WEB-BASED MEDICINE DISPENSER SYSTEM USING RFID CARD

BY

Tan Qin Huan

A REPORT

SUBMITTED TO

Universiti Tunku Abdul Rahman

in partial fulfillment of the requirements

for the degree of

BACHELOR OF INFORMATION TECHNOLOGY (HONS) COMPUTER ENGINEERING

Faculty of Information and Communication Technology

(Kampar Campus)

MAY 2018

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ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to Universiti Tunku Abdul Rahman for providing us an opportunity to undertake and complete this project.

I am very thankful to my supervisor, Mr. Teoh Shen Khang who suggested me this project and gave me this opportunity to take part in this project. Thanks for the guild he has been given to me. It is my first experience to do such a project involving many fields.

It is unfair without mentioning my friends and family. I am grateful to my parents and friends for their support and encouragement when I am doing this project. It has been a wild ride.

ABSTRACT

Nowadays, the use internet are very common and popular in our real life, most of the thing and device are connected with internet, for example, TV, Smartphone, Laptop, etc., which linking from the virtual world to our real world. Internet of things (IoT) gives us many advantages like increase our life quality and bring many convenience. IoT was also widely used in many sectors, for example engineering, robotic, nanotechnology, hospitality, banking service and so on. Dispenser System machine (a.k.a. vending machine) also consider as one of the IoT in our real life, most of the common vending machine that can see like soda vending machine, candy bars vending machine, snacks vending machine, cigarette vending machine and so on. Vending machine are very popular and widely common use in our real world, but never seen there is any medicine dispenser system machine existing in our real-life. Therefore in this project, medicine are used as our product scope instead of other products like soda or candy bars. Furthermore, most of the transaction that done in the vending machine that commonly seen in our real life was using cash payment system. To make the system more towards on real-time functions, which are also one of the goals from the IoT scope, the system was going upgrade into cashless payment system which means that customer can just use RFID card on transaction without any cash involvement. Cashless payment system bring a lot of benefit and ease to everybody, advance in business management system and improve management into more secure and safety condition. Therefore, this is one of the motivation and purpose of implementing this project. The aims of this project is using the connection and functionality between the hardware and software to build an enhance dispenser system. All the software functionality was done and controlled by using Raspberry Pi whereas the hardware functionality was using Arduino Uno Board to carry out the mechanical and technical function on this dispenser system. The main objective of this project is using cashless payment system (RFID card) as transaction method by replacing cash payment system. Besides that, this project also attempt to emphasize the connection and working between the software and hardware when implementing this project. And most importantly, this project also attempt to bring out non-real worker business function management.

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LIST OF ABBREVIATIONS

Abbreviations	Description
a.k.a	As known as
DC Motor	Direct Current Motor
EEPROM	Electrically Erasable Programmable Read-only Memory
Et. Al.	And others
Etc.	And So On
FYP	Final Year Project
HTML	Hypertext Markup Language
IDE	Integrated Development Environment
IDLE	No action
IoT	Internet of Thing
IR	Infrared
LAMP	Linux, Apache, MySQL, PHPMYADMIN
LCD	Liquid Crystal Display
MDS	Medicine Dispenser System
MISO	Master In Slave Out
MOSI	Master Out Slave In
MYSQL	My Structured Query Language
OS	Operating System
PC	Personal Computer
PHP	Hypertext Preprocessor
PVC	Polymerizing Vinyl Chloride
RFID	Radio Frequency Identification
SCK	Serial Clock
SDM	System Development Method
UID	Unique Identification
URL	Universal Resource Locator
USB	Universal Serial Bus
Wi-Fi	Wireless Fidelity

Chapter 1: Introduction

1.1 Problem statement

Although those vending machine that common seen and exist in our real life is good enough but it still can be done a lot of improvement to make it more perfect. Usually nowadays vending machine was done in cash payment system, however, there is a limitation for the machine to store all cashes or coins inside since most of the space was occupy by the hardware wiring and product storage. When these coin/cash storage is fully stored, it may not accept the cash or coin for the next customer transaction, user had to call the administration to figure out this problem like collect all the moneys in the machine so that customer can continue to buy a product for himself/herself. Some common problem that customer usually faced when they was going to buy the product from the machine like, the system is not accepting the cash due to the crease on the cash itself and sometime the system was unable to read and accept the particular cash. This was very inconvenience for customer when they had enough money to pay but unable to buy their product they want. Besides that, customer may need to insert the cash or coin one by one in order to reach the product price requirements. This will give inconvenience to the customer and consuming a lot of time in order to purchase a product from the machine.

Another problem faced in currently vending machine system is the system doesn't provide the out of stock signal to the administrator in order to tell them that restock of product in the machine is necessarily be done as soon as possible. Administrator doesn't know the accurate time and possibility to restock the product inside the machine. Sometimes, the machine was leave in out of stock status in a month and lead to business flow suspended. This lead to customer cannot buy their product they want in time. More to worst case, administrator have to check the system every day in order to avoid machine from out of stock status.

Most vending machine doesn't provide database system to record down the customer transaction report in that particular day. Administrator may not able to generate the transaction report for their finance and management purpose uses. Besides that, they also doesn't know how many product was sell in that particular day.

1.2 Background and Motivation

This project consist of implementation of hardware and software. The combination of hardware and software has been used to implement this project. The hardware used in this project like Arduino Uno Board, MFRC522 Card Reader, RFID Card, LCD 16x2, Servo Motor, Diffusor Sensor and potentiometer. Usually Arduino is used in building of electronic project and this board is also programmable. Arduino also provide an IDE software for user to write and execute their code when implementing hardware project. After that, user can burn the code into the board to make the board carry function according to program coded. To burn the code into board, user can just connect the board to the PC USB with Port B type USB Cable.

Coil springs droplet system has been used in this project. The coil springs were fixed with the servo motor. The servo motor will be triggered based on user choice and dispense the correct product from the machine. The diffusor sensor used to scan whether the item was dropped from the coils, when the product was scanned, it will sent the signal to stop the servo motor. The LCD will also updated the status of the system process. The contrast of the LCD able to adjust by using the potentiometer. The RFID Card Reader was used to scan the customers RFID card. Customers can use RFID card to purchase the product they want through the system instead of using cash payment system.

Raspberry Pi also one of the device has been use for implementing this project. Raspberry Pi is like a minicomputer with contain of Linux OS (Raspbian OS). The purpose of using this device was mainly used in communication between software and hardware. In order to do that, Python code was used to communicate between Arduino (Hardware) and Raspberry Pi (Software). Whenever that is a transaction done in the software, the software will sent the signal to the Arduino (Hardware) and dispense the product from the machine to the customer.

Another use of Raspberry Pi is to create our webpage with PHP and HTML coding style. Customers can goes through the webpage to register their RFID Card, Top-Up RFID Card credit, and purchase the product. Besides that, admins can configure their stock maintenance and customer card maintenance through the webpage. The creation of database is necessary with MYSQL platform in order to save data and any action done in webpage will automatically update into the database record.

With the help of database, system able to generate the self-transaction report and RFID Card profile when customer requested. On the other hand, the system also able to generate customer transaction report and stock report for admin purpose uses.

To launch whole this project, all these hardware part must be wiring to the Arduino Board in order to execute them. Raspberry Pi must power up with 5v adapter and Arduino Uno Board must connected to it in order to do their own function. Python code in Raspberry Pi must execute first to open the communication between these two devices. If Python Code is not open, the Raspberry Pi cannot send data to the Arduino Board and generate/dispense the product from the machine.

The motivation of implementing this project is to bring vending machine system into more real-time system. When customer/admin doing some update and configuration, Raspberry Pi will immediately update the database data. After customer purchase product through the webpage, Raspberry Pi will send signal to Arduino Board and generate the correct signal to the servo motor in order to dispense correct product from the machine. On the other hand, implementing cashless payment system into the system was necessary since it gives a lot of convenience and easy to implement.

(Notes: Medicine are not included control medicines which are illegal to sell according to Malaysia act of law, all of the transaction between control medicines must getting the permission from doctor or professional surgeon. Basically the medicines inside the machine are usually common sell at outside pharmacy like Panadol, Flu medicine, Cough medicine and etc. All of these medicines are having guarantee and permit from the government and is legal to sell in public.)

1.3 Project Scope

The project scope are to develop a medicine dispenser system in that particular area for convenience purpose and even customers doesn't need to go pharmacy to buy certain medicines. This project scope also aims to tackle problems and limitation stated at **Section 1.1: Problem Statement.** Cashless payment system was proposed in this project. This system can bring a lot of convenience and also can be used to encounter the problem statement. With the implementation of this system, customer may not need to bring a lot of cashes in order to buy the product they want. On the other hand, customer also no need to insert the cash one by one in order to reach the product price requirements. They just need to buy the RFID card from the admins, scan the card and all the transaction would be just be done within a short time. All the RFID card must be registered into the system by admins and after that customer must activate their card through webpage in order to access transaction process.

Installation of LAMP server (Linux, Apache, MYSQL and PHPMYADMIN) into the system is necessary in this project. All these servers must be installed and configured into Raspberry Pi for working on software functionality. Next, installation of PHP server as webpages coding language has been used in this project. These server are very convenience for implement software function since all of them can be connected to each other. To access webpages, customer/user have to register their account before they can logged in, whenever there is a new customer/user register, all the information will be save into the database. All the logged in information must perfectly match with the information in the database. Any unmatched result the system should not allow to log in and access into the webpages. Next, all retrieve information requested (account profile, RFID card profile, etc.) by user/customer and correct information was correctly display to them from the database. With the help of MYSQL server, all these criteria can be maintain easily.

Admin can using this webpages to register, delete and update the stock information, all the stock configuration will automatically save and update into the database system. The system was able to deduct the stock quality of particular product from the database after the transaction has been done. If all product inside the machine

was out of stock, the system should not allow any transaction can be done within these period until the admin has restock the product.

Next, report generator was built in this project like customer transaction report which was convenience for customer or admin to check and revise back their transaction history. Besides that, admin also able to view this report for their record purpose use. Customer registration report also able retrieve to admin for the backup record uses, in case that customer has forgotten their username or password of the account, admin can gone through this report to help customer solve this problem. The system also able to let customer revise back their top-up credit RFID card history, they can check the latest credit in the card, how much credit they had been top-up, and able to identify whether the top-up process are done by themselves or administrator.

This project also emphasize between hardware (Arduino) and software (Raspberry Pi) communication like how to send data from the Arduino to Raspberry Pi and vice versa by using the help of python code. Whenever there is a transaction done in a webpage, the system will save the transaction details into the database. When customer scanned the RFID card from the RFID reader in the machine, the Arduino will send the RFID card number to the Raspberry Pi and check whether the customer has done the purchasing process through the webpage. If there is a transaction record found, the Raspberry Pi will send a signal to the Arduino and inform the Arduino to dispense the correct product to the customer. However, if transaction was not found, the Raspberry Pi will send an error signal to the Arduino and Arduino will display an error message on the LCD screen.

1.4 Project Objective

The primary objective of this project to implement low budget system. This project was only used Arduino Uno Board, Distance Diffuser Sensor, LCD 16x2, MFRC522 RFID Scanner, RFID Card, and Raspberry Pi which are not expensive to purchase. Good programming skill was needed in order to configuration on the Arduino hardware or Raspberry Pi software.

The secondary objective is to implement cashless payment medicine dispenser system with the Arduino microcontroller device. All the transaction are done in RFID card without cash involve. All the RFID card must be registered by administrator and activate by customer/user through the webpage before they can purchase any product from the system. All unregister and inactivate RFID card was unavailable to buy any product from the system. In small conclusions, the aims of implement system using RFID card is to improve the quality of the security to the system.

The third objective is to design low-cost prototype. The good mechanical skill was needed in order to run the prototype perfectly although with just low-cost budget material. The hard-cardboard box has been used to implement for prototype design instead of using real steel machine which are over budget for this project.

The fourth objective is to implement the prototype with the communication of software and hardware. Both of these must dependent and stay connect with each other, if one of them is doesn't work, the machine will not dispenser any product from the machine. Besides that, these communication can make the system more convenience and advancement without involving any real worker is needed. The system will automatically generate and dispense the correct product to the customer. Most important is, these communication able to transform the system into non-button system and it can save a lot of budget on wiring button into the system.

The last objective is to implement a convenience and user-friendly system. The system must be ease to use and not complicated for customer use. The information was clearly mention to the customer and solution is given when they faced some problem during purchasing.

1.5 Impact, Significant and Contribution

This project aims to transform business into more intelligence and digitally ways. This will replace the traditional ways of normally business in our real-life. With the present of this system, all the business also can be done in normal even without the present of the owner. This dispenser system also provide many choices for customer to choose just like customer going to buy medicine in a pharmacy shop. Besides that, this vending machine also can represent as the first-aid in our life. When someone is need certain medicine in first time but they just realize they had finished the particular medicine and don't have extra in their house/office, customer can just buy the medicine through dispenser system which is locate near from them. Customer can just buy the medicine without going to pharmacy that far away from home/office. Therefore, this can ensure that customer can get the emergency treatment as soon as possible and avoid delay of time in buying medicine from pharmacy which may take risk of patient life from first aid. Additionally, this system was also work in 24 hours in all day. Normally pharmacy or clinic doesn't open in 24 hour in all day, so with this system implement, customer can get the first aid anytime even in the midnight. Apartment, School and even office also can implement this vending machine near the area from them as first-aid kit.

This system using cashless payment system (Card Reader) which is used to replace the traditional ways of cash/coin operated system. The purpose of changing this particular system is to transform business into more real-time transaction and more enhance ways on business management. Cashless payment system also save a lot of budget on project implementation compare with cash payment system. Usually Coin/Cash Acceptor System in market price was double or even triple price from the Card Reader. Besides that, Coin/Cash Acceptor also hard and need a lot of fees to maintenance compare with Card Reader. Using cashless payment also can boosted in security of the system compare with traditional ways (cash/coin operated system). In traditional ways, because of vending machine was not having person in charge, thief can stole the money away from the machine easily. Now with this cashless payment system, this can overcome this problem and provide business protected. By implementing this system, life quality will be improved and provide more efficiency business management.

1.6 System Flowchart

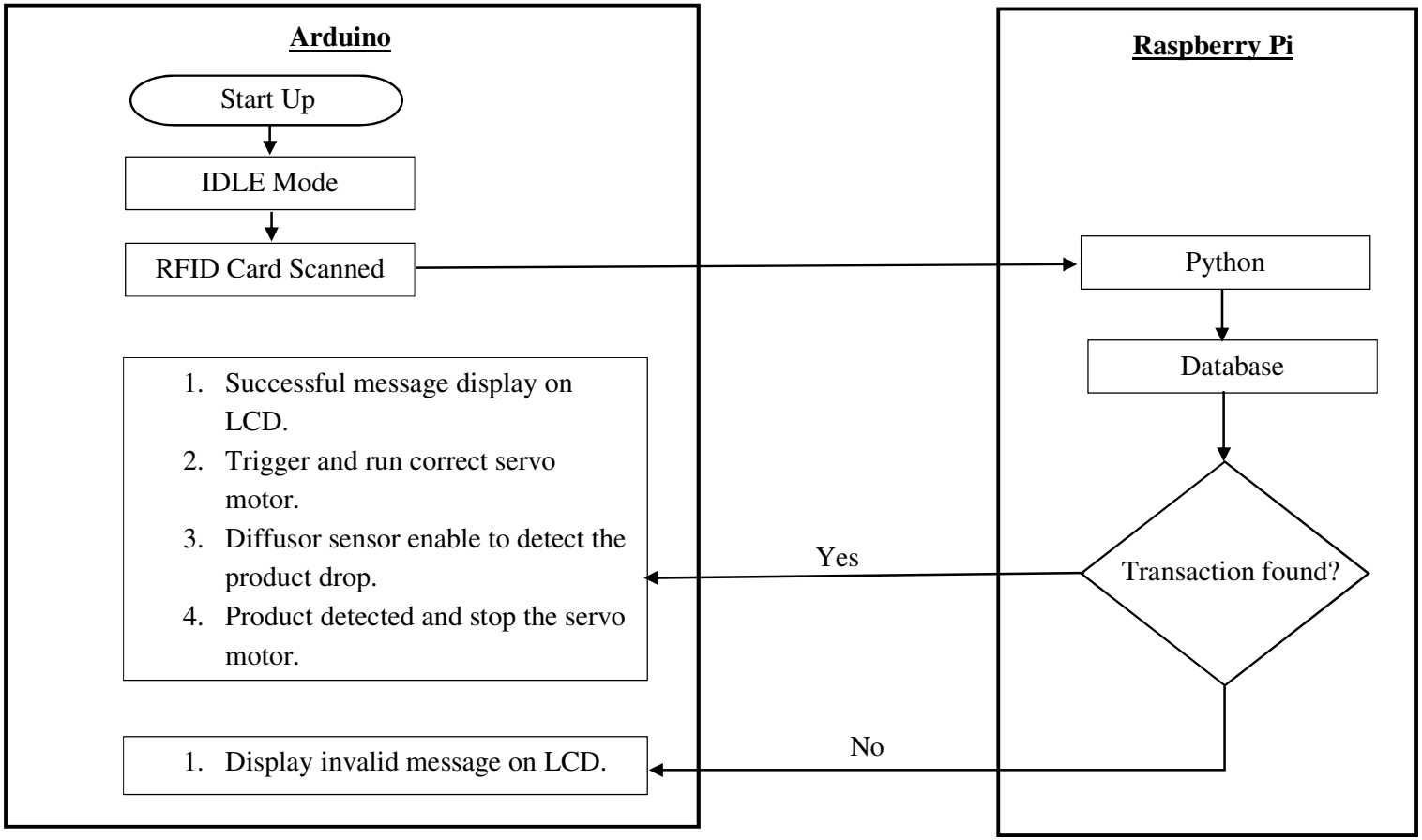


Figure 1.1 Overall System Flowchart Diagram

1.7 Achievement

1. All the registration information are able to store into the database. Customer can view their account profile with the correct data retrieve given. Customer also able to update their profile and database update also included.
2. All the RFID card information are able to store into the database. All RFID card must register by admin and activate by customer then only can access the transaction process on the webpage. Non-register account are not available to access the particular transaction site.
3. The credit value in the card are able to deduct from current credit value after the transaction has been done and immediately update into database.
4. All RFID card credit are able to top-up either by customer or admin through the webpage. The system are able to sum up the current credit value with the amount of credit that customer wanted to top-up. The credit in the database will update immediately after the top-up process done
5. Customer able to view their own transaction report, RFID card profile and top-up credit transaction report. All the result are retrieve from the database with the own customer username as condition.
6. Admin able to register, delete, update and view stock information in the machine through the webpage. All the action done will be immediately update into the database.
7. Admin able to view customer account list, RFID card list and transaction list in the webpages. Admin also able to help on top-up customer RFID card credit and delete the RFID card from the database.
8. When card reader read scanned RFID card, Arduino will send the RFID card number to the Raspberry Pi through the serial communication. At Raspberry Pi, it will check on the database whether the transaction is found based on the RFID card number.
9. Raspberry Pi and Arduino able to communicate with the serial port. If one of them is malfunction, any transaction process will not be going and progress until the administrator fix the issue.

10. If transaction found, Raspberry Pi will send the signal back to the Arduino to trigger the particular servo motor in the machine based on the choice of the product choose by the customer. Successful message will be display on the LCD screen to notify customer that transaction is successful.
11. If transaction not found, Raspberry Pi will send invalid message to the Arduino. Invalid message will be display on the LCD screen to indicate that invalid RFID card was scanned.
12. Out of stock message will be send to admin email to note admin that restock need to be done immediately.
13. All wiring in the machine must get connected in good condition and hardware like card reader, sensor and servo motor must always functioned 24 hours.
14. Good prototype is built and ready to go-live.

1.8 Report Organization

Chapter 1 – Introduction of the project (Problem statement, Project Background, Project Objective, etc.)

Chapter 2 – Literature Review (Comparison of previous work with currently work.)

Chapter 3 – System Design (Details on development of the project, system process flow, etc.)

Chapter 4 – Methodology and requirement of the project.

Chapter 5 – Test Program (Website design)

Chapter 6 – Implementation and Testing

Chapter 7 – Conclusion (Improvement of the project)

Chapter 2: Literature Review

2.1 Literature Review

Through the research, there are some similar products also related with this project. Comparison of the strength and weakness of these product throughout the research are mention in this chapter.

One of the products called “Snacks Vending Machine Powered by Arduino” and was developed by (Sevenmojoe, 2015). The aim for developer to create this project is to implement a snacks vending machine powered by Arduino with a simple and cheap components. Author had also used Arduino board as the hardware background implementation. This product was using coin acceptor method transaction. Author has create coin slot that only accept 500 Rupiah and 1000 rupiah. Other than that the system will not accept and drop to certain place to give back customer. Besides that, author has use magnetic field way to identify between these two rupiah, these two rupiah are made up of different material, one is silver and one is gold. Coins that affected by magnetic field will rolling down slower.

