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RFID Based Smart Health Card for Managing Patients Medical Records

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Abstract: Smart cards are an efficient and safe solution to store medical information. Smart cards, on the other hand, give immediate access to medical information, protect medical privacy, and provide regulated access to data. They are also compatible with all Medical Information Systems, networks, and apps. The innovation of this smart e-health card is to store the digital data every time an appointment is construct by patient and doctor. It is equipped with Arduino Uno, Arduino Ethernet Shield and RFID reader with tag and card. The implementation of this system only require user to scan the card and the digital data will be stored in the system. The traditional data collection such as filling a form are taking longer time and it is not effective. The forms also can be misplaced and a lot of time are required to find the data of a person. With RFID technology, this issue can be solved as it only required user to scan, therefore, digital data of the patients will be stored in the system.

Keywords: RFID, e-Health, Medical Records, Smart Card

1. Introduction

The number of patients who use health services such as in hospitals or any health centre is increasing nowadays. As the number of patients increases, so does the patient data also increase and needs to be well stored into the healthcare system [1]. The identification and monitoring of patients are two processes that modern hospitals are especially interested in improving in terms of quality and effectiveness [2].

Extensive patient data also causes the time taken for health management to be long [3]. They need to peruse each patient's file to find the data they need. Accordingly, their work became increasingly complicated [3]. When using the old way such as using files for patients it will take as long as difficult to find back when needed and take up a lot of space to store a lot of patient data causing employees to have to find new space [4]. Although there is a system that is able to facilitate the work of doctors to handle this patient data, there is an error if important patient's data went missing and not available [5].

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However, with the availability of electronic medical records (EMR), it facilitates the work of doctors in the care system [6].

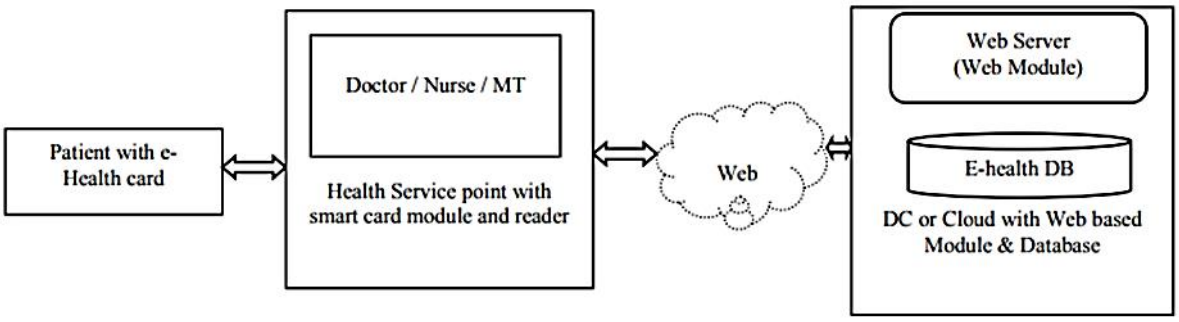

Figure 1: Cloud Storing Data for E-Health Smart Card [7].

However, every hospital has the freedom to select its own data format, utilise a different system, and store data in a variety of ways as example in Figure 1 [7]. As a result, access to medical information is severely hampered, and good physician-to-physician contact is not achieved [8].

The main objective of this project is to improve medical health data storing system. Other than that, this project aims to store data in cloud storing using RFID system. Next, this project aims to register RFID identification number in computer based medical record tracking system. This project also aims to increase security system for storing data in e-health smart card.

RFID is an abbreviation for Radio Frequency Identification. In this project, Arduino is used to create an RFID-based data storage system. The EM-18 RFID Reader is a straightforward yet useful gadget. It's an RFID module that's used to scan RFID cards. It is a new technology that is rapidly growing. It is now widely utilized in offices, where employees are provided RFID cards, and their data is registered when they touch their card to an RFID reader. In a nutshell, it is a new developing technology that is quite valuable.

2. Methods

2.1 Workflow & Flowchart

RFID tags and readers, an easy-to-use User Interface, and a local server make up the automated Hospital administration system. In terms of patient identification and medicine authentication, passive RFID tags was used often, whereas active RFID tags will be used more frequently for tracking purposes. Each hospital department and region will have its own Active Readers stationed across the facility. The RFID reader reads data from the tag and sends it to the application, which filters, analyzes, and records the data in the back-end database before passing it on to be processed further. It is anticipated that the system will use a combination of wired and wireless networks to transmit data between the many readers situated throughout the system. Each patient gets an RFID card, and the HMS will maintain and monitor their medical data. By utilising their RFID, patients may schedule appointments [5].

