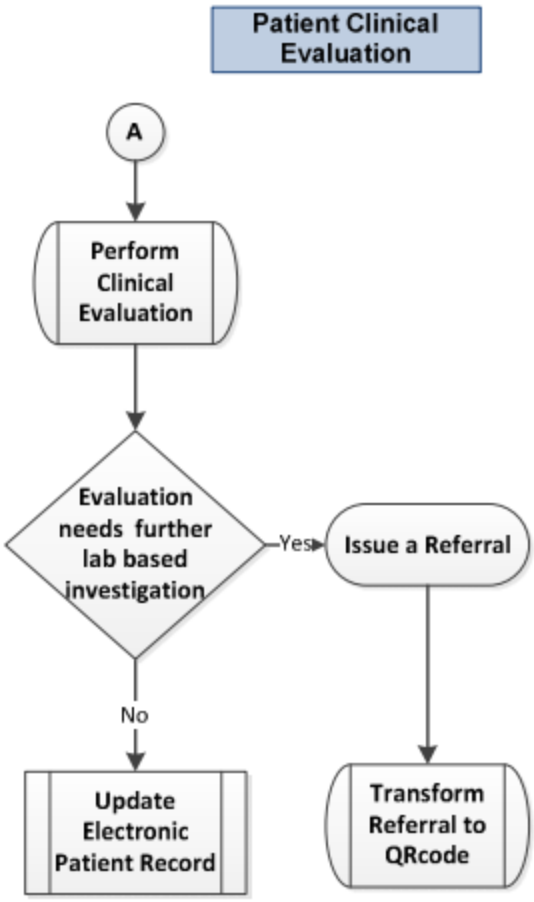

Figure 2. Patient Clinical Evaluation w/ QR Codes

C. Data Gathering

In this study, the researcher will use two data collection methods, namely observational and survey techniques. In the observational method, the researcher will ask the sample population to use the QR application and will observe the operator's reaction to the system. The researcher will then proceed with the survey method through which given questions continue to the sample population. The survey's questions will focus on the application's user interface, its compatibility, accessibility, trustworthiness, response time, the system's simplicity, and its security. Through observation and surveys, the researcher can use the average data collected to see if the operators are satisfied with this modern healthcare system.

D. Trials and Replicates

The researchers will conduct three initial trials to check the accuracy of the experiment. If the trial is a success, the researcher will perform three replications to verify the trial results.

E. Population and Samples

The population that the researcher will use are all current health workers and physicians in the hospital. On the flip side, the sample concerning this study and the researcher needs are three randomly selected doctors.

F. Sample Technique

The sampling technique that the researcher will use consistently in the experiment is the Stratified Random Sample. In this type of sampling, the population divides into subgroups called strata that share similar characteristics. The strata can be a similarity of age, sex, height, or anything similar. If a formed stratum is complete, the researcher will pick a random doctor for each stratum and will eventually get a sample randomly.

G. Variables

The classification of variables that were evident in this research is qualitative or categorical variables. This study is classified as qualitative because it needs the views and opinions of the testers. Following is the independent and dependent variable: Utilizing a personalized QR code system and the QR code app will serve as our independent variable in this experiment since it is the treatment that the researcher suggests for this research. Oppositely, the dependent variable of this experiment is the hospitalization time, efficiency, and the operator's satisfaction.

H. Programming

Android Studio is the official Integrated Development Environment (IDE) for Android app development (Google, 2021) and Kotlin is a programming language widely used by Android developers everywhere. (Google, 2020) The researchers will use these two to make the android app.

A database is another material that the researchers need for this experiment. According to Oracle, a database is an organized collection of structured information, or data, typically stored electronically in a computer system. A database controller is usually caused by a Database Management System (DBMS). The data and the DBMS, collectively along with the

applications that are associated with them. This collection is a database system, often shortened to just a database.