There are two proximity sensor place was used in this project, one is place at near to coin slot (sensor 1) and one at coin ramp (sensor 2). When the sensor sense the coin passes, it will trigger the Arduino and start timer counting that the coin travel from sensor 1 to sensor 2. This timer counting are user to determine and differentiate the value of accepted coin. (Sevenmojoe, 2015)

This project are also use infrared sensor to detect the product fall from spiral mechanism. When product fall is detected, the sensor will be trigger and stop the spiral mechanism rotating. (Sevenmojoe, 2015)

Figure 2.1 Complete Prototype Display Made by Sevenmojoe

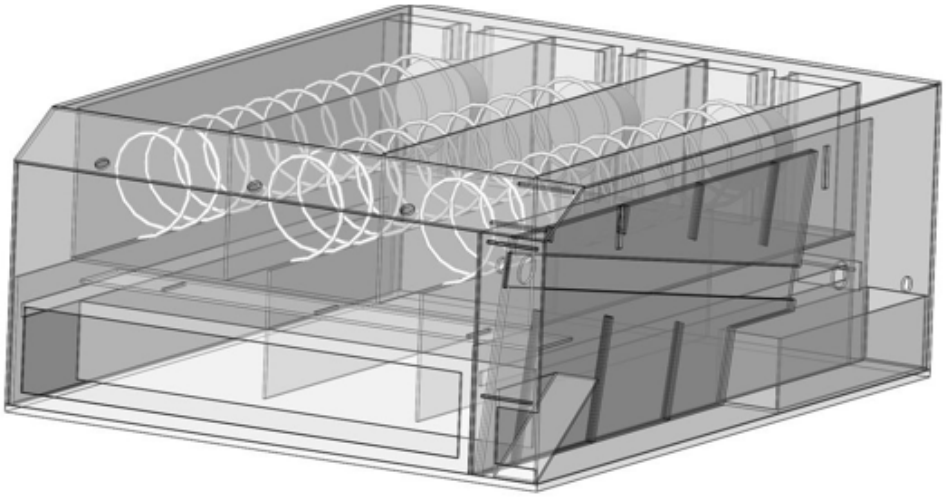


Figure 2.2 Prototype Model Design made by Sevenmojoe

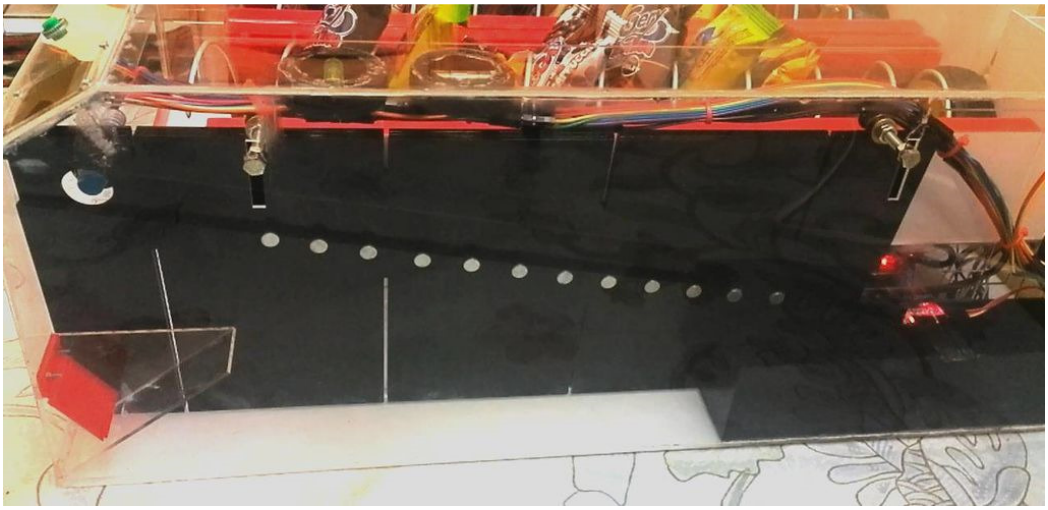


Figure 2.3 Build Coin Mechanism made by Sevenmojoe

Another product also related with this project is called “Automatic Chocolate Vending Machine by Using Arduino Uno” and developed by (Prof Desai, Et Al., 2017). The purpose of design this project is to launch new technology application like Radio Frequency Identification (RFID) and replace current coin based vending machine. Author had also used Arduino board as the hardware background implementation.

According to author description, he said that previous vending machine system make by others was unable to detect fake coin insertion. This is due to the system only senses the density and the size of the coin only, it is possible that insertion from fake coin may access the product out from machine. To prevent this case happen and solve this issue, Author has introduce RFID to replace with coin detector system. Different tags may attach with different serial numbers. Therefore, by using RFID, it can give more secure and safety uses on the system.

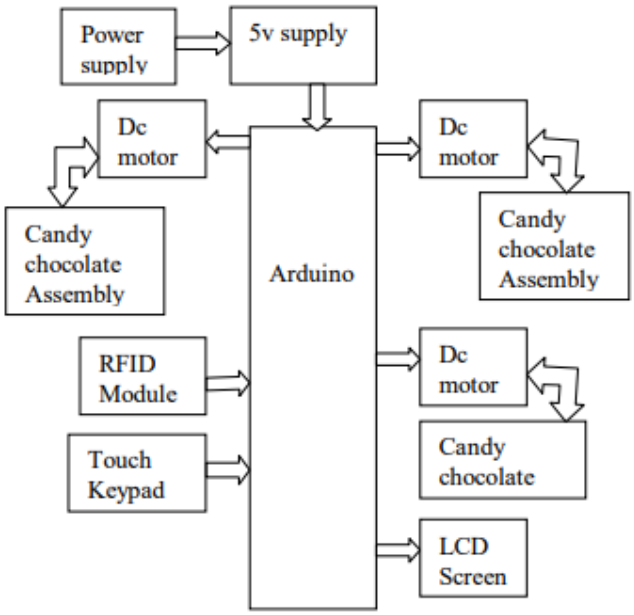


Figure 2.4 Block Diagram of the system

"Medicine Dispensing Machine Using Raspberry Pi and Arduino Controller" proposed and developed by (Prof Tank, Et Al., 2017) is also one of the product that related with our project scope. According to the authors said, they are emphasize that medicine dispenser system gives a lot of benefit and able to extend the most basic healthcare to all other places in very average cost. Besides that, authors also target on the working and communication between the hardware and software part. This system also able to give warning message to nearest chemist in pharmacy and indicate that the number of medicine strips was decrease and below a particular level. This warning message can give advice and alert to nearest chemist that restock is necessary to be done in a time.

According to the paper, authors using Arduino Mega 2560 Microcontroller as controller of the medicine dispensing and payment module. The system control and transfer the cash collected to the specific storage box inside the machine. Medicine will be dispense and system will return the change to the user if necessary. Next, with the help of LCD display, user will able to interact with the machine. According to authors said, the LCD will display a welcome message and consequently ask user to select their medicine they want to purchase. User have to press the switch to select the medicine they want to buy. After they had press the switch, the price will be shown on the LCD screen and user will be asked to insert the cash. (Prof Tank, Et Al., 2017)

Whilst, Raspberry Pi also used in this paper for identified the money image processing unit control. This paper also stated that, camera was configured inside the machine for system to identify the currency and its authentication. Take on note that, the system only able received 10 and 20 dollar only. Additionally, Authors also emphasize on serial communication with USB cable between Raspberry Pi (software) and Arduino (hardware) in this paper. To see the communication between them, if the denomination identified, Raspberry Pi will send the amount required to the Arduino board. If amount received is less than the price of the medicine, the LCD will display a message to ask user to place the money so that it meet required amount. (Prof Tank, Et Al., 2017)

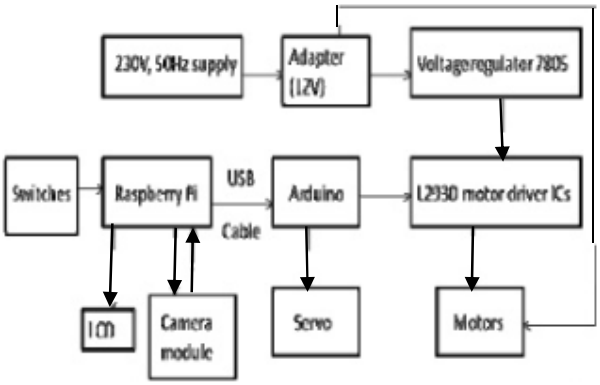


Figure 2.5 System Controller Interface

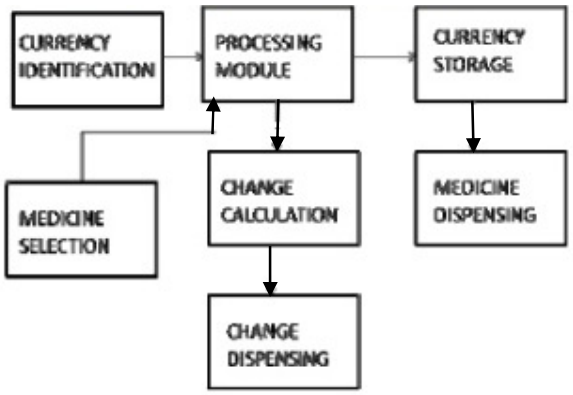


Figure 2.6 System operating flow and processing modules

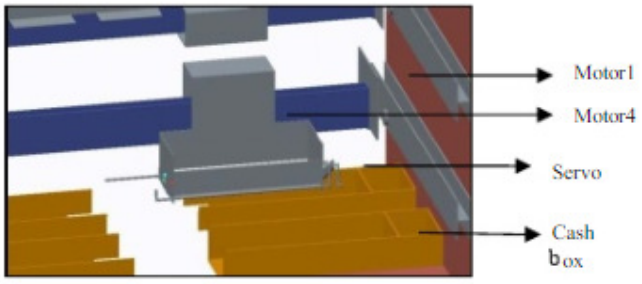


Figure 2.7 Cash collector mechanism

Another similar and look-like project was called "Voice-Enable Vending Machine with RFID Control" worked by (Bosch, Et Al., 2015). According to Bosch, although vending machines provide convenience access to food or beverages, but it may be not give convenience for students with disabilities to use. Some student with physical impairments may have faced problem when they tried to purchase the product they want (Bosch, Et Al., 2015). Therefore in this project was mainly aimed to solve the critical problem that faced by disability student. Disability students may have difficulty on inserting money, pressing on keypad for choosing their product and even retrieving their item out from machine. To solve all these problem, authors introduce voice-enabled vending machine with RFID control (Bosch, Et Al., 2015) as additional features for disability students. The machine provide audio feedback for guideline the user when doing selection and vending process. RFID card will be given to students for them to purchase their product.

According to this paper stated, the main objective for implement this project is to upgrade their current vending machine system into smart, voice-activated vending machine with RFID scanning capability and bank charging authorization for disability students (Bosch, Et Al., 2015). Combination work of RFID payment with voice control are discussed in this paper.

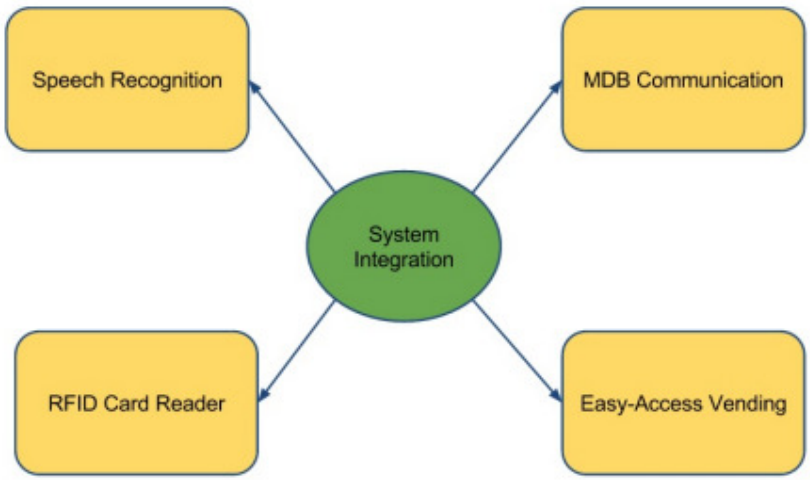


Figure 2.8 Project System Integration

2.2 Fact Finding

The strength of the first product which is a detection mechanism that able to detect product drop from the machine. This can ensure that customer was guaranteed can get their product drops after insert certain amount of coins. This implementation is necessary to give the system more intelligence and more secure. The weakness of this product is the usage of coin mechanism. Although coin mechanism is used in many years on implementing vending machine, but there is still some issue unable to prevented. As mention from second product author, coin mechanism cannot prevent from fake coin insertion as system only sense from the size and density of the coin detection. In this product, although it still can differentiate the different coin insert, but it still can't prevent that similar density and size fake coin is insert into the machine and able to access the product.

The strength of the second product is replace old coin insertion system by using Radio Frequency Identification (RFID) System. RFID is the wireless use of electromagnetic fields to identifying and track the tags correctness information. Different tags may have different serial number content. Therefore, RFID system can increase the quality and security of the system. The weakness of this product is product drop detection is not well known. Author doesn't include any proximity sensor that able to detect the product drop. They just set certain time for motor to rotate and drop the product. This cannot be guarantee that customer can get the product once they had make payment into the machine.

The strength of the third product is able to identify different currency with the help of using the image processing system. Different currency will be store in different storage box inside the machine. This system also able to send the alert message to nearest chemist and indicate that the stock in the machine is under certain level and restock is necessary to be done as soon as possible. The weakness of these product is product drop detection is not well known. The system also doesn't given alert on fully occupy on currency storage box to administrator, this may lead to error or problem will be happen when customer try to insert the money in order to purchase the product but the system was rejected the currency acceptation.

The strength of fourth product is using of voice-activated vending machine with RFID scanning capability. These features are really give a lot of benefit and convenience to disability people when they want to purchase their needed through the vending machine. Some disability people may have difficulty when they try to choose the product by pressing the button. With the voice recognition system, this help a lot for them when they try to purchasing the product. Besides that, some people may found money insertion is a troublesome way of transaction process. To overcome this problem, RFID scanning are introduce in this product. The weakness of this product is sometimes the system may not able get the voice recognition of the customer. This is due to some customer may had suffer heavy sore throat that lead to change of voice in sound and therefore system unable to recognition and transaction access is denied. Another weakness is the new RFID scanning features was only for disability person use only. These may lead to unfairness on the servicing behavior to the customer. This product was just adding new features into the existing system instead of changing the brand new system in the machine. The currency storage or product storage capability may be weaken due to the increase of the wiring inside the machine.

Product / Function	1st	2nd	3rd	4th	FYP
Arduino Board	Yes	Yes	Yes	Yes	Yes
Raspberry Pi	No	No	Yes	Yes	Yes
Coin/Cash Mechanism	Yes	No	Yes	No	No
RFID	No	Yes	No	Yes	Yes
IR Sensor	Yes	No	No	No	Yes
Touch Keypad	No	Yes	No	Yes	No
DC Motor	Yes	Yes	Yes	Yes	Yes
LCD Display	Yes	Yes	Yes	Yes	Yes
Image Processing	No	No	No	Yes	No
MYSQL Database	No	No	Yes	Yes	Yes

Table 1: Function comparison between 1st product, 2nd product and FYP

2.3 Critical Remarks

All of these product are using Arduino as the hardware background controlling and configuration. The mainly transaction mechanism between these product are using coin/cash operator system in first and third product and second and fourth are using RFID System. Coin operator system is the traditional ways implementation of vending machine. Customer just need to place the coins into the coin slot to buy the product they want. Although this is a very good system, but it was not secure enough. This system only detect the size and the density of the coin, but any item that made in shape like coin and even have a same density and size may allow pass through the system. A fake coins insertion will happen at here as common.

The best solution to solve the issue above is by implementing RFID system which used on second product. RFID system is more secure compare with traditional coin operator system. There is a scanner for customer to scan their card and make their transaction. Each customer has its own RFID card with unique identification registered into the card. Therefore, fake insertion is impossible happens at here. Additionally, RFID card have a small chips implements inside that can stored the customer information and even can store credit. Customer no need to use cash to buys the product, all the transaction can just be done with their cards.

The weakness in second product is the confirmation of product drop is not achieved. This system only used timer calculation to estimate on the product fall. If there is a small mistake on the calculation, customer may not get the product drop from the machine. To solve this problem, system checking is need to avoid customer from inconvenience caused. At first product, the author use the IR Sensor to detect the product fall from the machine. Once the system detected product fall, it will stop the motor rotating and ready for the next customer transaction.

The third and fourth product using Raspberry Pi as the software part configuration. Both these product also use Raspberry Pi as the database storage with the MYSQL Database platform. The third product used to store the currency image processing data while the fourth product used to store the RFID card information data into the database system.

Chapter 3: System Design

3.1 Description of the Project

Hardware needed in this project like Arduino Uno Board, Servo Motor, LCD 16x2 Screen, MFRC522 Card Reader, Potentiometer and Obstacles Infrared Sensor. All the hardware part must connected to the Arduino Uno Board in order to carry out their works and functions. Arduino IDE software has been used to write our hardware code and lately burn into the board to come out the hardware control and working function. Software has been used in this project is Raspberry Pi with the configuration and installation of LAMP server (Linux, Apache, MYSQL and PHPMYADMIN).

PHP and apache web server was using to create out webpage. There are two function are working out in this webpages, one is for user/customer and another is for administrator. Both of them will having different pages and webpages function. User/Customer can use our webpages to account registration, MDS RFID Card registration and product purchasing. Customer must register their account first then only able access into webpage. All the new registration will be save into database and customer also can view their account profile, RFID card information and transaction history through the webpages.

All the RFID card must register by admin and user must activate their card in order to start purchasing their wanted item. Account with unregister or inactivate card will not able to access the transaction webpage, the warning message will be shown to them to indicate that the register/activate of RFID must be done so that they can access the transaction process. The credit inside the RFID card must be able to deduct from the purchasing items and add from the top-up credit by customer or admins. After customer had purchased their item they want, the transaction information will be saved and card credit will immediately update consequently into the database.

On the other hand, admin pages has its own username and password in order to access the administrator webpages. Admins can use webpage to register the stock and will be display as one of the option choice in the purchase webpages. Admins also able to delete, edit and view the stock information through this webpages. All the stock data must be get up-to-date like the stock quality must be able to deduct in time after the transaction has been done. Admins also have authority to view the customer account

profile, customer transaction report, and customer card list. Admins also holding the main authority on configuring and managing the customer RFID card, deletion of customer RFID card only can done through by admins but not the customer.

The Arduino and Raspberry Pi are connected to each other with the serial port communication. Both of them will be send data to each other with the serial communication port. When the customer scanned their scan through card reader, Arduino Uno Board will send RFID number to the Raspberry Pi for it to check whether the transaction has been done before the card was scanned. If the transaction found, the Raspberry Pi will send data number 1 to Arduino Board and dispense the first product while number 2 is to dispense the second product in the machine. At the same time, the LCD will also display valid card was scanned and preparing the product. The servo motor will be stopped when the infrared sensor has sensed the product drop from the machine and LCD will display the product is ready to get. However, if the transaction not found, the Raspberry Pi will send number 0 to Arduino Board and LCD will display invalid card was scanned.

Most importantly feature in this project is the detecting out of stock alert and message to administrator. The system will send the message to the admins email and alert to them that restock must be done as soon as possible. The transaction process still can be done if one of the product still left inside the machine. However, if all product was out of stock in the machine, customer/user are not able to process the transaction webpages until the admins has restock the product and stock information updated.