The patient information system is the primary component of the system's software design. The card information may be handled in the application's information system after RFID connection has been established [6]. Figure 2 depicts the architectural diagram.

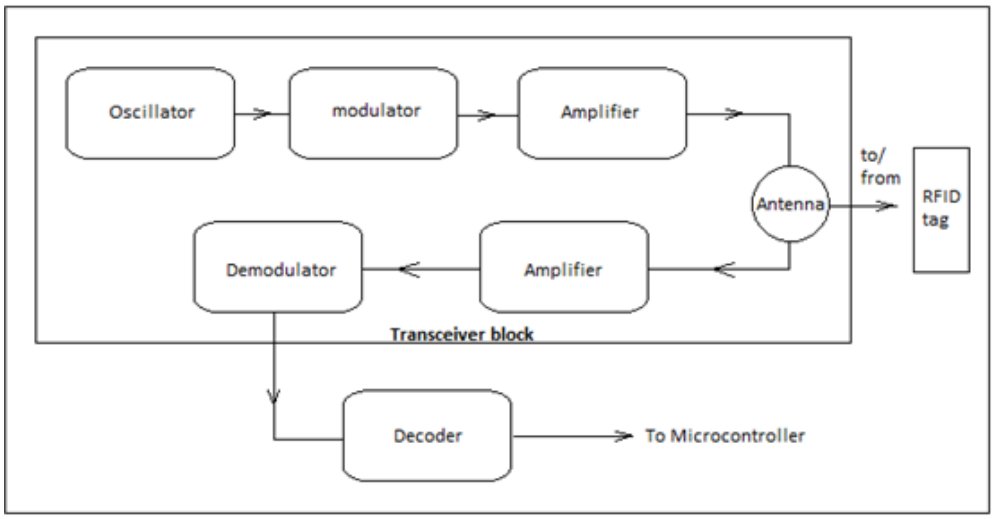

Figure 2: RFID Flowchart

2.2 RFID Smart Card Design

RFID tags, RFID readers, a local server, and an easy-to-use User Interface make up the automated Hospital administration system [1]. In terms of patient identification and medicine authentication, passive RFID tags will be used the most often, whereas active RFID tags will be used more frequently for tracking purposes [2]. Each hospital department and region will have its own Active Readers stationed across the facility. The RFID reader reads data from the tag and sends it to the application, which filters, analyzes, and records the data in the back-end database before passing it on to be processed further [2]. It is anticipated that the system will use a combination of wired and wireless networks to transmit data between the many readers situated throughout the system [3]. Every patient will be given an RFID card, and the HMS will maintain and monitor their medical data. By utilising their RFID, patients may schedule appointments.

2.3 Components Used

Figure 3 shows the components that was used in this project. There are 3 basic components which are Arduino UNO, Ethernet shield and RFID RC522 reader with tag & card.

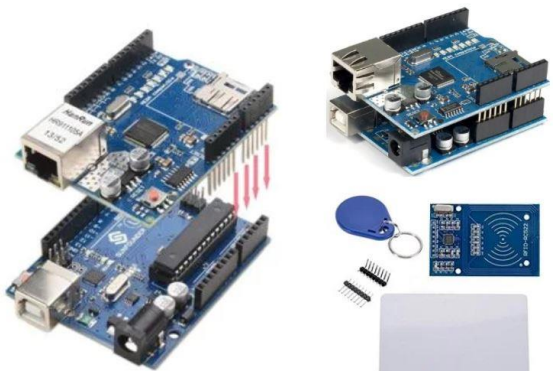

Figure 3: Arduino UNO, Ethernet Shield and RFID RC522 Reader with Tag & Card

1) Arduino UNO:

A microcontroller board called the Arduino Uno is based on the ATmega328P processor (datasheet). It contains 14 digital input/ouput pins, six of which are PWM outputs, six analogue inputs,

a reset button, a USB connection, a power connector, an ICSP header, and six analogue outputs. A low-cost, adaptable, and simple microcontroller board that may be used in a variety of electrical applications is the open-source programmable Arduino UNO. To control relays, LEDs, servos, and motors as an output, this board can be interfaced with other Arduino boards, Arduino shields, and Raspberry Pi boards.

2) Ethernet Shield:

An RJ45 connection and a few basic steps are all it takes to start managing the programme over the internet by plugging this module into an Arduino board, connecting it to network, and following a few simple steps. The Ethernet shield and Arduino board is connected to computer using a USB cord as usual to upload sketches to it. The board can be unplugged from computer and powered by an external power source after the sketch has been submitted. The usage of a cross-over cable may be necessary when connecting to a computer.