Data within the most common types of databases in operation today is typically modeled in rows and columns in a series of tables to make processing and data querying efficient. The data can then be easily accessed, managed, modified, updated, controlled, and organized. Most databases use Structured Query Language (SQL) for writing and querying data. (Oracle, 2021) In this research, the researchers will use a DBMS called MySQL. This open software is popular due to its security, features, and its usability.

A given unique ID to each patient will be the use of checking information inside the database. The use of the ID is to generate the QR code for each patient. This QR code can then be scanned and get its corresponding unique ID, used to find the patient in the database with the matching ID. Through this, a health worker can easily find or change a patient's information in the database by scanning the QR code given to the corresponding patient

I. Prototype Testing

A prototype is also built-in for this research, where the process of the study is under testing. This research method starts with accessing the app by inputting valid credentials; these stored valid credentials are also in the database: this is to increase security and avoid damage by accidentally giving someone access to the app. It can also serve as a way to find out who changed what on the database. Once an entered credential is valid, a person can get access to the QR code scanner of the app.

When a qr code is scanned, the app first decodes the qr code and checks if it's a valid unique ID, once it's verified, the app will send a request to the server if there is a matching unique ID within the patients in the database. If a match is detected, the server returns the information of the matching patient to the app. The app then shows the information and gives the choice to change it or add into it: if a change is detected, the app sends the changed information to the server so that the database can update.

However, if there is no match detected with a scanned valid unique ID, the app shows all the list of the patients currently in the database. You can search the list with the patient's name. If data is present in the system, you can choose to change the information of that patient.