3.2 Top-Down System Design

3.2.1 Overall Diagram

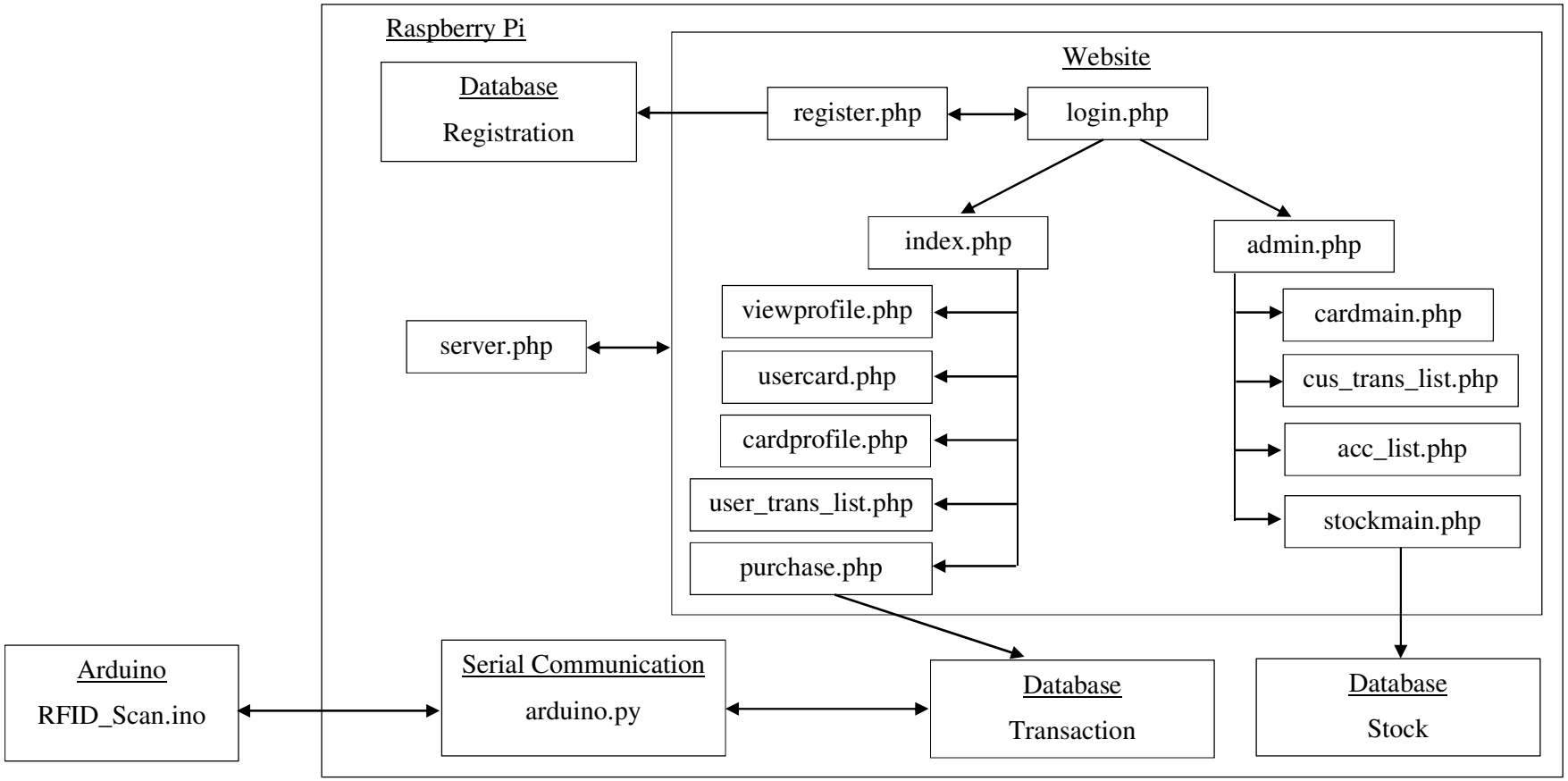


Figure 3.1 Overall System Diagram

3.2.2 Customer Webpages Design and Process Flow

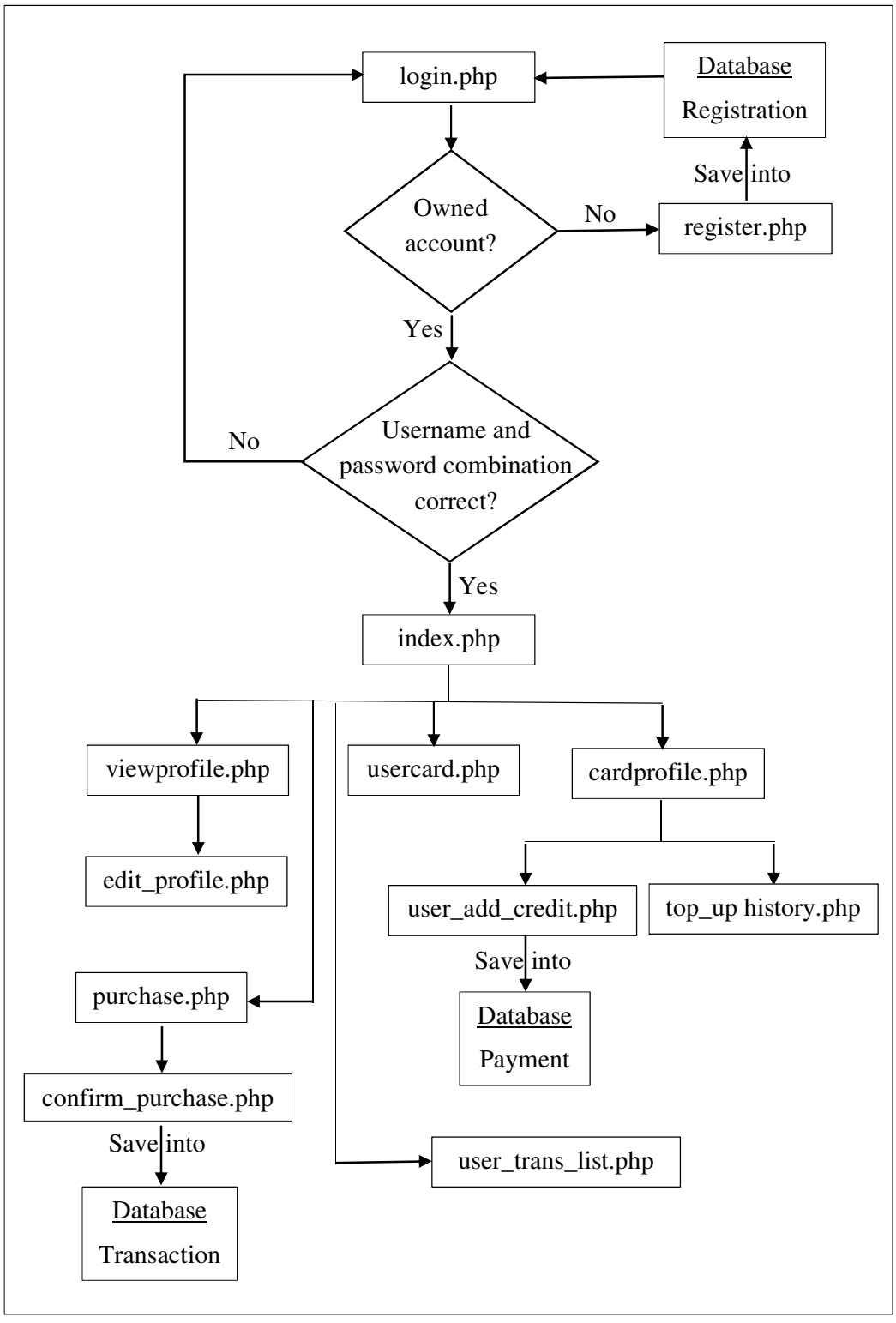


Figure 3.2 Customer Webpages Design (PHP and HTML)

Webpage Function Description

Website	Website Name	Description
login.php	MDS Login Page	• For user to login their account
register.php	MDS Register Page	• For new user to register their account, details will be save into Registration database
index.php	MDS Home Page	• MDS Website Home Page (User view)
viewprofile.php	MDS Profile View Page	• For user to view their account profile (own user row data retrieve from Registration page)
edit_profile.php	MDS Edit Profile Page	• For user to edit and update their account profile (update own user row data in Registration database)
usercard.php	MDS Card Register	• For user to activate their MDS Card
cardprofile.php	MDS Card Profile View Page	• For user to view their MDS Card profile (Card Number, Credit Left)
user_add_credit.php	Add Card Credit Page - User	• For user to top-up credit of their MDS Card (User Top-up view)
top_up_history.php	MDS Card Credit Top Up History (User View)	• For user to view their top-up MDS Card history
purchase.php	MDS Purchase Page	• Purchase item page with the user card profile view and stock list available
confirm_purchase.php	MDS Confirm Purchase Page	• For user to confirm the item they want to buy before the transaction done.

user_trans_list.php	MDS Transaction List Page	• For user to view their transaction list after transaction done (purchase time will be display)

Table 2: Customer Webpages Design with each website function description

3.2.3 Admin Webpages Design and Process Flow

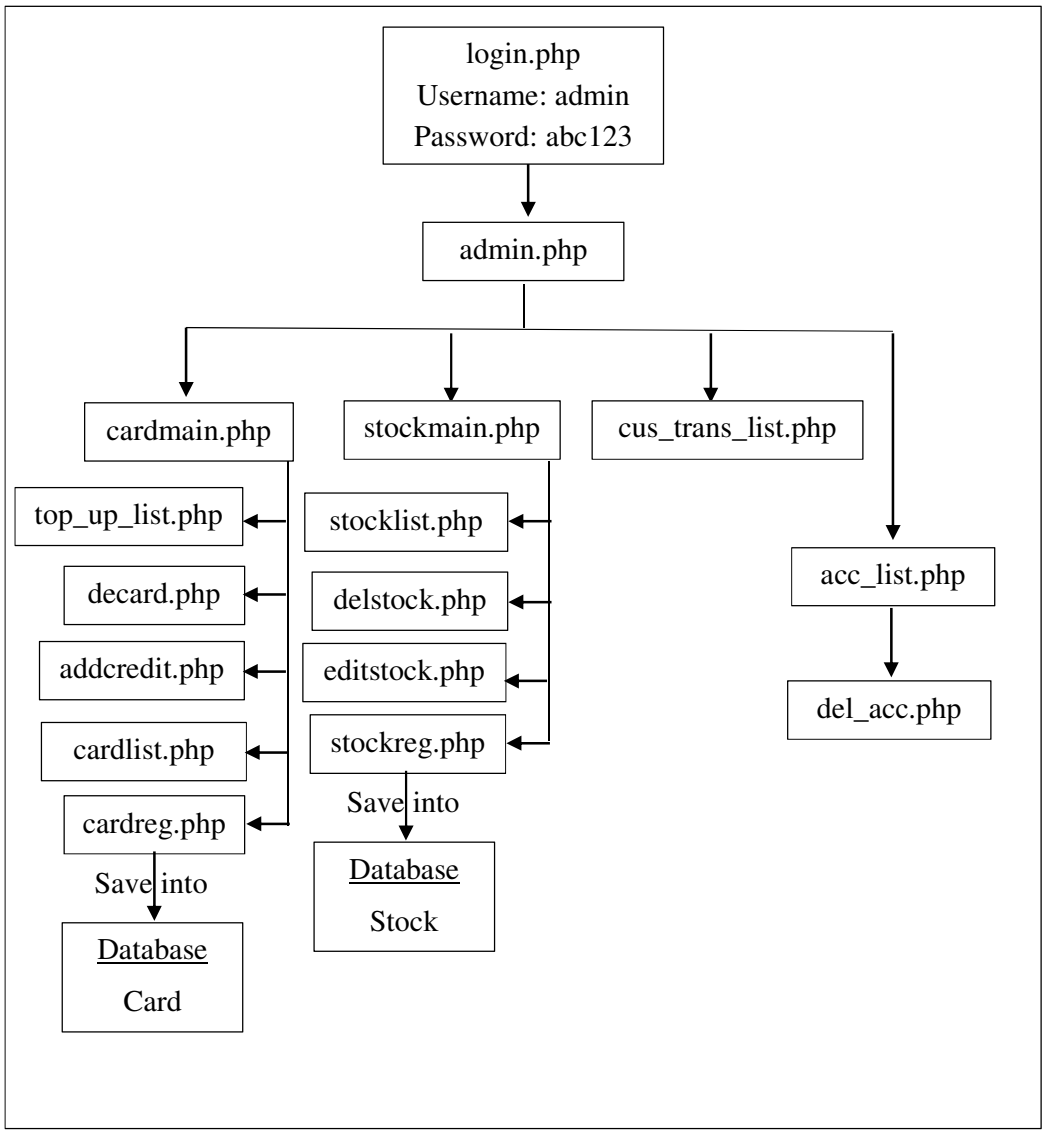


Figure 3.3 Admin Webpages Design (PHP and HTML)

Webpage Function Description

Website	Website Name	Description
login.php	MDS Login Page	• For admin to login their account
admin.php	MDS Admin Home Page	• MDS Website Home Page (Admin view)
cardmain.php	User MDS Card Maintenance	• Top-level page of User MDS Card Maintenance
cardreg.php	User Card Register	• For admin to register user MDS Card and save into Card and Registration database
decard.php	Delete User Card	• For admin to delete user MDS Card
addcredit.php	Add Card Credit Page - Admin	• For admin help in top-up credit of user MDS Card (Admin Top-up view)
cardlist.php	MDS User Card List	• For admin to view all user MDS Card list
top_up_list.php	MDS Card Credit Top Up History (Admin View)	• For admin to view all user top-up MDS Card history (User View)
stockmain.php	Stock Maintenance	• Top-level page of MDS Stock Maintenance
stockreg.php	Stock Register	• For admin to register new stock and save into Stock database
delstock.php	Delete Stock	• For admin to delete existing stock
editstock.php	Update Stock	• For admin to update stock information
stocklist.php	MDS Stock List	• For admin to view stock list data that retrieve from Stock database

cus_trans_list.php	Customer Transaction List	• For admin to view all user transaction
acc_list.php	MDS User Account List	• For admin to view all the MDS user list data that retrieve from Registration database
del_acc.php	Delete Account	• For admin to delete particular user account from the webpage, all the related data will also be delete

Table 3: Admin Webpages Design with each website function description

3.2.4 Block Diagram

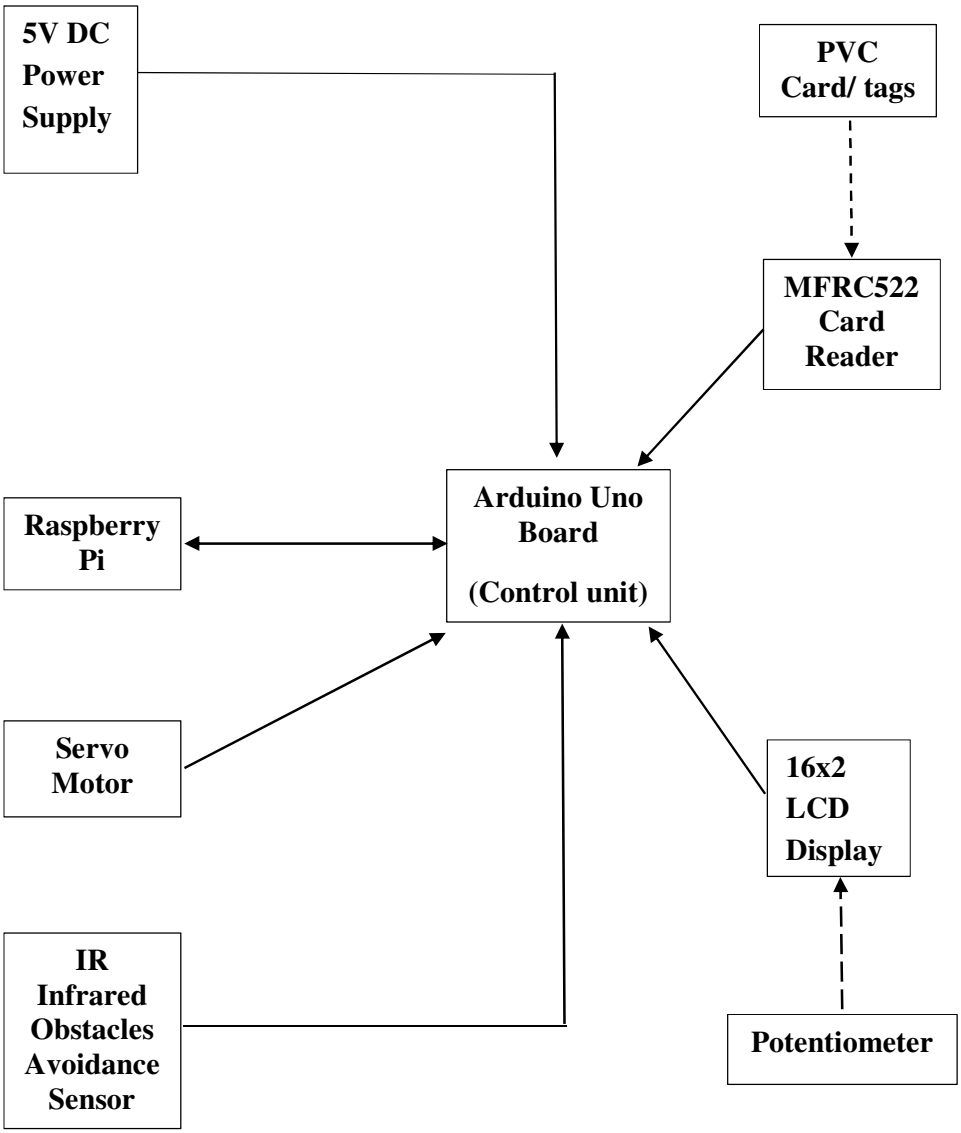


Figure 3.4 Overall Block Diagram

3.2.5 Breadboard Diagram

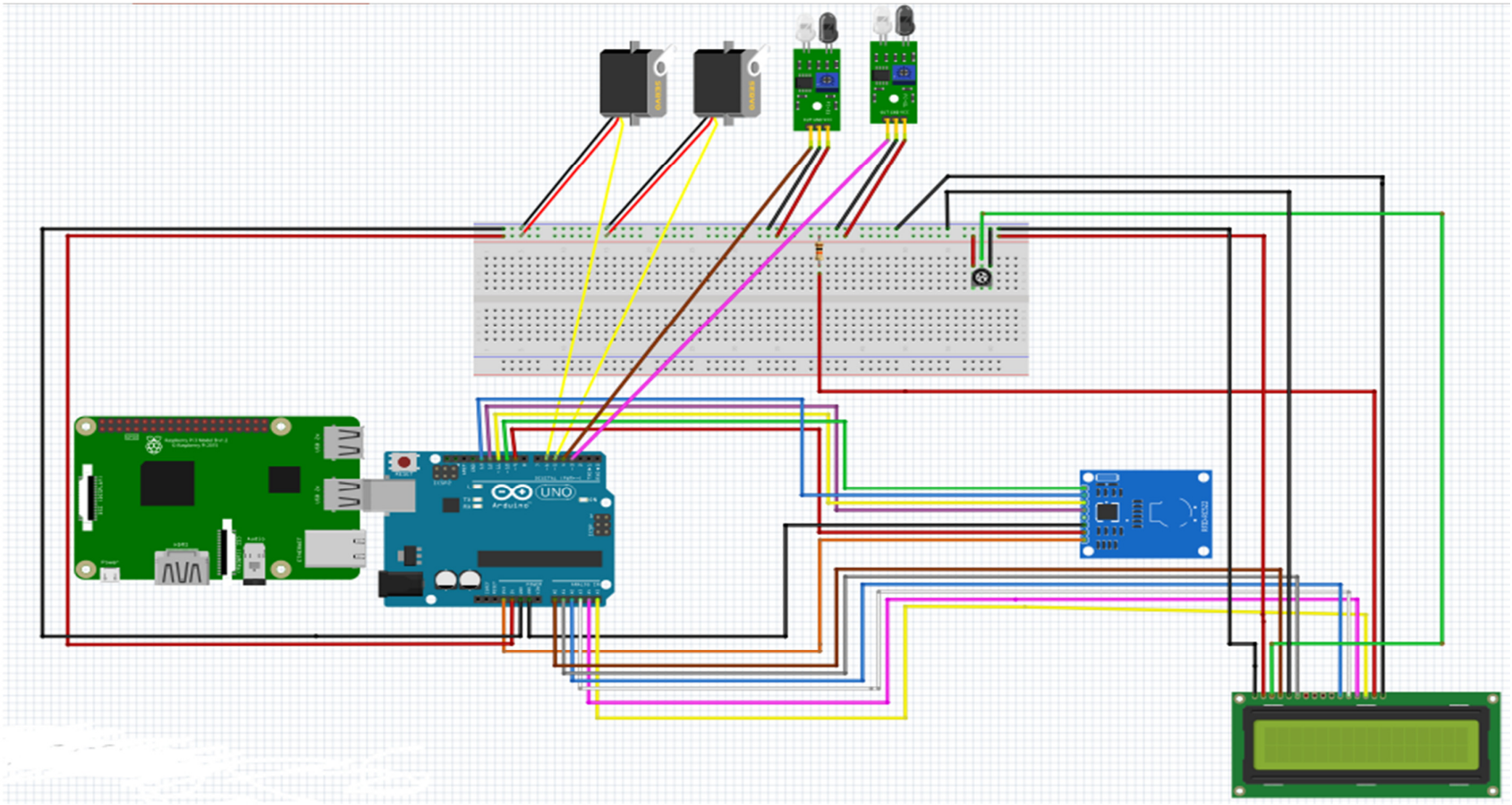


Figure 3.5 Overall Breadboard Design

Pin Number	Function
0	NULL
1	NULL
2	NULL
3	IR INFRARED A
4	IR INFRARED B
5	SERVO A
6	SERVO B
7	NULL
8	NULL
9	RESET PIN (RFID READER)
10	SS PIN (RFID READER)
11	MOSI (RFID READER)
12	MISO (RFID READER)
13	SCK (RFID READER)
A0	D7 (LCD SCREEN)
A1	D6 (LCD SCREEN)
A2	D5 (LCD SCREEN)
A3	D4 (LCD SCREEN)
A4	E (LCD SCREEN)
A5	RS (LCD SCREEN)