3) RFID RC522 Reader with Tag & Card:

Through SPI, the microcontroller and card reader interact (the chip supports I2C and UART protocols, but the library does not). A 13.56 MHz electromagnetic field is used for communication between the tags and the card reader. The RFID RC522 reader and tag are depicted in the Figure 4 below.

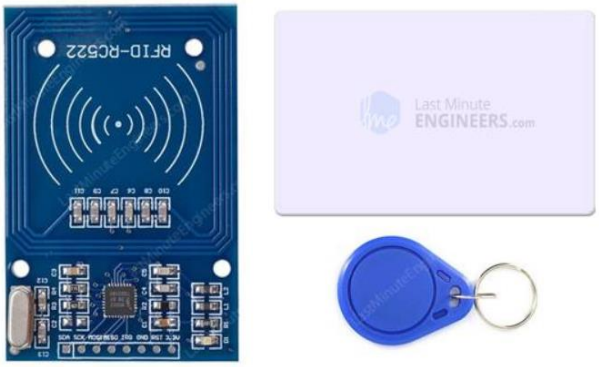

Figure 4: RFID RC522 reader with tag and card

3. Results and Discussion

3.1 Results

For this project, library Arduino UNO, PushingBox, Google sheet & Google app script was used to run this project. In order to connect with the Arduino and Ethernet shield, the coding was inserted in order for it to connect. Figure 5 shows the Google Sheet data as the result of the project while Figure 6 shows the pushingbox tool interface for the project.