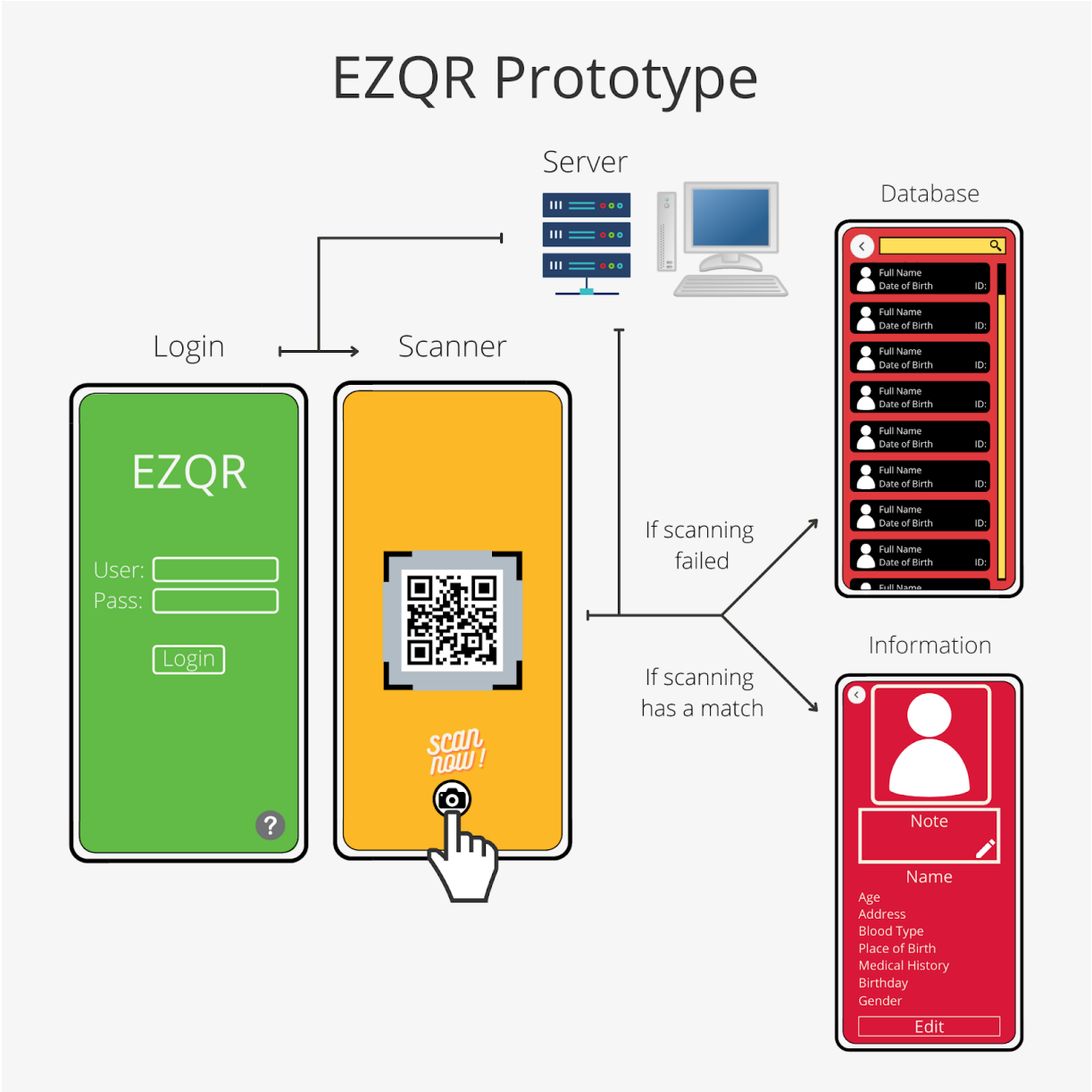

Figure 3. EZQR Prototype

For us to test the prototype, we need users to operate our system. The doctors can use this system for their checkups and other patient services for a whole day. The physicians will have a copy of the QR code application, and patients will have a QR code ID for the doctors to use. The QR code ID is distributed to the patients. The data collection of the system will gather all the information that the hospital needs for its service. After a whole day of sample testing, we will give forms for the doctors about the new system.

J. Risks and Safety

The health risks and safety that needs to be considered are eye strains. Soaking yourself to your phone is awful. It can make your eyes burn and itch. Too much use of gadgets may also give you headaches. While the risks of this study are:

1. The leakage of patients' information;
2. The possibility of hackers decrypting patients' data and;
3. The alteration of the patient's data without being detected

K. Statistical Analysis

Since the researcher used a survey in gathering the data for this study, copies of the questionnaire, stated in English, are used to interview the selected sample. In this part, the researcher will also get the views and opinions of the samples throughout the three trials. The statistical treatment that the researcher chose is Narrative Analysis. The researcher will narrate every statement of all the participants.

L. Expected Output

The researchers foresee that this study will help operate more efficiently, securely, and briskly for the vital work of hospitals here in the Philippines. The researchers also presume the receptiveness for both the patient and clinics.

M. Personnel Requirement

One of the essential factors toward developing this research is the personnel. The researchers will be working full and part-time toward this project. It's recommended that the program personnel exhibit positive characteristics, such as flexibility, professionalism, caring, assertiveness, and thorough training to provide a high quality of assistance and output.

(9) EXPECTED OUTPUTS AND POTENTIAL IMPACTS

- The researchers foresee that this study will help operate more efficiently, securely, and brisk for the vital work of hospitals here in the Philippines. The researchers also presume the receptiveness for both the patient and clinics.

(10) WORK PLAN AND TARGET DELIVERABLES

Activity	Week
FIND & CONTACT HOSPITAL MAKE APP	

TESTING ANALYZE RESULTS DISCUSSION	

(11) REFERENCES

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~NOTES

To do (Research):

- [ ] EXECUTIVE SUMMARY
- [ ] REVIEW OF LITERATURE
- [ ] WORK PLAN AND TARGET DELIVERABLES
- [ ] Grammar Checking
- [ ] Video Making
- [/] THEORETICAL FRAMEWORK (Malapit na <3) (dematerialization?)
- [/] DM PAGE 12 (Patapos naman na / slight)
- [/] MGA SUGGESTIONS NI MAAM KAY