Table 4: Arduino Pin Description

3.2.6 Schematic Diagram

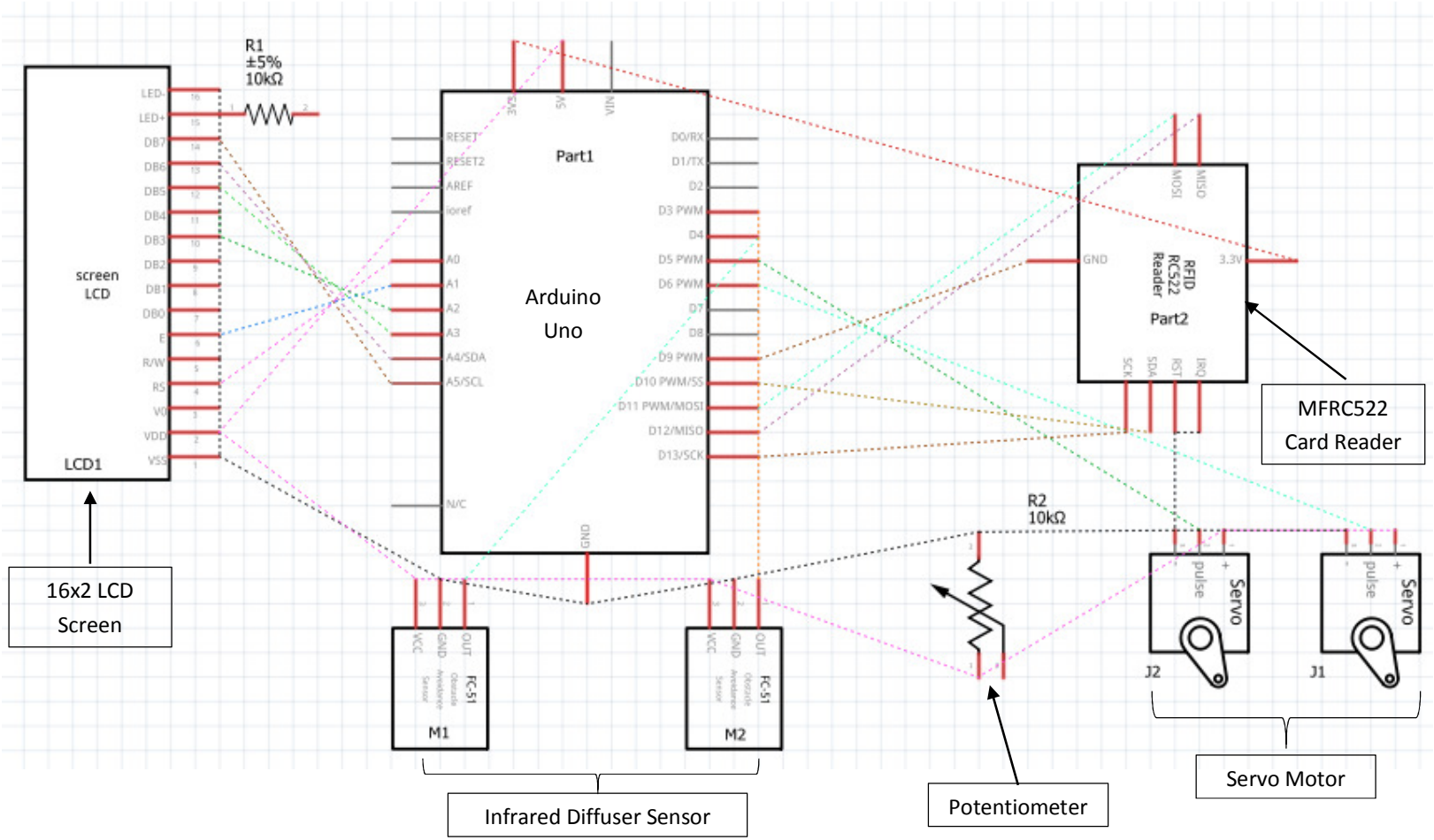


Figure 3.6 Overall Schematic Diagram

3.2.7 Prototype Design

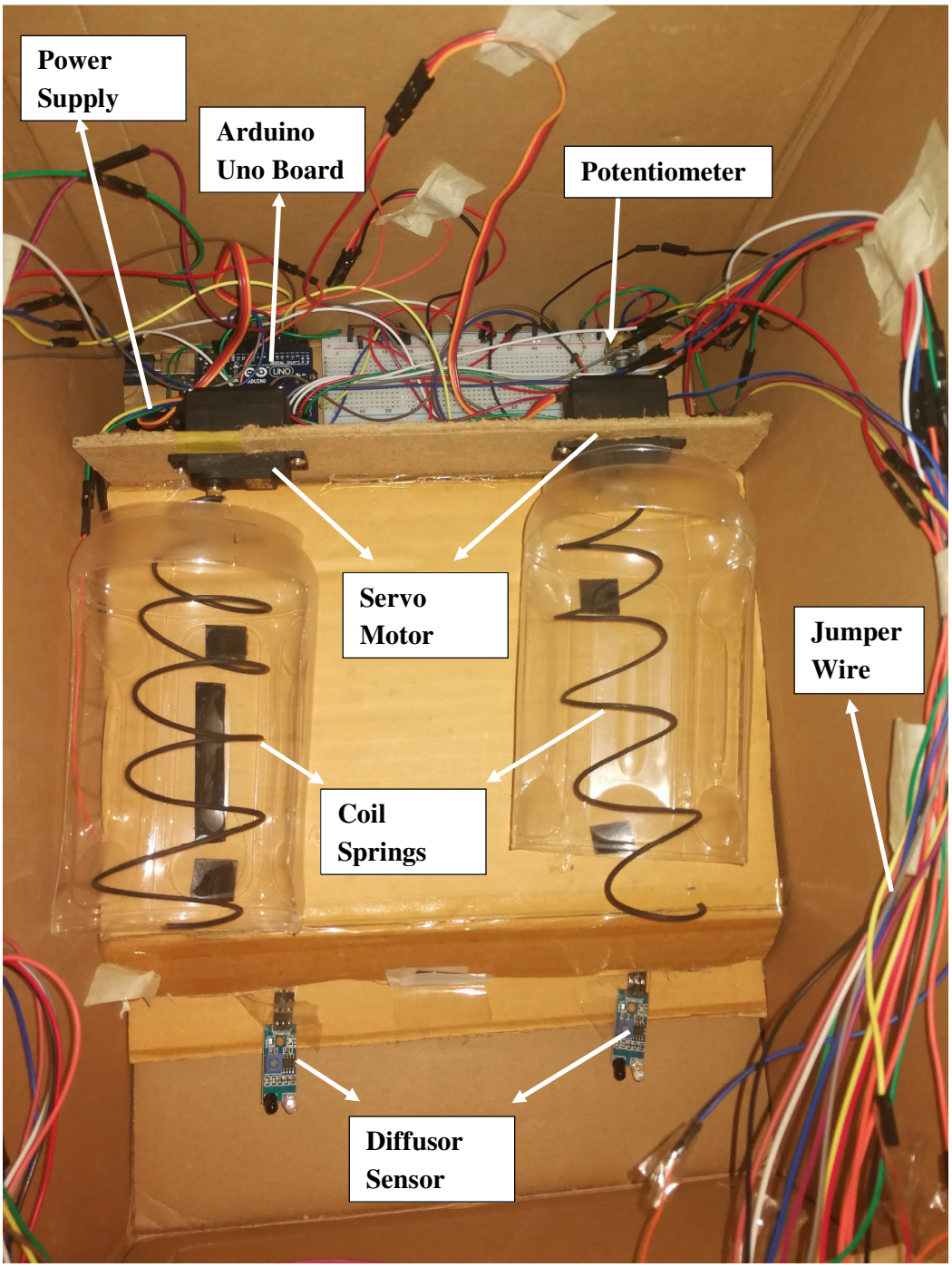


Figure 3.7 Prototype Design 1

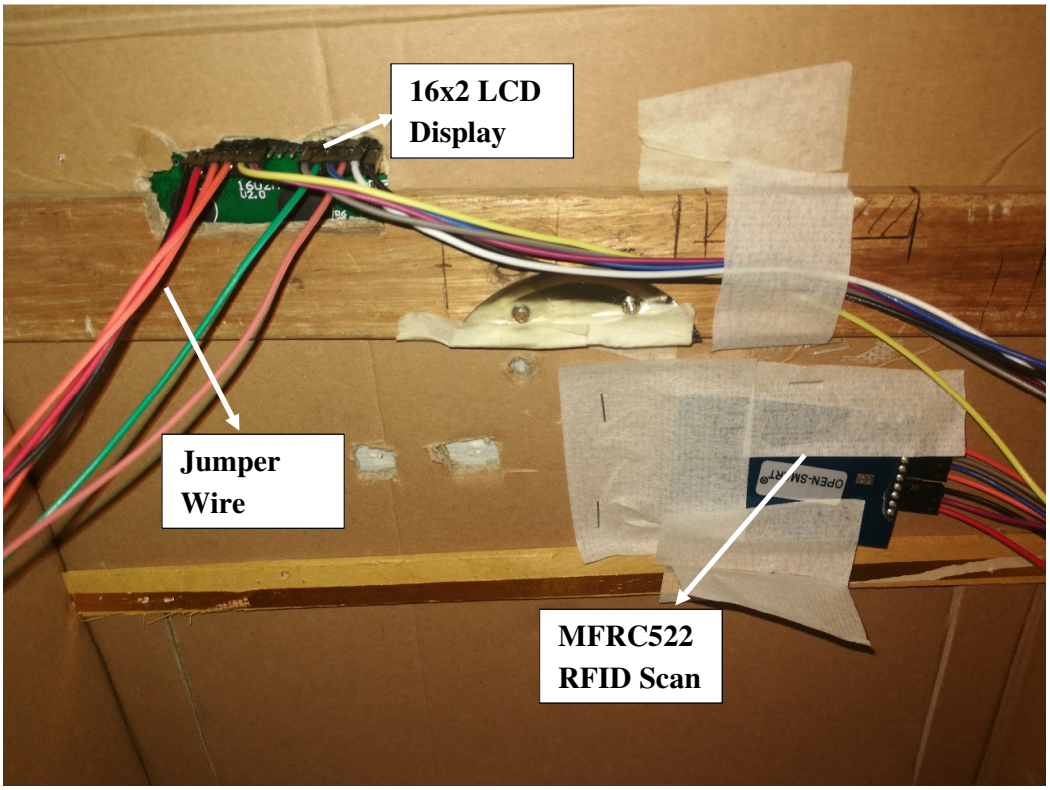


Figure 3.8 Prototype Design 2

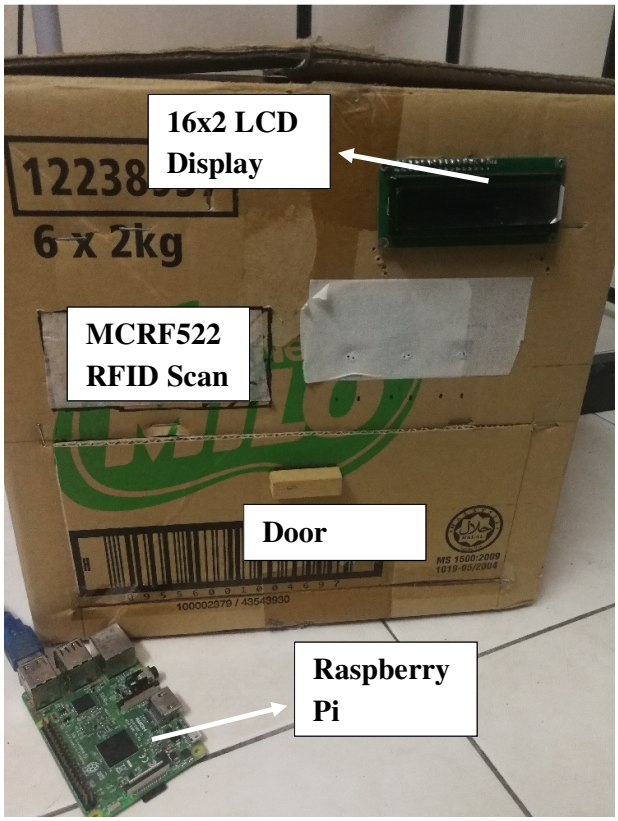


Figure 3.9 Prototype Design 3

3.2.8 System Setup Procedure

1. After Raspberry Pi has been start up, the system will automatically boot the python file which is **arduino.py** from the Terminal. To let the Terminal automatically start up the python file, some modification need to be done on the .bashrc file.

   i. First, open up this file by using this command in Terminal.

   ```
   sudo nano /home/pi/.bashrc
   ```

   ii. At the last line of the script, add in these following command

   ```
   echo Running at boot
   sudo python /home/pi/Desktop/arduino.py
   ```

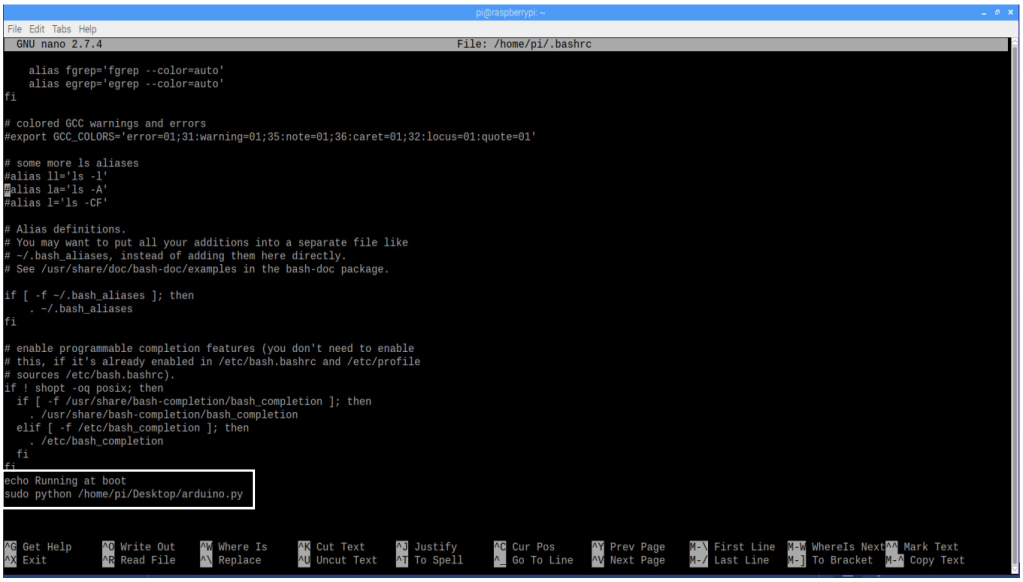


Figure 3.10 .bashrc file in Terminal

   iii. After that, click Ctrl+X, type Y and press Enter to save the file.

   iv. Finally, reboot the raspberry pi and python file will automatically start up after opening the new Terminal.

2. Make sure that Raspberry Pi are always connected to the Arduino or connected to the correct port. Otherwise, the Raspberry Pi Terminal could not open the Arduino port and error will be prompt.

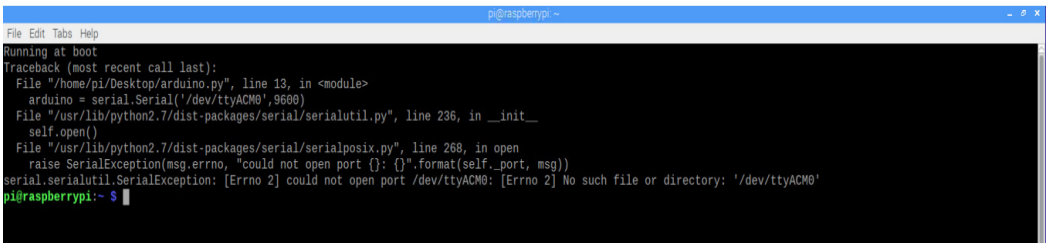


Figure 3.11 Sample of undefined Arduino Uno Port in Terminal

3. When the MDS scan, the system will transfer the MDS Card number from the Arduino to the Raspberry Pi. The system will check from the Transaction database whether the purchase process has been done before the card scan.

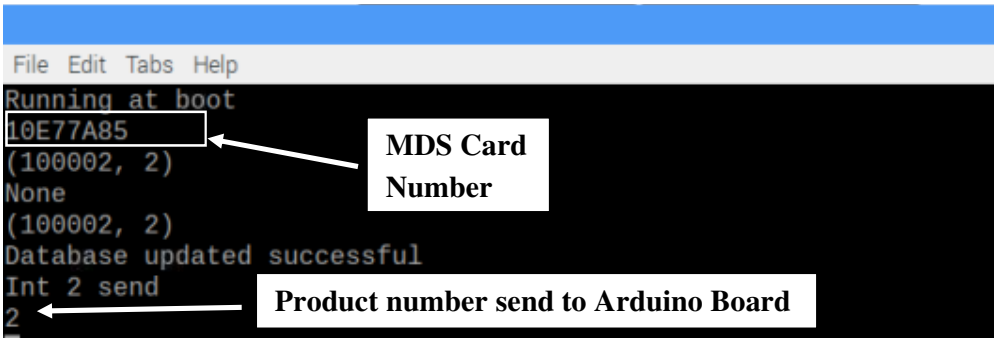


Figure 3.12 Python code run sample 1

4. If the transaction was found, the system will send either number 1 or 2 to the Arduino and dispense the correct product out from machine. The system will also display transaction found message on the LCD screen and display necessary information.(Number 1 = first product in the machine, Number 2 = second product in the machine)
5. If the transaction not found, the system will send number 0 to the Arduino to indicate that transaction was not found in the database and error message will be display on the LCD screen.

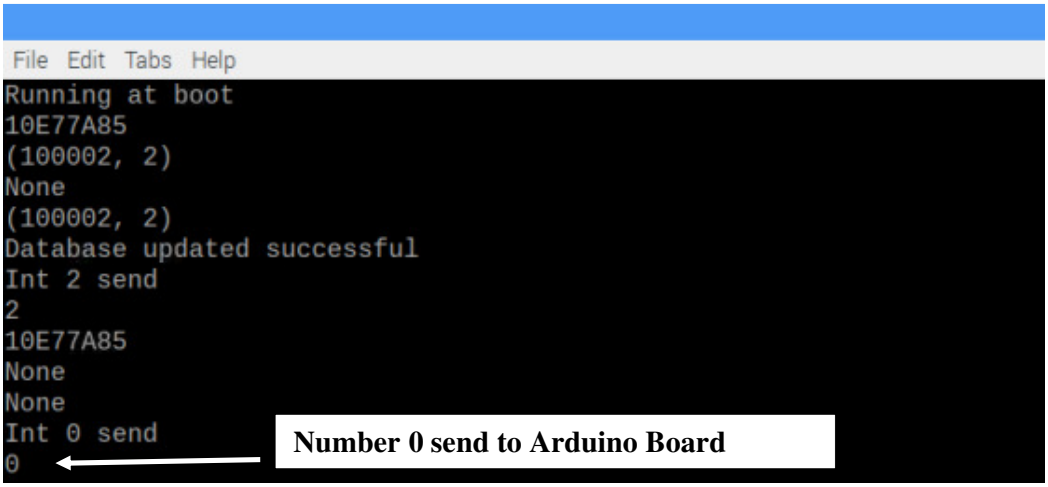


Figure 3.13 Python code run sample 2

3.3 Webpages

1. To allow another devices also able to access the webpages, we had to make sure that the Raspberry Pi has been connected to any available Wi-Fi.
2. After the Wi-Fi is connected, just type in the IP address of the webpages (IP Address of Raspberry Pi/login.php).

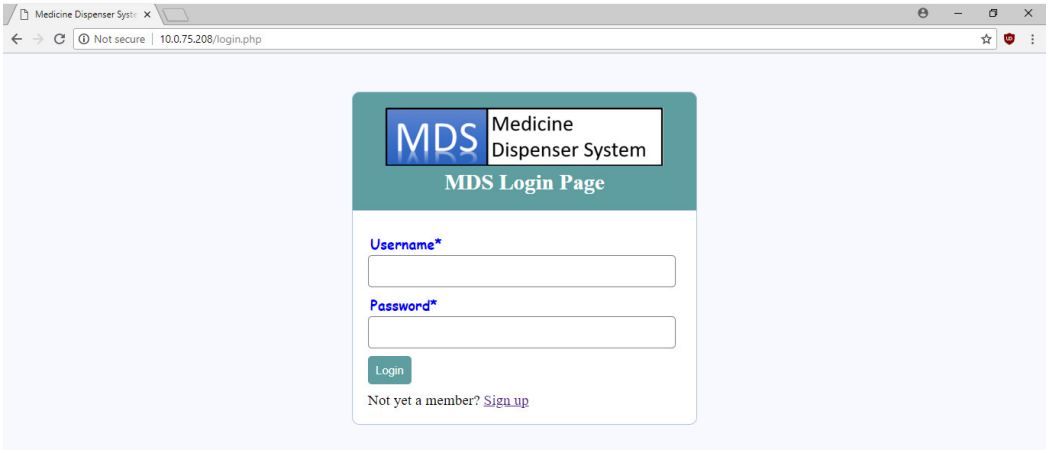


Figure 3.14 MDS Login Page

3. Below are the sample of customer/user home page website.

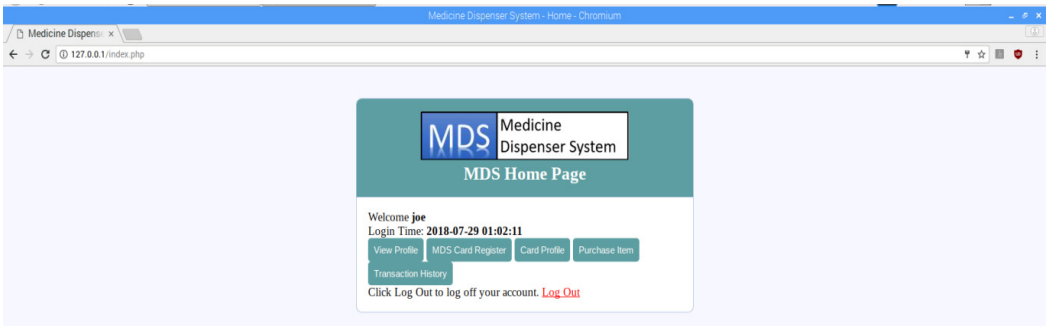


Figure 3.15 MDS User Home Page

4. Below are the sample of admin home page website.

Figure 3.16 MDS Admin Home Page

3.4 Database (MYSQL)

Database Name	Function
Registration	• Use to store customer account registration information and MDS Card information.
Card	• Use to store customer MDS Card information.
Stock	• Use to store stock information in the machine.
Transaction	• Use to store all the transaction information has been done on the webpages
Payment	• Use to store the customer MDS Card top-up credit history and bank credit card information.

Table 5: MYSQL Database Description

3.5 Arduino Coding

a) Function of Card Reader get UID of the RFID Card scan.

```
uint8_t getUID() {
   // Looking for the new cards
 if ( ! mfrc522.PICC_IsNewCardPresent()) {
   return 0;
 }
 // Select one of the cards
 if ( ! mfrc522.PICC_ReadCardSerial()) {
   return 0;
 }
    for ( uint8_t i = 0; i < 4; i++) {
    readCard[i] = mfrc522.uid.uidByte[i];
    Serial.print(readCard[i] < 0x10 ? "0" : "");
    Serial.print(readCard[i], HEX);    //return the UID into HEX form
    }
 Serial.println("");
 mfrc522.PICC_HaltA(); // Stop reading
}
```

b) Function of diffusor sensor and servo motor trigger.

```
switch(n)
  {
    case 1:      //if Number 1 was receive from Raspberry Pi
      while(digitalRead(obstaclePin1) == HIGH){    //Trigger diffusor sensor to HIGH
         Servo1.write(60);                         //Run servo motor 1
         //If item drop detected, return back and stop the servo motor
          if(obstaclePin1 == LOW){
            return;
          }
         }
         Servo1.write(90);                         //Stop servo motor 1
         delay(2000);
      break;
    case 2: //if Number 2 was receive from Raspberry Pi
      while(digitalRead(obstaclePin2) == HIGH){    //Trigger diffusal sensor to HIGH
         Servo2.write(120);                         //Run servo motor 2
         //If item drop detected, return back and stop the servo motor
         if(obstaclePin2 == LOW){
            return;
          }
         }
         Servo2.write(90);                         //Stop servo motor
         delay(2000);
      break;
  }
```

c) LCD Message Display

i. System IDLE mode. (Waiting MDS Card to be scan)

```
case IDLE_Mode:
    lcd.setCursor(0,0);
    lcd.print("Please scan");
    lcd.setCursor(0,1);
    lcd.print("your RFID card.");
  break;
```

ii. System checking MDS Card UID.

```
case Checking:
    lcd.setCursor(0,0);
    lcd.print("Welcome to MDS.");
    lcd.setCursor(0,1);
    lcd.print("Card scanned...");
    delay(2000);
  break;
```

iii. Transaction found and servo number received from Raspberry Pi.

```
case Trans_NFound:
    lcd.setCursor(0,0);
    lcd.print("Transaction");
    lcd.setCursor(0,1);
    lcd.print("Not Found.....");
    delay(1500);
  break;
```

iv. Transaction not found and display error message.

```
case Trans_Found:
    lcd.setCursor(0,0);
    lcd.print("Transaction");
    lcd.setCursor(0,1);
    lcd.print("Found.....");
    delay(1500);
   break;
```

v. Invalid MDS Card scanned.

```
case Invalid:
    lcd.setCursor(0,0);
    lcd.print("Invalid card");
    lcd.setCursor(0,1);
    lcd.print("scanned.");
    delay(3000);
   break;
```

vi. Display product in preparing and running servo motor.

```
case ServoRun:
    lcd.setCursor(0,0);
    lcd.print("Item in ready.");
    lcd.setCursor(0,1);
    lcd.print("Please Wait... ");
    lcd.blink();
   break;
```

vii. Display product is dispense successfully from the machine and detected by diffusor sensor.

```
case Prod_Ready:
    lcd.setCursor(0,0);
    lcd.print("Product is ready");
    lcd.setCursor(0,1);
    lcd.print("Thank you!");
    delay(3000);
   break;
```

d) Serial Communication setup between Arduino and Raspberry Pi

```
if (Serial.available()) {
   data(Serial.read() - '0');
 }
```

3.6 Implementation Issue and Challenges

The most challenges in this project is to implement website design of this system. It took about 1 month to implement this website design because many trial and error is needed in order to make a perfect system design. All the function done in the website and the information must be saved into the database so that its convenience for the next data retrieve.