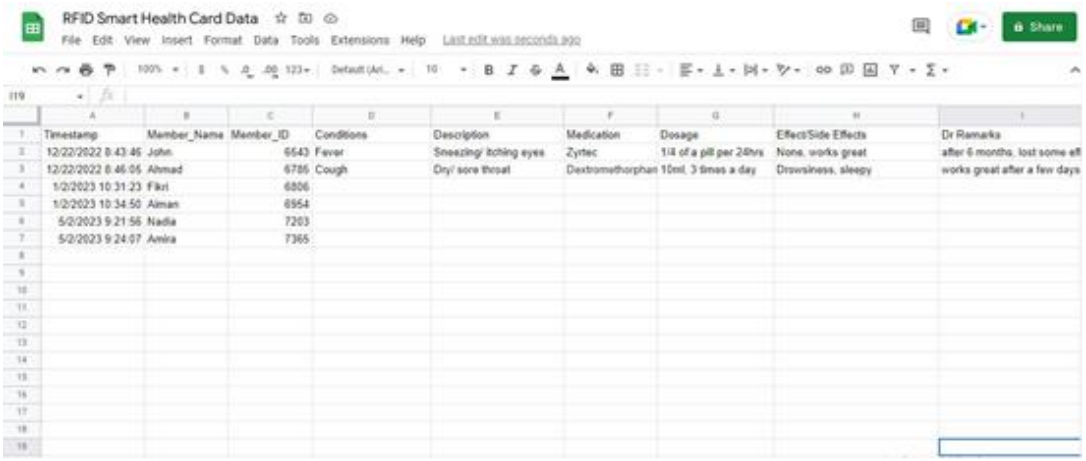

Figure 5: Google Sheet for Storing E-health Patients Data

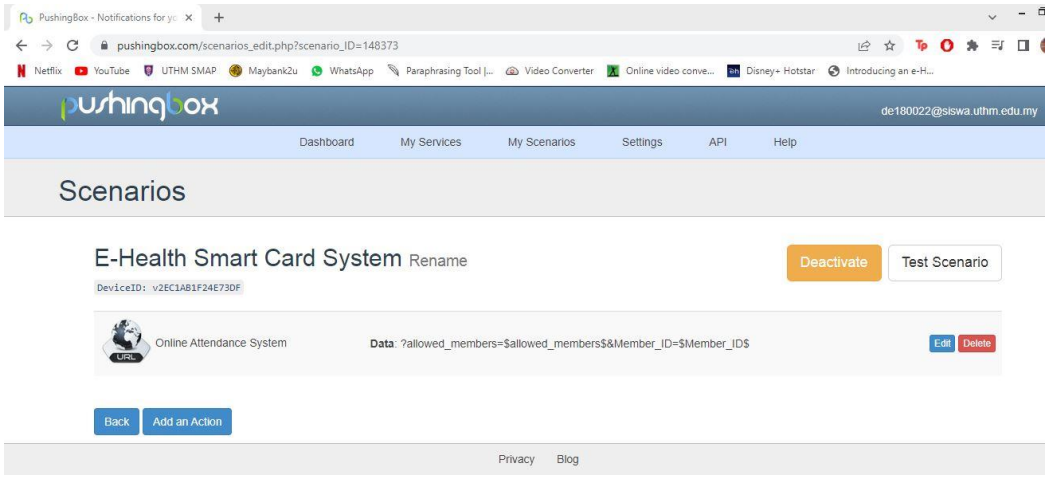

Figure 6: Pushingbox Tool Interface

When the card is touch to the sensor, the patients ID, name, time and date of the appointment is recorded into the system. All the recorded data will be stored in the google sheet as shown in Figure 5. Pushing box tool is use in this system to push and insert the data from Arduino to the google sheet. Google app script is used as a command for the data storing operation. The system is convenient as the data and information of a patient ongoing an appointment is automatically recorded. This can save some time and make health care system operation more efficient and constructed.

Figure 7 shows the connection of RFID card reader and Arduino Ethernet Shield. Arduino Ethernet shield is combined and connected to the RFID card reader based on the connection shown. The hardware is connected based on the connection shown in Figure 7 and tested. Figure 8 showed the prototype of smart e health card with RFID tag and Arduino Ethernet Shield. Based on the testing, the prototype is working and given the output as shown in Figure 5 when the card is touch on the card reader.

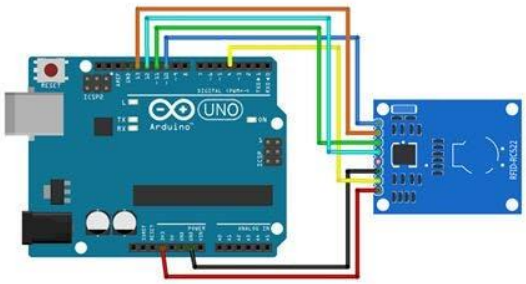

Figure 7: Pin connection of RFID card reader and Arduino Ethernet Shield

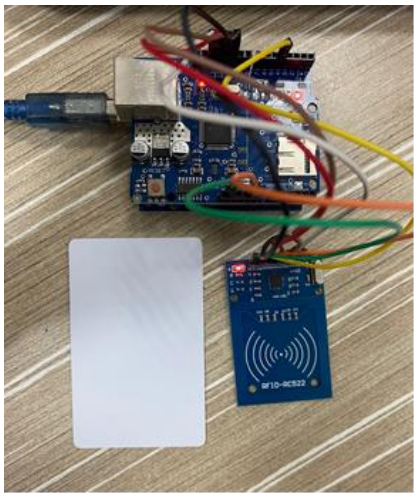

Figure 8: Prototype of the System

Step by step of how the RFID smart card system processing the data:

1) The RFID card touch the RFID RC522 sensor, this process will allow card to automatically upload the data stored into the system.
2) After that, Pushingbox tool will allow the system to push and insert the data from Arduino to the google sheet.
3) Google app script will act as command for the data storing operation.
4) The RFID card works whenever the card touches the sensor. It allows user to use it multiple times.
5) Then, the system will automatically record patient's ID, name, timestamp and date. This will enable users to record the medical data of patients.

Google sheet is accessible so that it is convenient for user to manually update the medical records anytime.

3.2 Discussion

Several opportunities can be seen to cut healthcare operational expenses after assessing the RFID smart card. This smart e-health card might improve the treatment queue, expenditure, illness diagnosis, and accountability of physicians and pharmacists. This initiative will also be able to persuade individuals to correctly utilize the planned e-Health card and take use of its benefits, making access to patients more effective. The suggested e-Health smart card RFID technology would then serve to

improve the quality of the health care system. It can also store data and analyze information while allowing numerous people to use one computer sequentially. The security of the system however did not achieve the objective of this project. There is no security measure apply to the system.

4. Conclusion

Smart healthcare as a whole has huge promise. Medical services can be obtained quickly and appropriately, as there is no need to go through a lengthy registration process, and the content of medical services will be tailored to the individual's needs. Systematic healthcare system can assist medical facilities in reducing costs, freeing up staff time, streamlining the flow of materials and information, and easing the patient's experience. Smart healthcare has the potential to alleviate existing levels of medical resource disparity, promote medical reform, promote the use of preventative approaches, and reduce societal medical expenses. However, there are still a few outstanding difficulties in this project which is the security measure for the card system. There is no security apply to this project card system especially the storing data system for the patients. If these difficulties are to be overcome, patients, doctors, hospitals, and technology companies must collaborate to discover answers for future research.

Acknowledgement

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