Another challenge part in this project is to configure and implementing the communication between the Raspberry Pi and Arduino. Both of these device must keep in touch and connected all times when system is under running. These communication was gives a lot of meaning and convenience for achieve current system towards the IoT system design scope and goals. Besides that, these communication also able to provide user-friendly characteristics to the system. A lot of time and testing is needed in order to achieve the achievement.

3.7 Upgrades and Improvements from FYP1 to FYP2

This section shows the upgrades and improvements features from FYP1 to FYP 2. Below are the following upgrade features:

1. Bring in the software parts and features to the system.
2. Database created in this project.
3. Webpages is created with the admin webpages and user/customer webpages.
4. Serial communication between Raspberry Pi and Arduino is implemented.
5. Change the system to the button-less system. Customer choose their product they want to buy through the webpages instead of using button press. This also save a lot of pin on Arduino wiring.
6. Auto start Python file after Raspberry Pi reboot is implemented.
7. Elimination of save data into Arduino EEPROM since the size of EEPROM is limited. Database was replaced with this features.
8. The system now can work without the involving of admins registration needed in the system.
9. Report generator available. (Customer transaction report, Customer Account List, etc.)
10. Restock alert system available. The system will send alert message to the admins email to indicate that restock is necessary to be done as soon as possible.
11. Better prototype implemented.
12. Other devices able to access the webpages with the correct URL
13. Security system enhancement achieve.

Chapter 4: Methodology and Tools

4.1 Design Specification

An appropriate design methodology is very important in order to design and implement a good multifunction and complex system. According to TechTarget (2017), The Prototyping Model is a systems development method (SDM) in which a prototype (an early approximation of a final system or product) is built, tested, and then reworked as necessary until an acceptable prototype is finally achieved from which the complete system or product can now be developed. Design Methodology also can help in estimation budget of the design on the system in terms of functionality, quality and avoid defected (malfunction and error) product.

4.2 Methodologies and General Work Procedures

The methodology used in this project is prototyping model. According to (SDM, 2016), Prototyping model is one of the best methodology to use when user's requirement not clear and communication problem happened between developers and users. On this other hand, by using this model, debugging working can easily done and fix the error immediately. That's why prototyping model will be used in this project. Figure 4.1 show the prototyping model:

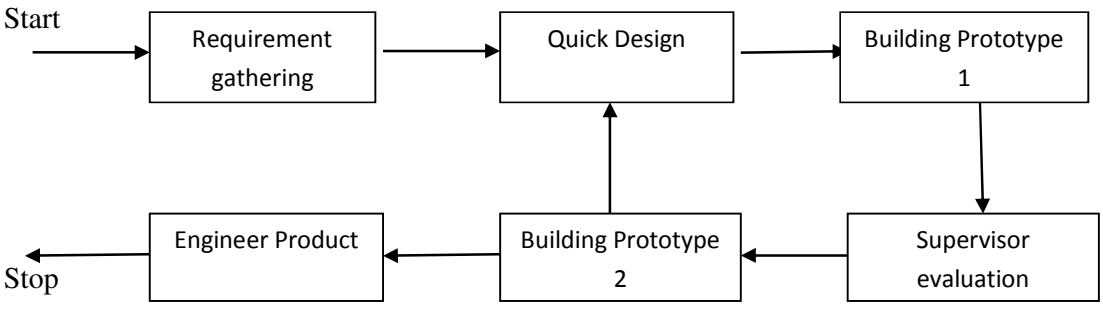


Figure 4.1 Prototyping Model

Description on prototyping model

1. **Requirement gathering:** The small discussions was needed between student and supervisor to define the new requirement of the project in as much detail as possible. Student may gone through the literature review to get some information and idea related to vending machine like specification of the system in order to fulfill the requirement of this project..
2. **Quick Design:** A preliminary prototype design of the system is needed based on the requirement set by supervisor. The complete design is not necessary, this design was just the simple draft including important aspects for this project.
3. **Building Prototype 1:** The first prototype is out with the reference of quick design, but this is not in complete prototype.
4. **Supervisor evaluation:** Supervisor will going to evaluate on first prototype design and give some advice or encouragement to student for improvement.
5. **Building Prototype 2:** The first prototype is modified, based on the comments supplied by the supervisor, and a second prototype of the new system is constructed. The new quick design is necessary if there is major changes on the project compare to the previous work. The process is keep repeated until supervisor's was satisfied with the new prototype.
6. **Engineer Product**: Complete and well-functioning prototype should came out the result in this stages. The project should be able to present by the student. The final system is evaluated thoroughly followed by the routine maintenance on regular basis so that large-scale failures can be prevented and downtime will be minimized.

4.3 Tools to Uses

Figure 3.2 shows the hardware that will be used in this project include Arduino Uno board, Raspberry PI, 5V power supply, Servo Motor (Continuous rotation), breadboard, MFRC522 Card Reader, White PVC Card, PVC Tag, shell kit (made by hard cardboard), IR Infrared Obstacle Avoidance Sensor, 16x2 LCD Screen, 10k Resistors, Potentiometer and jumper wires.

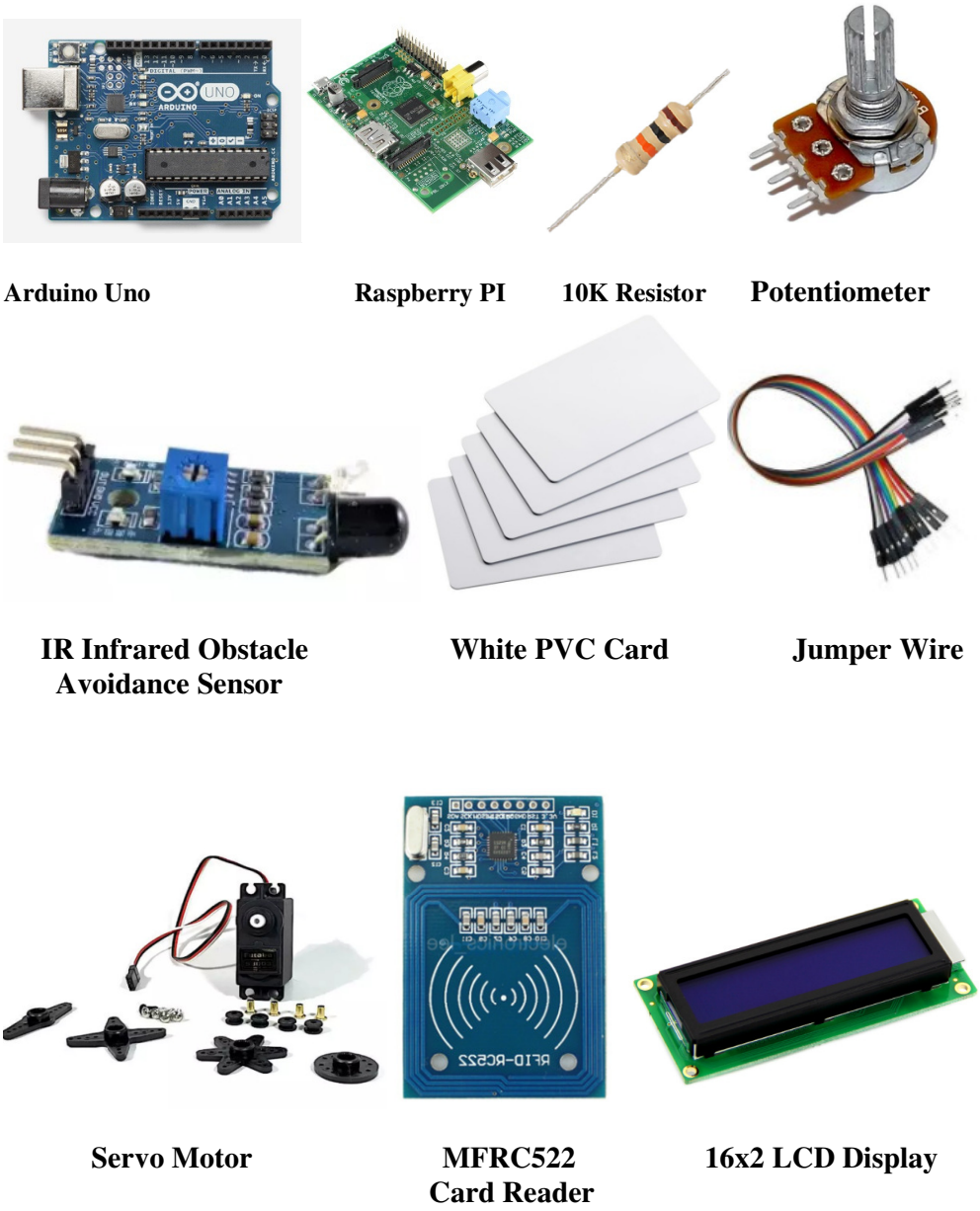


Figure 4.2 Component use in this project

Chapter 5: Test Program (Website Design)

This chapter is about website design test program with HTML and PHP as website design platform and MYSQL as database platform. This chapter also include with the scenario, test case and error test case details. There are two major part in the website design test program, one is user page (section 5.3 – section 5.12) and another is admin page (section 5.13 – section 5.27). Both of them has their own content and function inside. This chapter introduce each content, function and working of the program flow.

5.1 Login Page

Every customer, user or even admin must goes through this login page then only able to log in your webpages account.

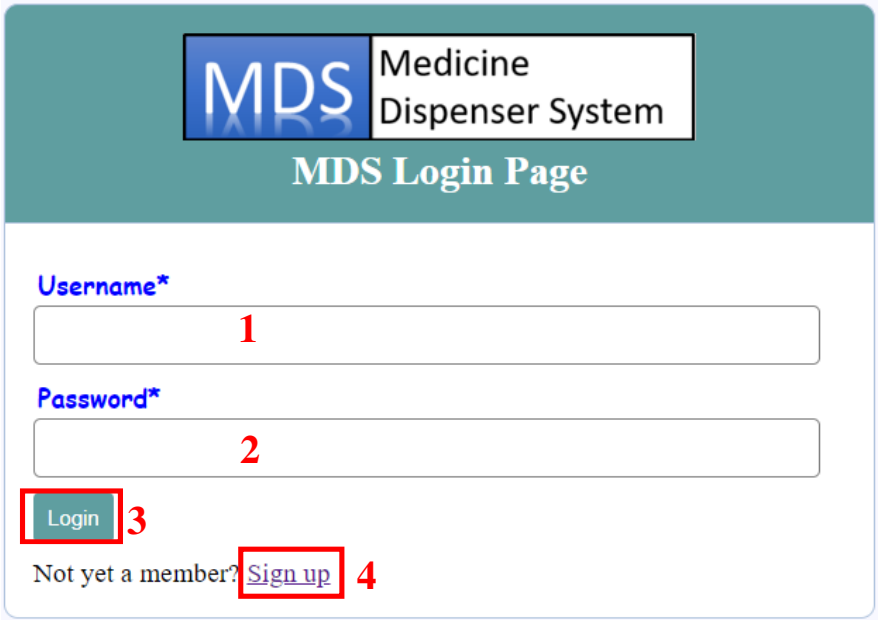


Figure 5.1 MDS Login Page

1. Key in username.
2. Key in password.
3. After key in, click on Login button to log in your account.
4. If those customer/user have not own the account yet, they can click on the sign up link and system will bring them to register page to create their new account.

Error Test Case

a) User or customer must fill in username and password before click on Login button. If Login button is click with non-fill username or password, error message will be prompt out at the header.

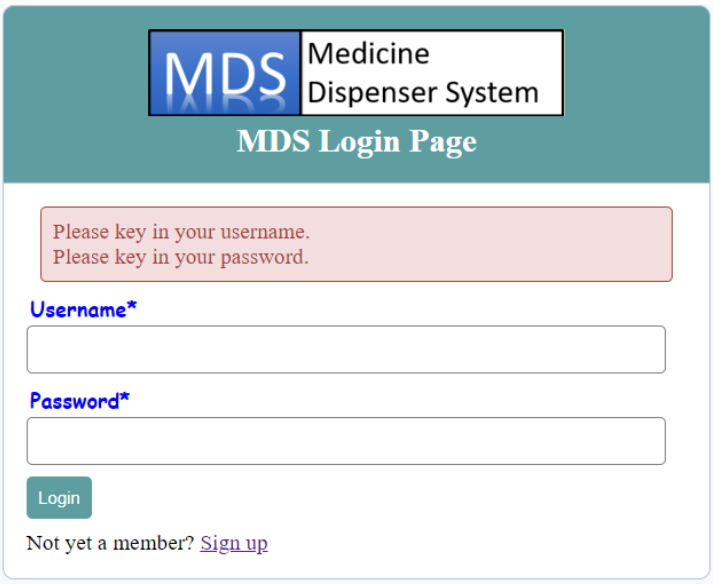


Figure 5.2 Blank in password and username (Login Page)

b) If user or customer key in wrong username or password and combination was not match, error message will be prompt out at the header.

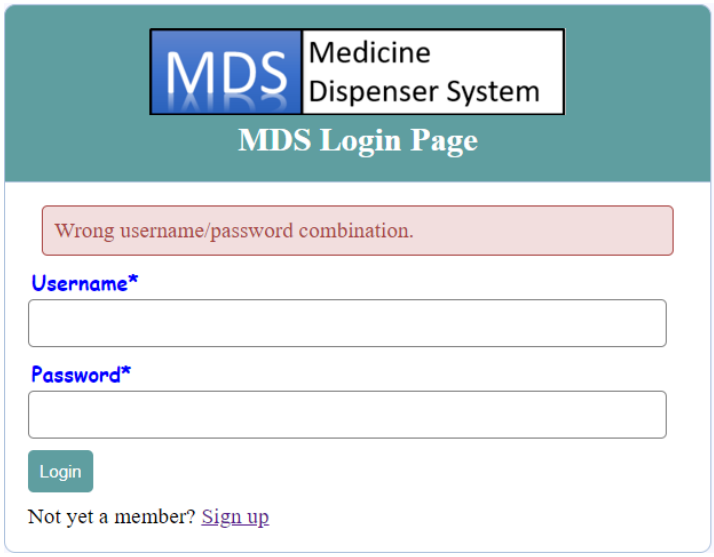


Figure 5.3 Wrong username/password type

5.2 Register Page

This page is for new user or customer to create their new account. The information will be store into the Registration database after the registration has been done.

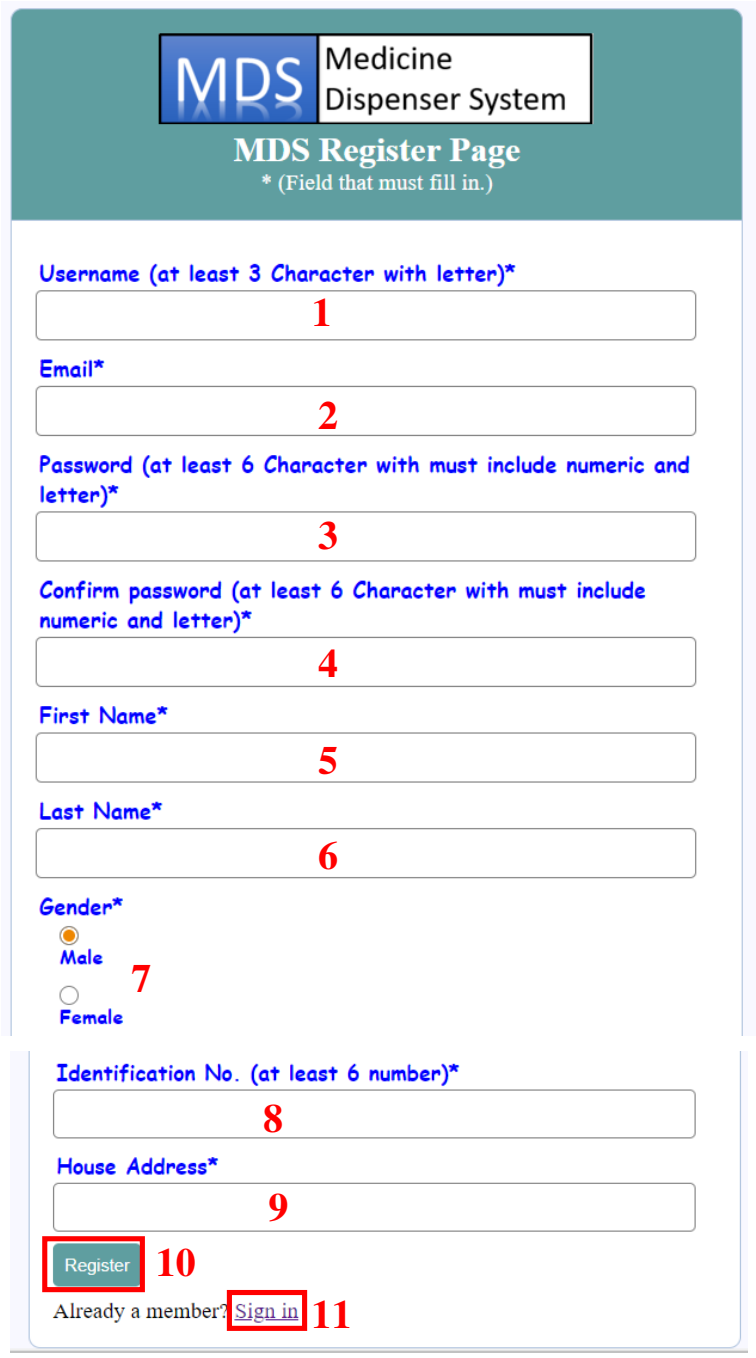


Figure 5.4 MDS Register Page

1. Key in username that user or customer want to use. Must at least contain 3 character. No other symbol and number can be use as username.
2. Key in Email address.
3. Key in password. Must contain at least 6 character. Combination of number and letter must use as password. No symbol can use as password.
4. Key in confirm password with the same password set at step 3.
5. Key in first name.
6. Key in last name.
7. Choose one of the option as gender.
8. Key in house address.
9. Key in Identification number.
10. Click on Register button to complete the registration.
11. Click on Sign In link back to login page.

Test Case

If the account was successfully created, all the information will be save into the Registration database and register date and time will be created. Below are the sample of the successful created account and information in the database.

Registration database:

	id	username	email	password	first_name	last_name	gender	IC_No	Address
Edit Copy Delete	2	admin	admin@123.com	abc123			m	0	
Edit Copy Delete	10	joe	joe_tan1015@hotmail.com	abc123	Tan	Joe	m	456987	1167, Jalan Seksyen 2

Figure 5.5 Register information save into Registration database

Error Test Case

a) All the particular must fill in before the Register button is clicked. Otherwise, error message will be prompt at header.

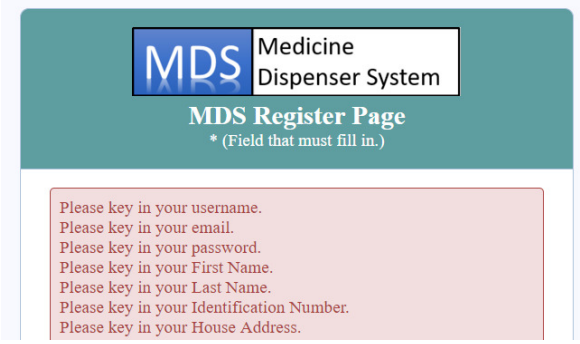


Figure 5.6 Blank in particular fill (Register Page)

b) Existed Username and Email are not allow to use again in this system. Any duplicate found the system will display an error message at the header.

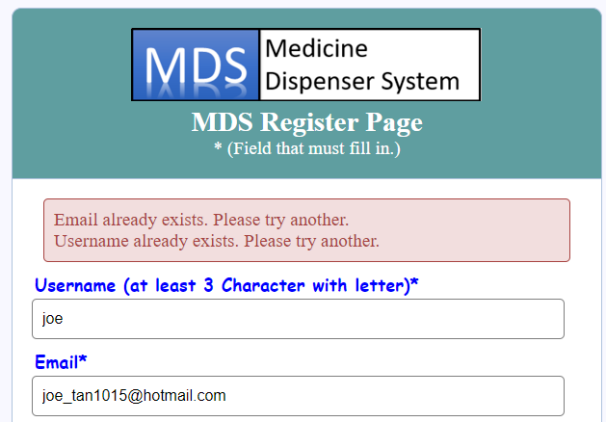


Figure 5.7 Existing username or email type

c) Password and confirm password combination must be same. If not match, the system will display an error message at the header.

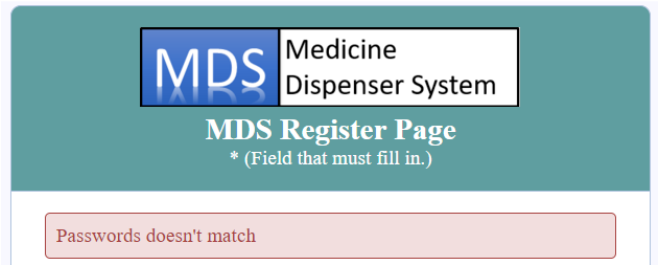


Figure 5.8 Wrong typing combination password and confirm password

d) Username must contains at least 3 character. Password and confirm password must contains at least 6 character with letter and number include. Identification number must contains at least 6 number. If all of these doesn't meet the requirement, an error message will be prompt out at the header.

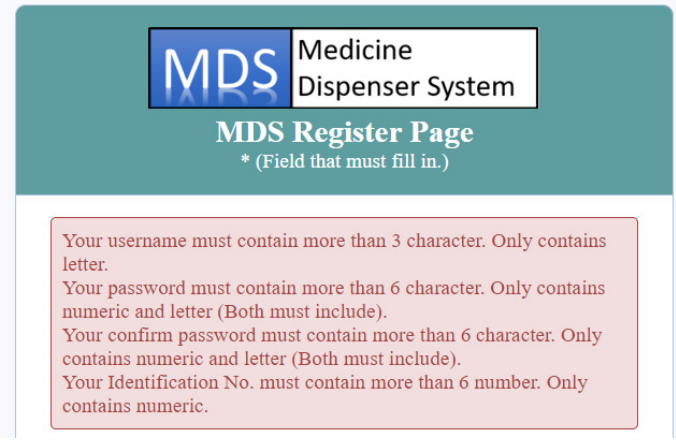


Figure 5.9 Criteria doesn't meet (Register Page)

5.3 User Home Page

After user or customer has successfully log into their account, the system will bring them to this user home page. Each time user or customer login and logout time will be save into the database and is for the security purpose. This can be the evidence if the user account has been fraud and used by third party.

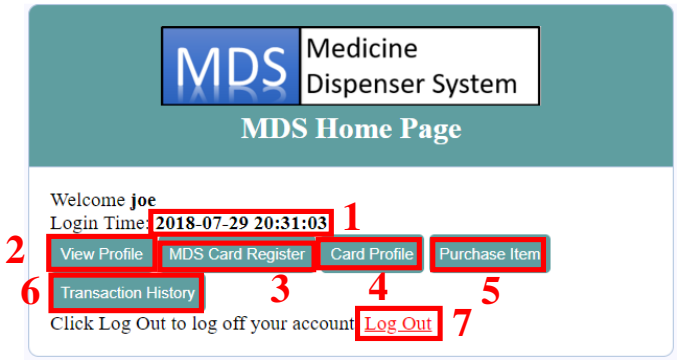


Figure 5.10 MDS User Home Page

1. Each time user/customer log in their account, the system will show the current login date and time at the webpages.
2. Click on the View Profile button to view their account profile. (see section 5.4)
3. Click on MDS Card Register Button to activate their MDS card. (see section 5.6)
4. Click on Card Profile Button to view their activated MDS Card. (see section 5.7)
5. Click on Purchase Item Button to start the transaction process. (see section 5.10)
6. Click on Transaction History Button to view previous transaction list. (see section 5.12)
7. Click on Log Out link to log out their account.

Test Case

The current login and last log out time and date will be save into Registration database. Below are the sample of the login and logout time and date in the database.

	id	username	email	Last_Login	Logout_Time
Edit Copy Delete	2	admin	admin@123.com	2018-07-29 21:13:58	2018-07-29 21:11:15
Edit Copy Delete	10	joe	joe_tan1015@hotmail.com	2018-07-29 21:11:20	2018-07-29 21:10:47

Figure 5.11 Record of last login time and logout time in Registration database

Error Test Case

a) Each account can only own one registered MDS Card. If owned account click on MDS Card Register button, the following error message will be display.

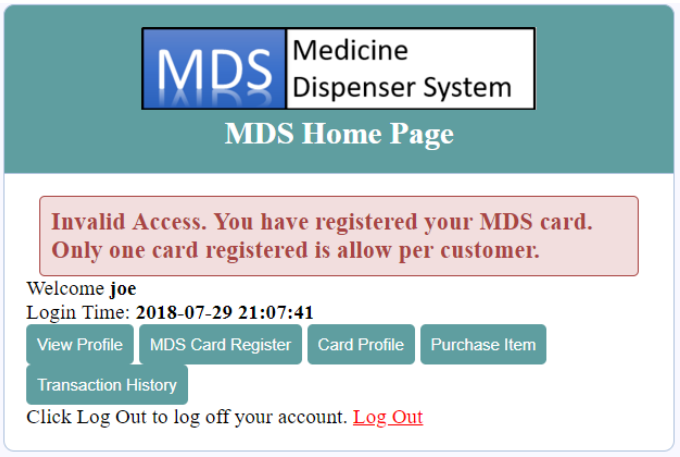


Figure 5.12 One MDS Card per customer only

b) If user has not activate their MDS Card, the system will not allow user to access Card View Profile Page.

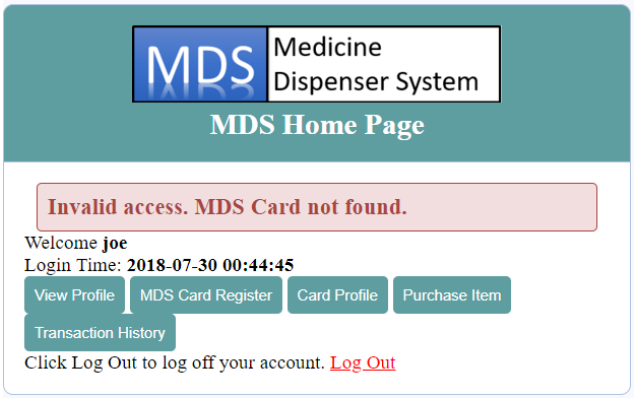


Figure 5.13 MDS Card not found in Registration database

5.4 User Profile View Page

This page is for user to view their account profile, user also can update their profile by click on necessary button. (Data retrieve from Registration database)

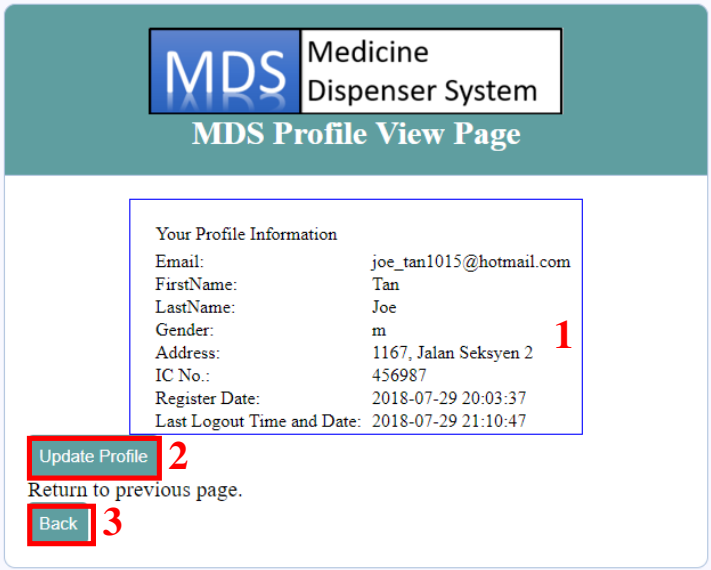


Figure 5.14 MDS Profile View Page

1. User account information will be shown in this page, system also able to shown the account register date and last logout time and date.
2. Click on Update Profile button to edit their current account profile. (see section 5.5)
3. Click on Back button back to previous page.

5.5 Update Profile Page

This page is for user to update their current profile. After update is done, the information in the database will also be updated. All details information will show in each textbox for user convenience to update their account. (Information retrieve from Registration database)

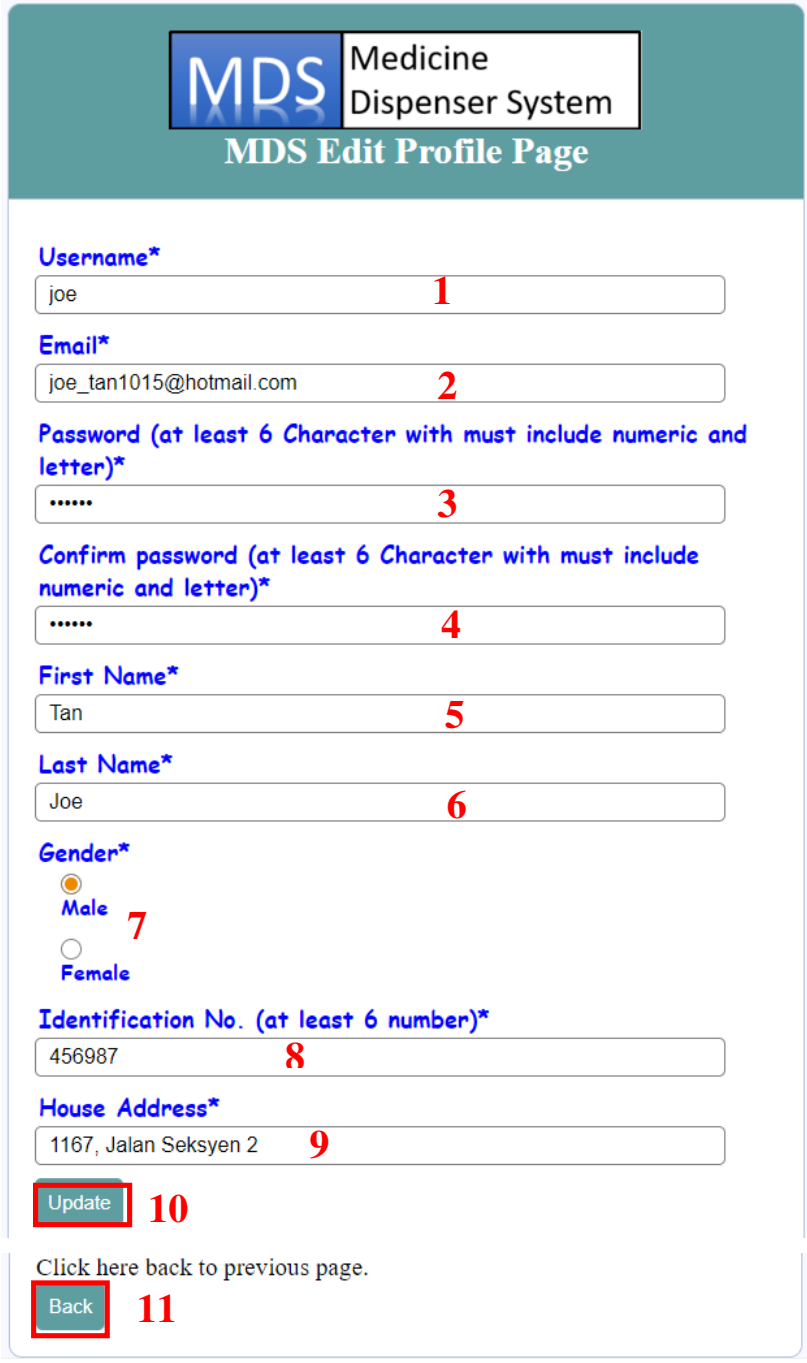


Figure 5.15 MDS Edit Profile Page

1. Username is not editable. (Information shown purpose only)
2. Key in new email if user wish to change their email.
3. Key in new password if user wish to change their password.
4. Key in back previous password at step 3.
5. Key in first name if user wish to change their first name.
6. Key in last name if user wish to change their first name.
7. Select gender.
8. Key in Identification number if user wish to change their first name.
9. Key in House Address if user wish to change their first name.
10. Click on Update button to complete their account update. All currently fill information will be update into the database.
11. Click on Back button back to previous page.

Test Case

Assume that Joe had update his account profile in this page, all the information must be updated into the database immediately after the Update button was clicked.

Before update (Registration database):

	id	username	email	password	first_name	last_name	gender	IC_No	Address
Edit Copy Delete	2	admin	admin@123.com	abc123			m	0	
Edit Copy Delete	10	joe	joe_tan1015@hotmail.com	abc123	Tan	Joe	m	456987	1167, Jalan Seksyen 2

Figure 5.16 Data in Registration database before update

After update (Registration database):

	id	username	email	password	first_name	last_name	gender	IC_No	Address
Edit Copy Delete	2	admin	admin@123.com	abc123			m	0	
Edit Copy Delete	10	joe	joe_tan1015@hotmail.com	123abc	Joe	Tan	m	574120	1, Victory Road

Figure 5.17 Data in Registration database after update

Account update successful message will be display at user home page.

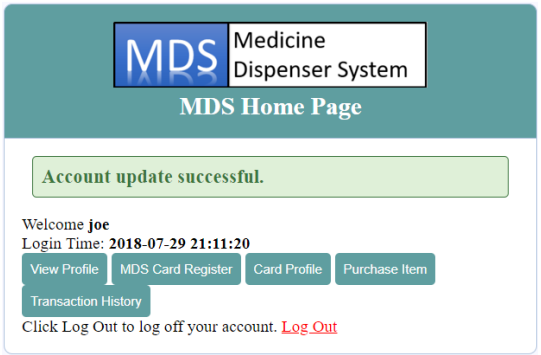


Figure 5.18 Account update successful message.

Error Test Case

a) Password and confirm password must be match and length of password must more than 6 character, otherwise error message will be shown at the header.

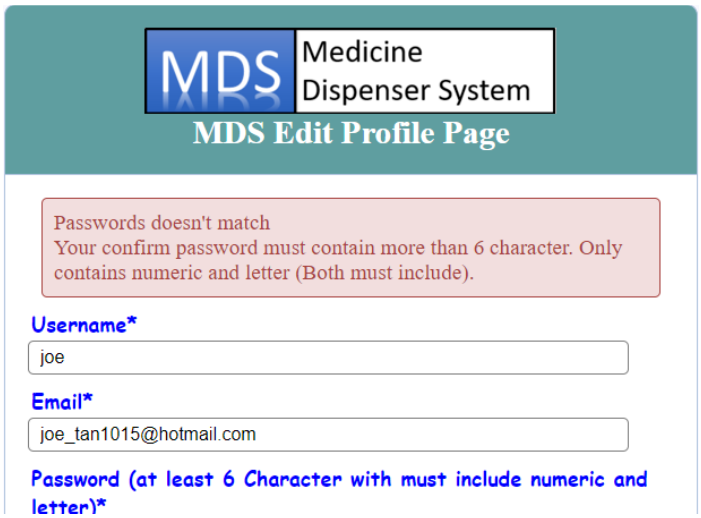


Figure 5.19 Password and confirm password doesn't match

b) Identification number must contain at least 6 number. No symbol and alphabetical is allow.

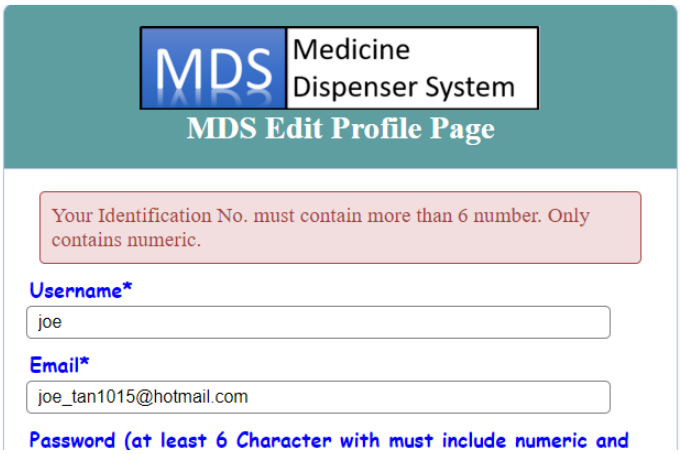


Figure 5.20 Identification length less than 6 number

5.6 User Card Register Page

This page is for user to activate their MDS Card. Note that the card must be register by admin first before the card can be activate since the activation involving combination of username and card number that had been record by the admin. Non-register card will not able to activate the card. This function is for the security purpose to avoid the card fraud used by unknown third party.

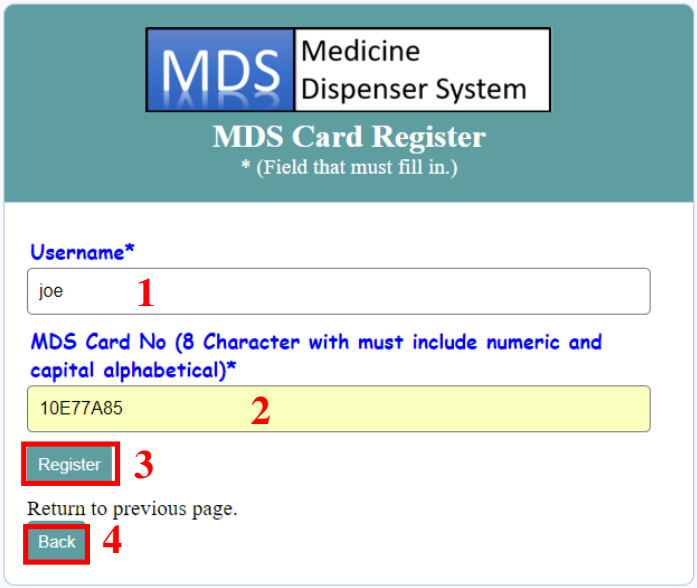


Figure 5.21 MDS Card Register Page

1. Username is not editable. (Information shown purpose only)
2. Key in MDS Card number here.
3. Click on Register button to complete the card activation.
4. Click in Back button to back to previous page.

Test Case

The card number and card credit in the MDS card will be save into the Registration database and the activation of the card will change from zero to one in the Card database after the card activation has been done.

Database Update:

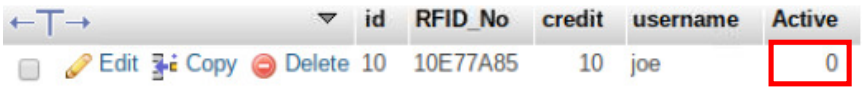
i. Registration database

	id	username	email	RFID_No	Credit
Edit Copy Delete	2	admin	admin@123.com		0
Edit Copy Delete	10	joe	joe_tan1015@hotmail.com	10E77A85	10

Figure 5.22 Card information will save into user Registration database

ii. Card database

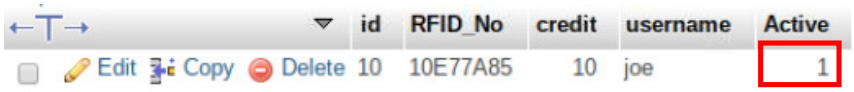
Before:



	id	RFID_No	credit	username	Active
Edit Copy Delete	10	10E77A85	10	joe	0

Figure 5.23 Card activation status before register (0= inactive)

After:



	id	RFID_No	credit	username	Active
Edit Copy Delete	10	10E77A85	10	joe	1

Figure 5.24 Card activation status after register (1= active)

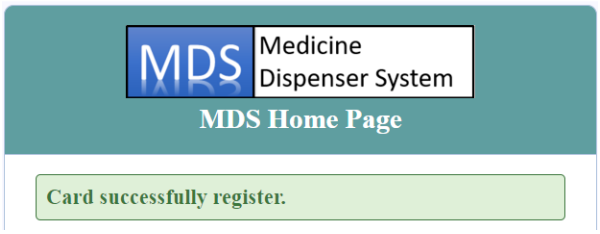


Figure 5.25 Card successfully register

Error Test Case

a) User must type the correct MDS Card number according to the card number that given by the admin. Other MDS number are not allow to do any register to avoid duplicate case happen.

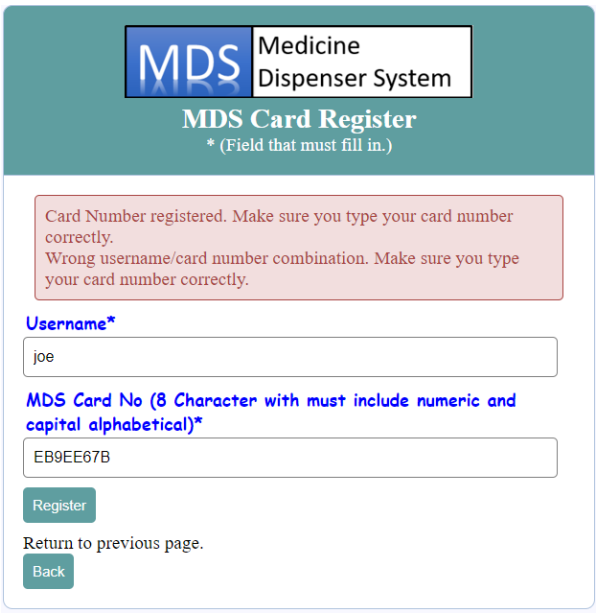


Figure 5.26 Error message 1

5.7 User MDS Card Information Page

This page is used for user to view their MDS Card information. (Data retrieve from Card database)

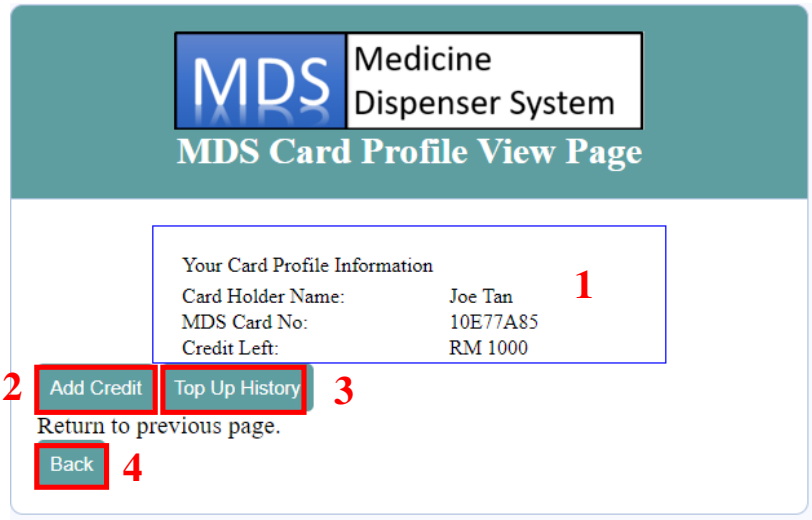


Figure 5.27 MDS Card Profile View Page

1. User MDS Card profile shown here.
2. Click on Add Credit button to top-up card credit. (see section 5.8)
3. Click on Top-Up History to view Top-Up Card credit history. (see section 5.9)
4. Click on Back button back to previous page.

5.8 User Add Credit Page

User able to top-up their card credit through this page without the involving of the admin is needed. User just need to fill in some particular, submit the form and the credit top-up can be done in just few seconds. All the particular information will be store into the payment database.

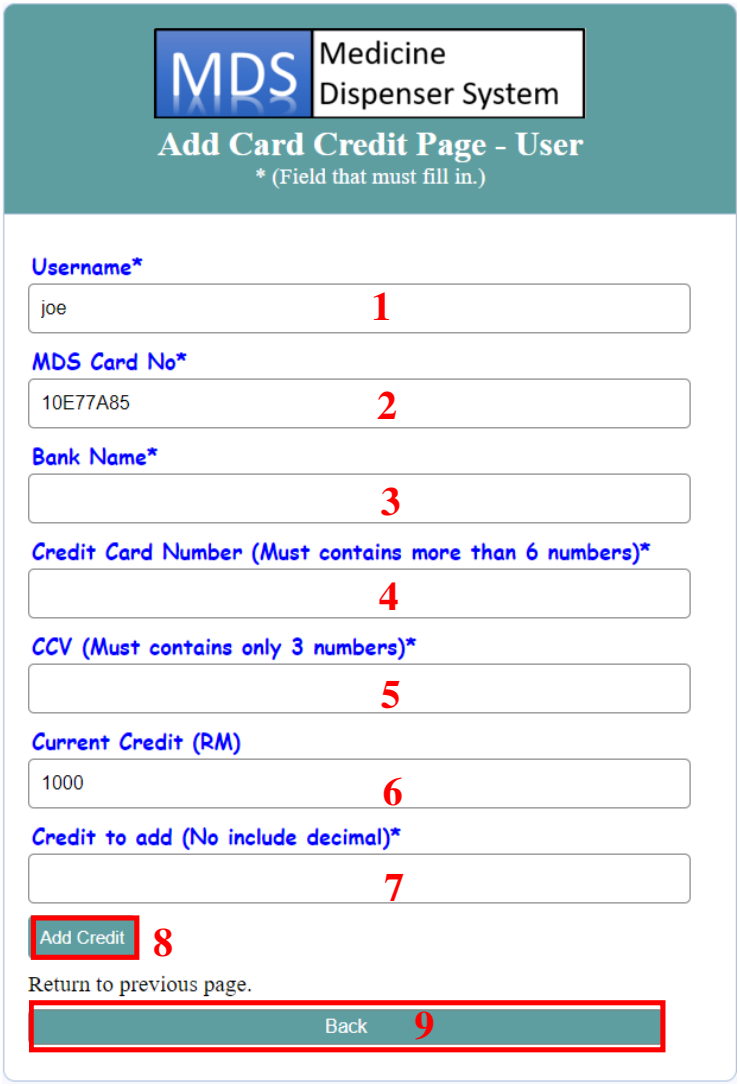


Figure 5.28 MDS Card Credit Page – User View

1. Username is not editable. (Information shown purpose only)
2. MDS Card number is not editable. (Information shown purpose only)
3. Key in Bank Name.
4. Key in Bank Credit Card Number.
5. Key in credit card CCV number.
6. Current credit (RM) is not editable. (Information shown purpose only)

7. Fill in the credit to add.
8. Click on Add Credit button to complete the top-up credit process.
9. Click on Back button back to previous page.

Test Case

Every time of the top-up credit process will be save into Payment database. The latest credit value will be update into the Card and Registration database.

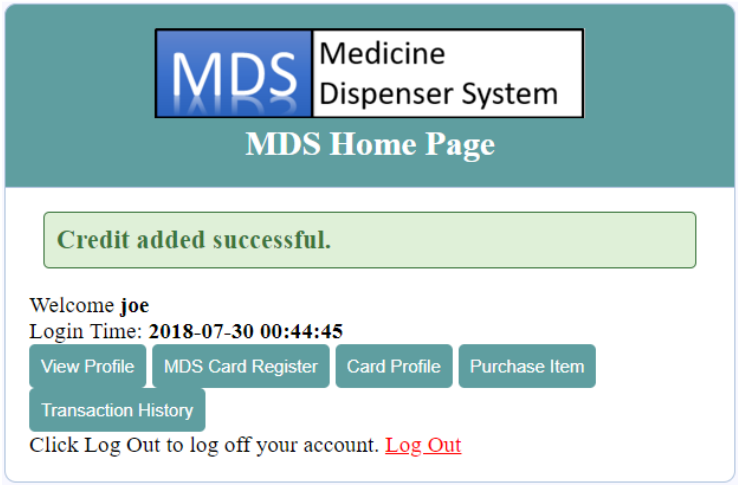


Figure 5.29 Card credit added successful

Payment database:

	id	Bank_Name	Card_No	CCV	Username	RFID_No	Top_Up_Credit	Final_Credit	Via	Top_Up_Date
Edit Copy Delete	4	Public Bank	789556	478	farron	EB9EE67B	50	260	1	2018-07-18 02:00:23
Edit Copy Delete	5	-	0	0	farron	EB9EE67B	40	300	0	2018-07-18 02:07:54
Edit Copy Delete	6	Public Bank	123456	123	farron	EB9EE67B	100	400	1	2018-07-18 02:09:03
Edit Copy Delete	9	Public Bank	871520	482	joe	10E77A85	1100	1110	1	2018-07-30 01:21:41
Edit Copy Delete	10	Public Bank	574201	587	joe	10E77A85	50	1160	1	2018-07-30 01:23:09

Figure 5.30 Top Up history

Card database:

	id	RFID_No	credit	username	Active
Edit Copy Delete	12	10E77A85	1160	joe	1

Figure 5.31 Card database credit update

Registration database:

Last updated credit value

	id	username	email	RFID_No	Credit
Edit Copy Delete	2	admin	admin@123.com		0
Edit Copy Delete	10	joe	joe_tan1015@hotmail.com	10E77A85	1160

Figure 5.32 Registration database credit update

Error Test Case

1. If blank textbox is not fill up, after user click on the Add Credit button, the error message will show at header.

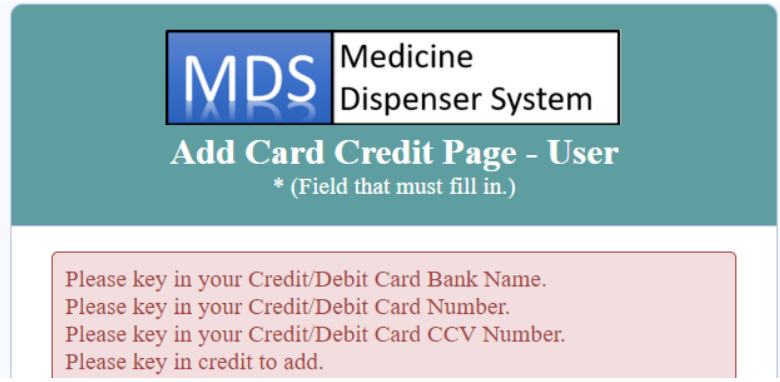


Figure 5.33 Blank in particular textbox

2. If the credit number is less than 6 numbers and CCV number is more or less than 3 numbers, the following error message will be prompt out at the header.

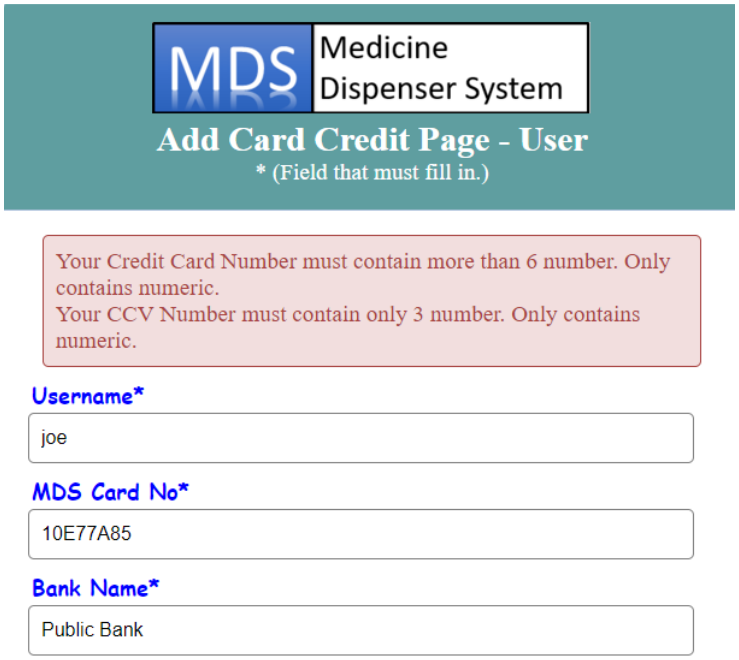


Figure 5.34 Card number less than 6 number and CCV number are no contains 3 number

5.9 Top-Up History View

This page is purpose use for user to revise back their credit top-up history. (Data retrieve from Payment database)

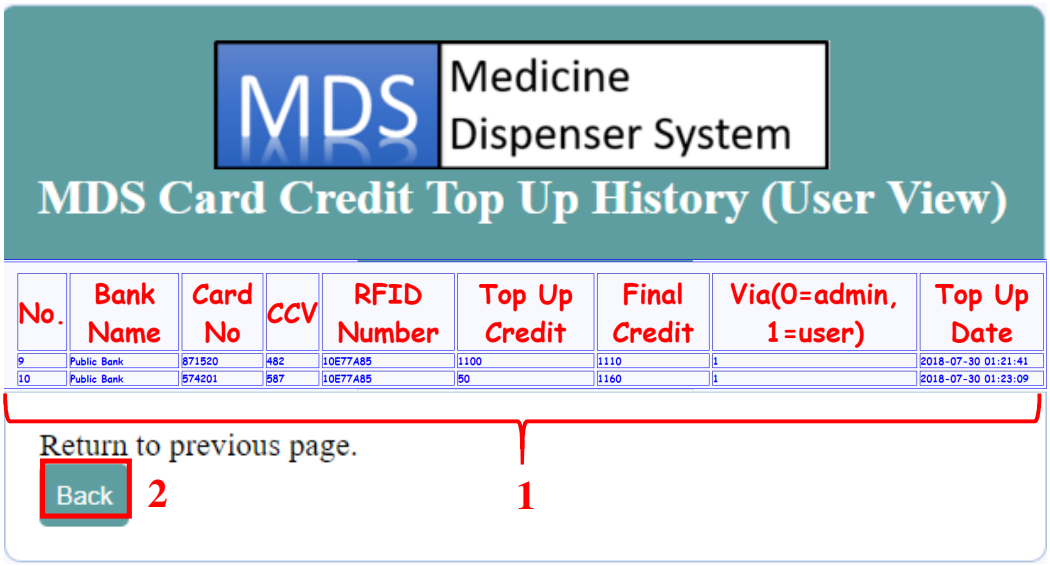


Figure 5.35 MDS Card Credit Top Up History (User View)

1. The details of top-up history are shown here.
2. Click on Back button to back to previous page.

5.10 Purchase Item Page

This page function is use to replace the button selection that done in FYP1. User can use this page to purchase the product they like and details information of the card profile (from Card database with username as condition) and stock information (from Stock database) are also shown in this page. This give a lot of convenience to customer when they had doubt to know they credit left and they can get guarantee details stock information.

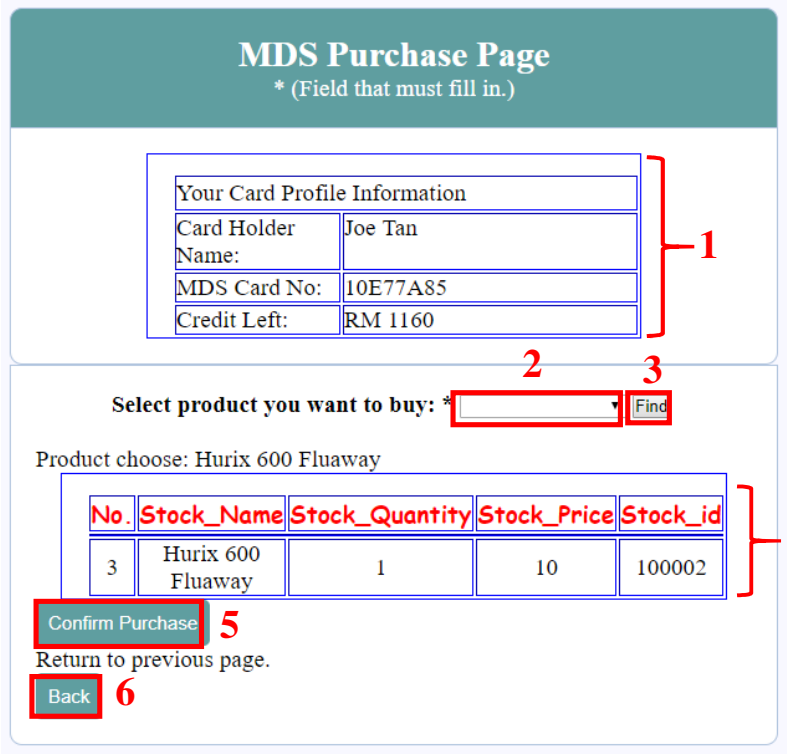


Figure 5.36 MDS Purchase Page

1. User card profile are shown to let user have information on their card status.
2. Choose the product want to buy from the drop down list.
3. Click on Find button after choose the product from drop down list.
4. Stock information will be shown after the find button was clicked.
5. Click on Confirm Purchase Button to process confirmation page.
6. Click on Back button back to previous page.

Error Test Case

a) If user doesn't select anything or select blank selection on the drop down list. When user click on the Confirm Purchase button, the error message will be shown at the header.

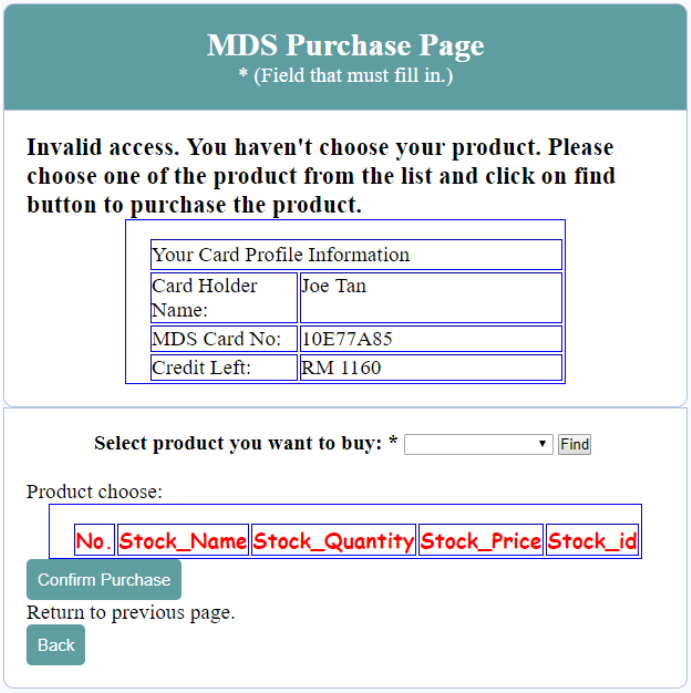


Figure 5.37 Invalid product choose

b) If user having insufficient money inside the MDS Card, the insufficient credit message will be show at the user home page header. User unable access into purchase item page with the insufficient credit in the MDS Card.

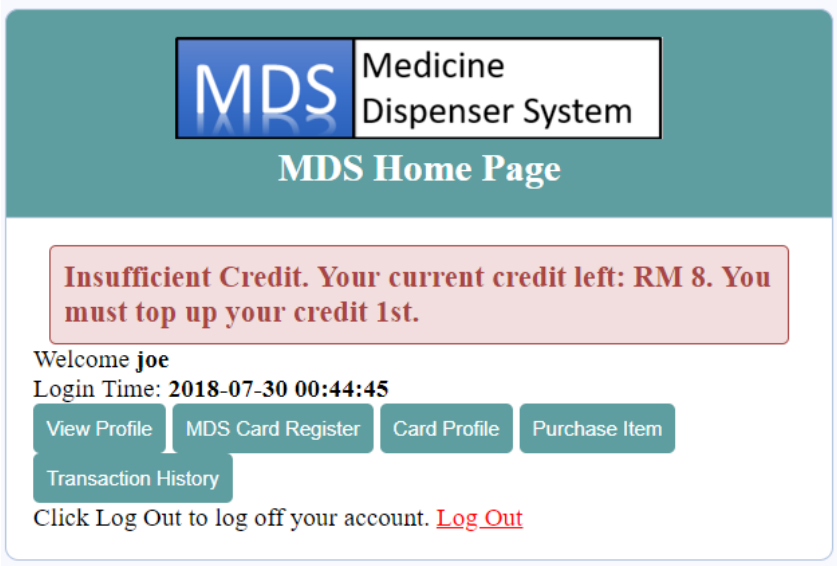


Figure 5.38 Insufficient Credit

c) If all the stock in the machine is out of stock, user are not available to access this purchase page until admin has restock all the product inside the machine. The following message will show at the user home page header.

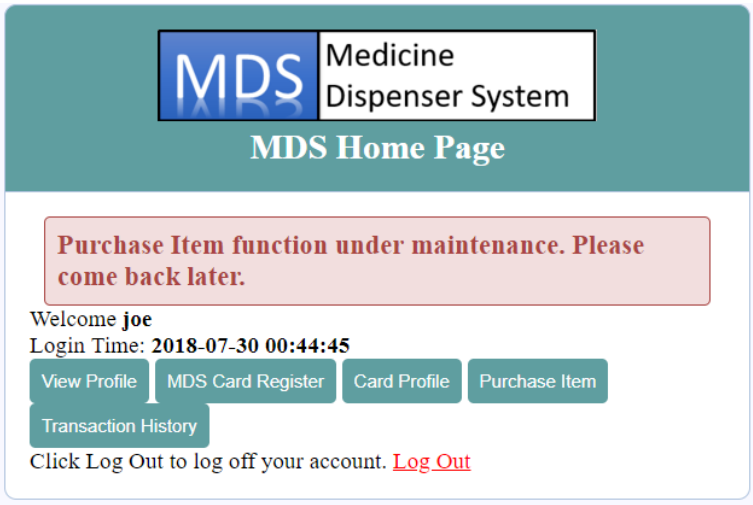


Figure 5.39 Out of Stock

d) If user doesn't activate or own the MDS Card, when they try to click on Purchase Item button, the system will not allow them to access this page.

Figure 5.40 MDS Card not found in the Registration database

5.11 Purchase Confirmation Page

This page is used for user to final confirm whether they want to buy this product. After the confirmation done, the transaction details has been recorded and save into the Transaction database. The credit value inside the Card and Registration database will also consequently deducted from the product price.

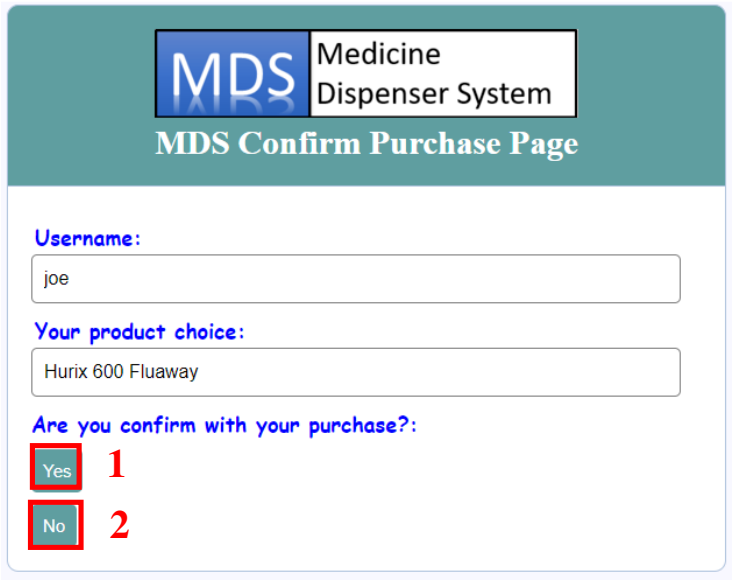


Figure 5.41 MDS Confirm Purchase Page

1. Click on Yes button if user confirm to buy this product.
2. Click on No button back to purchase page.

Test Case

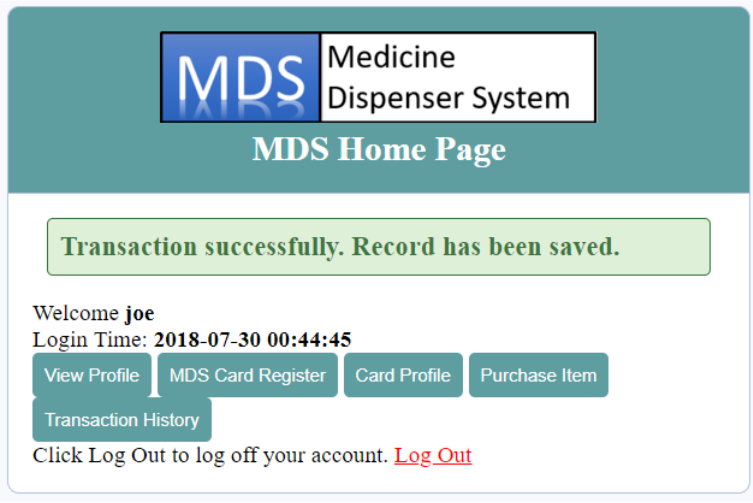
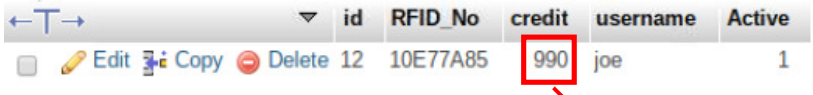


Figure 5.42 Transaction Successful

Card database:



	id	RFID_No	credit	username	Active
Edit Copy Delete	12	10E77A85	990	joe	1

Figure 5.43 Credit reduction in Card database

Assume that credit before purchase = RM1000
Product Price = RM10
Final credit = RM1000 – RM10 = RM990

Registration database:

	id	username	email	RFID_No	Credit
Edit Copy Delete	2	admin	admin@123.com		0
Edit Copy Delete	10	joe	joe_tan1015@hotmail.com	10E77A85	990

Figure 5.44 Credit reduction in Registration database

5.12 Transaction Report Page (User View)

This page allow user to revise back their transaction done previously. All the data retrieve are get from Transaction database with own user username as condition.

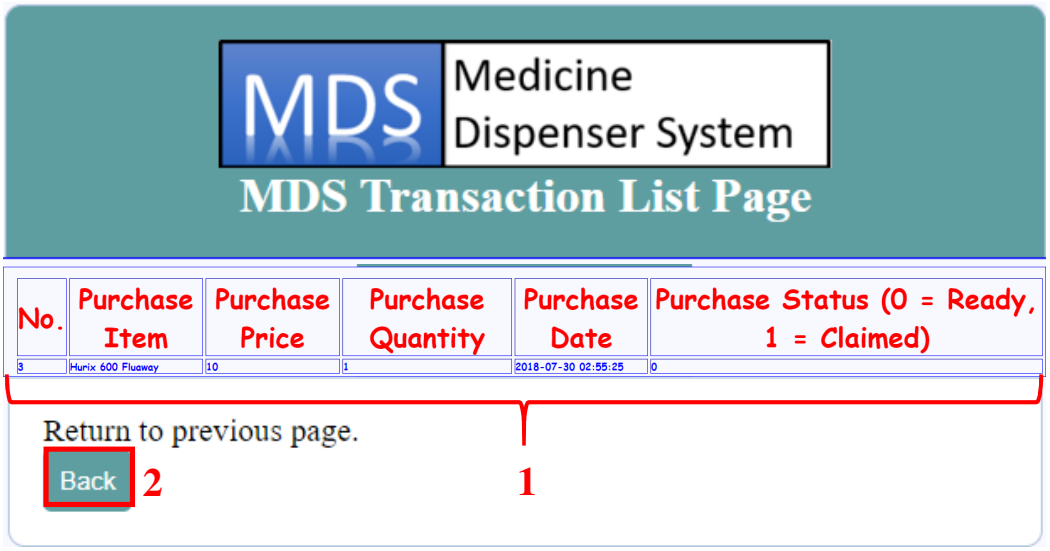


Figure 5.45 MDS Transaction List Page

1. Transaction list shown here.
2. Click on Back button back to User Home Page.

5.13 Admin Home Page

To login into this page, the combination of the username and password must type correctly. To access into this page, username is admin and password is abc123. This page contains 4 link which is User MDS Card Maintenance, Stock Maintenance, Customer Transaction Report and Customer Account List.

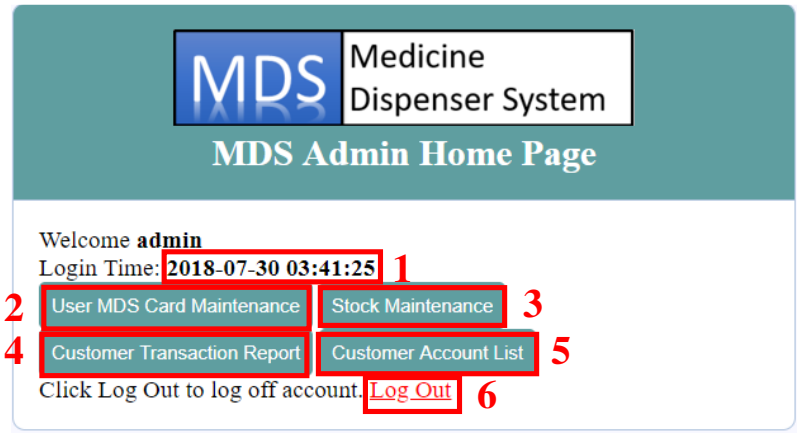


Figure 5.46 MDS Admin Home Page

1. Login time display here.
2. Click on User MDS Card Maintenance button to operate on user MDS Card. (See section 5.13)
3. Click on Stock Maintenance button to operate on machine stock configuration. (See section)
4. Click on Customer Transaction Report button to view all time customer transaction report. (See section)
5. Click on Customer Account List button to configure on the customer MDS Account. (See section)
6. Click on Log Out link to log off admin account.

5.14 User MDS Card Maintenance Page

Function of this page is for admin to configure and maintenance on the user MDS Card. All the MDS Card must be register by the admin first before the card can be use. All the MDS Card will assign with the user MDS Account username. Purpose of this is to avoid the fraud use of the card and avoid duplicate card use by other user or unknown third party. This is to enhance the security purpose of the system.

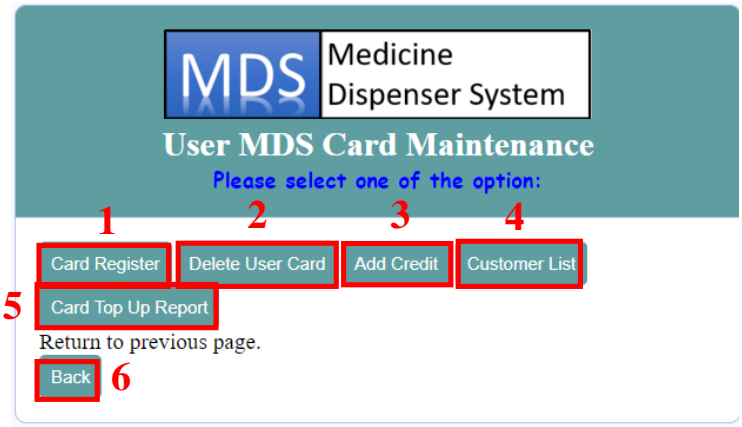


Figure 5.47 User MDS Card Maintenance Home Page

1. Click on Card Register button to register user MDS Card. (see Section 5.15)
2. Click on Delete User Card button to delete user MDS Card. (see Section 5.16)
3. Click on Add Credit button to help user top-up their card credit in the MDS Card. (see section 5.17)
4. Click on Customer List button to view each user with the MDS Card number in a list. (see section 5.18)
5. Click on Card Top Up Report button to view each user top-up credit history. (See section 5.19)
6. Click on back button back to previous page.

5.15 MDS Card Register Page (Admin View)

This page is use for admin to register user MDS Card. Each card will be assign to user MDS Account username. Each card are cost RM10. At default, each MDS Card will assign RM10 credit into the card. Credit inside the card are editable depend on how much credit in this card when user first buy MDS Card from the admin. For example, if user use RM100 to but this card, admin just need to set RM100 inside the credit. Every new registration information will save into Card database in the system.

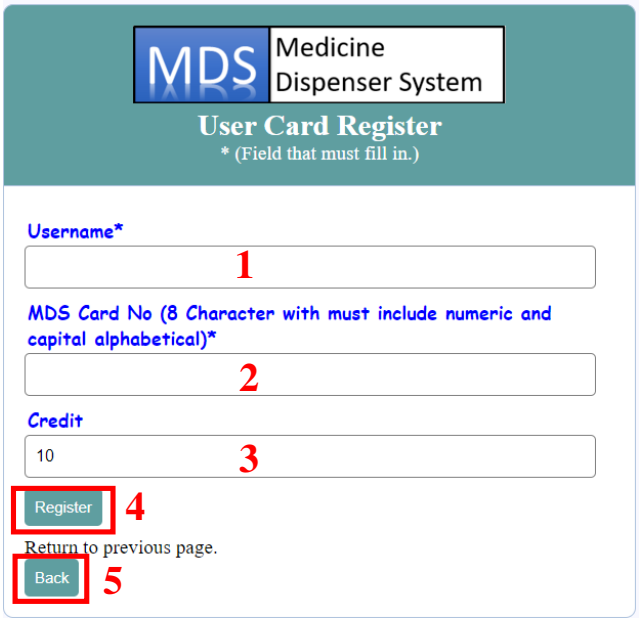


Figure 5.48 User Card Register Page (Admin View)

1. Key in user MDS Account username.
2. Key in MDS Card number.
3. Key in the amount of credit to assign into this MDS Card.
4. Click on Register button to complete MDS Card registration.
5. Click on Back button back to previous page.

Test Case

Assume that admin register new card for Joe and Joe use RM1000 to buy the card. The card credit should contain RM1000.

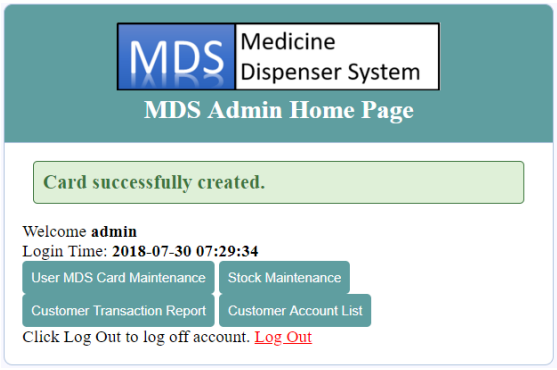
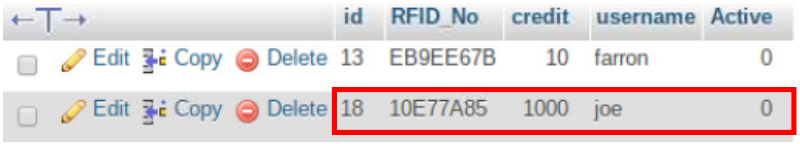


Figure 5.49 Card successfully created by admin

Card database:



	id	RFID_No	credit	username	Active
Edit Copy Delete	13	EB9EE67B	10	farron	0
Edit Copy Delete	18	10E77A85	1000	joe	0

Figure 5.50 Card information save into Card database

Error Test Case

a) Each customer can only own one MDS Card. If this user had owned the card. The following error message will be display.

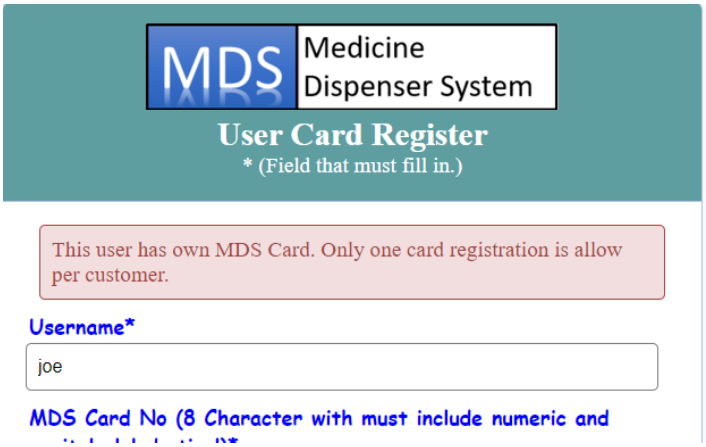


Figure 5.51 This user own the MDS Card and card register is not allow

b) Registered MDS Card are not allow to register again. This is to avoid duplicate MDS Card happen.

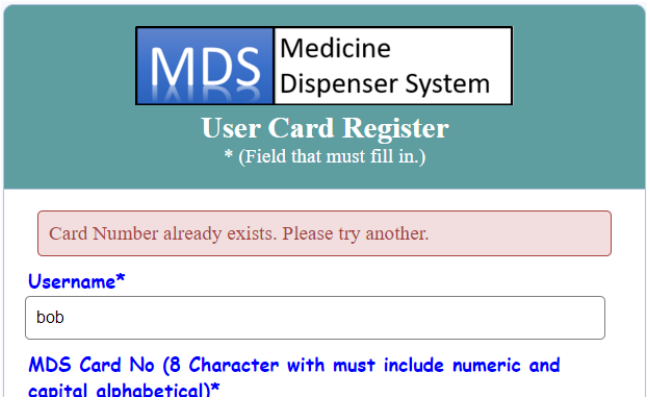


Figure 5.52 This MDS Card are using by other user

5.16 Delete User MDS Card Page

This page main function is for admin to delete user existing MDS Card. If user has lost their Card, to avoid the abuse use of credit inside the MDS Card, admin had delete the Card from the Card database and return back the credit left inside the card.

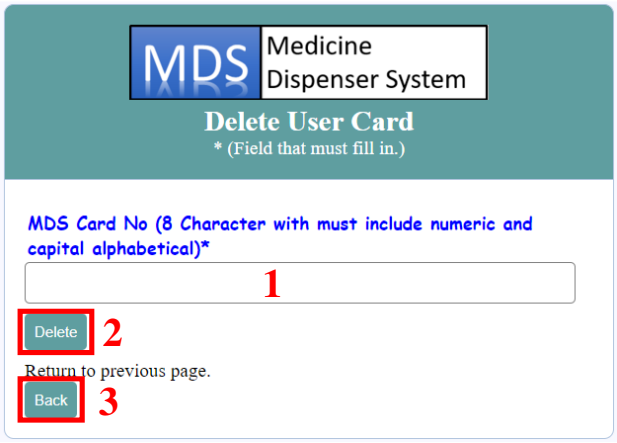


Figure 5.53 Delete User Card Page

1. Key in MDS Card Number to delete this particular card from the database.
2. Click on Delete button to complete card deletion.
3. Click on Back button back to previous page.

Test case

Assume that admin delete the Joe card and related information must be deleted from the Card and Registration database.

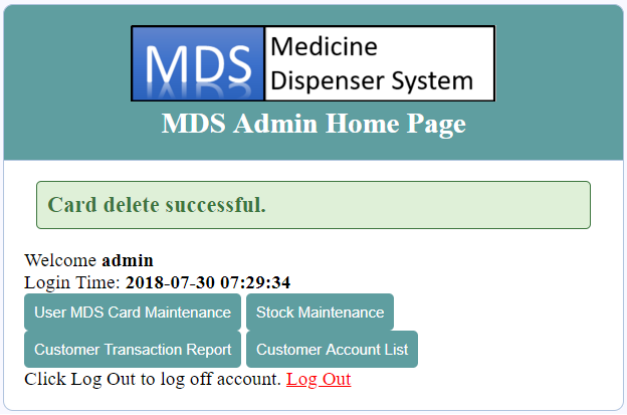


Figure 5.54 Card Delete successful

Registration database:

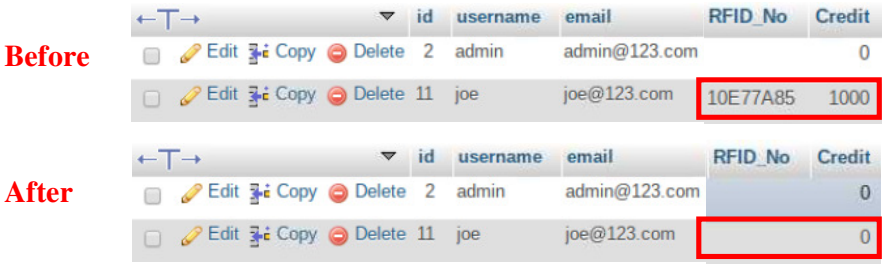


Figure 5.55 Comparison on Registration database before and after update

Card database:

Figure 5.56 Comparison on Card database before and after update

Error Test Case

a) Delete on non-register card must not available to carry out delete function.

Figure 5.57 Card number undefined in Card database

5.17 Add Credit Page (Admin View)

Admin also can help in add user MDS Card credit in case customer doesn't own the credit or debit card. All the credit addition must able to be save and update in Card and Registration database.

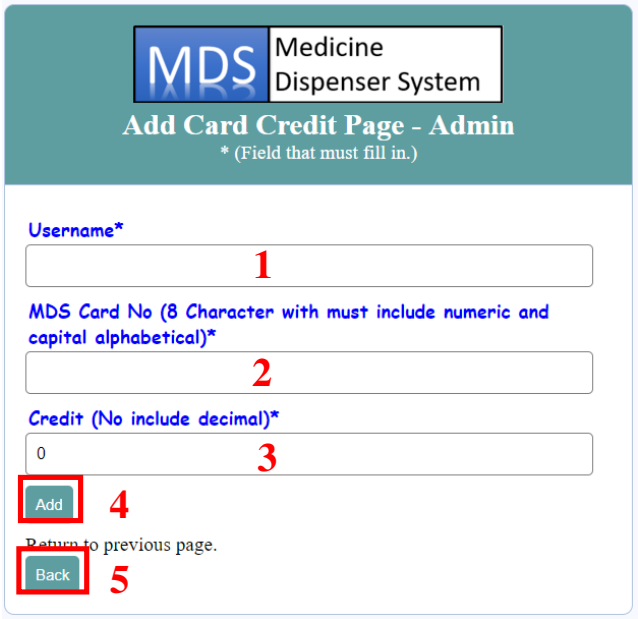


Figure 5.58 Add Card Credit Page (Admin View)

1. Key in user MDS Account username.
2. Key in this particular user MDS Card number.
3. Key in credit user want to add.
4. Click on Add button to complete credit addition.
5. Click on Back button back to previous page.

Test case:

Assume that admin help Joe top up RM100 credit and credit addition was successful done.

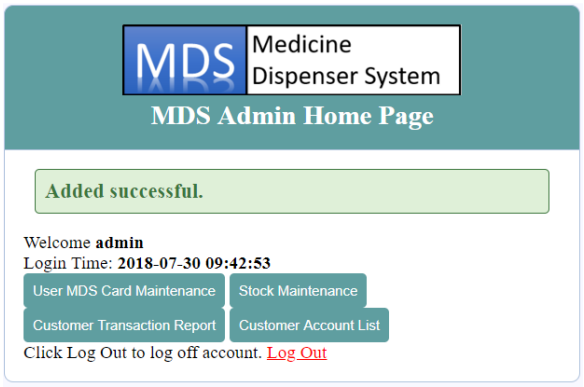


Figure 5.59 Card credit added successful by admin

Card database:

Before

	id	RFID_No	credit	username	Active
Edit Copy Delete	13	EB9EE67B	10	farron	0
Edit Copy Delete	21	10E77A85	1000	joe	1

After

	id	RFID_No	credit	username	Active
Edit Copy Delete	13	EB9EE67B	110	farron	0
Edit Copy Delete	21	10E77A85	1100	joe	1

Figure 5.60 Comparison on Card database before and after add credit

Registration database:

Before

	id	username	email	password	RFID_No	Credit
Edit Copy Delete	2	admin	admin@123.com	abc123		0
Edit Copy Delete	10	joe	joe_tan1015@hotmail.com	abc123	10E77A85	1000

After

	id	username	email	password	RFID_No	Credit
Edit Copy Delete	2	admin	admin@123.com	abc123		0
Edit Copy Delete	10	joe	joe_tan1015@hotmail.com	abc123	10E77A85	1100

Figure 5.61 Comparison on Registration database before and after add credit

Error Test Case

a) The username and MDS Card Number combination must be correct, otherwise an error message will show at header.

Figure 5.62 Wrong username/card number combination

5.18 MDS User Card List

This page is use for admin to check all customer MDS Card information in a list. (Data retrieve from Card database)

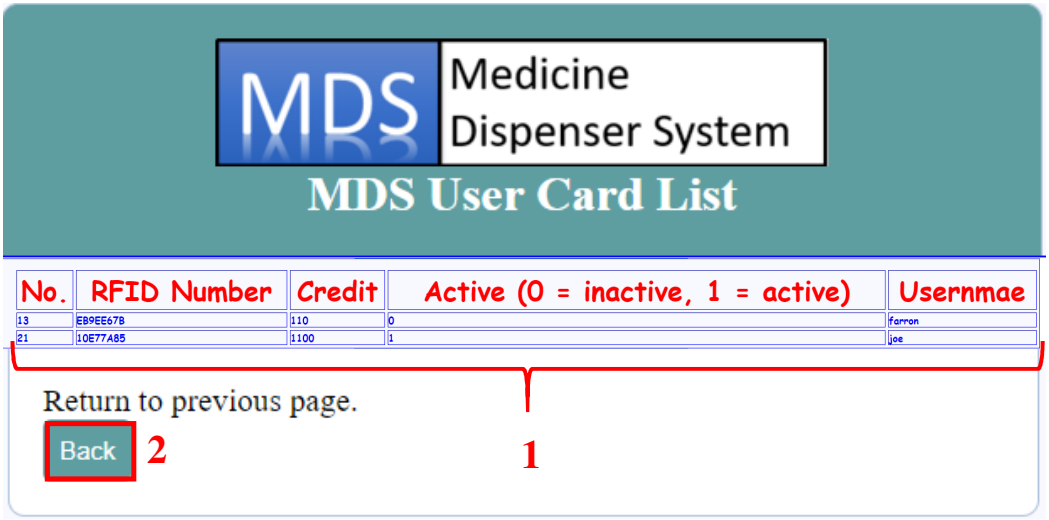


Figure 5.63 MDS User Card List Page

1. All user card list are shown here.
2. Click on Back button back to previous page.

5.19 MDS User Card Credit Top Up History (Admin view)

This page function list down all the user MDS Card Credit Top Up History in the report list form. (Data retrieve from Payment database)

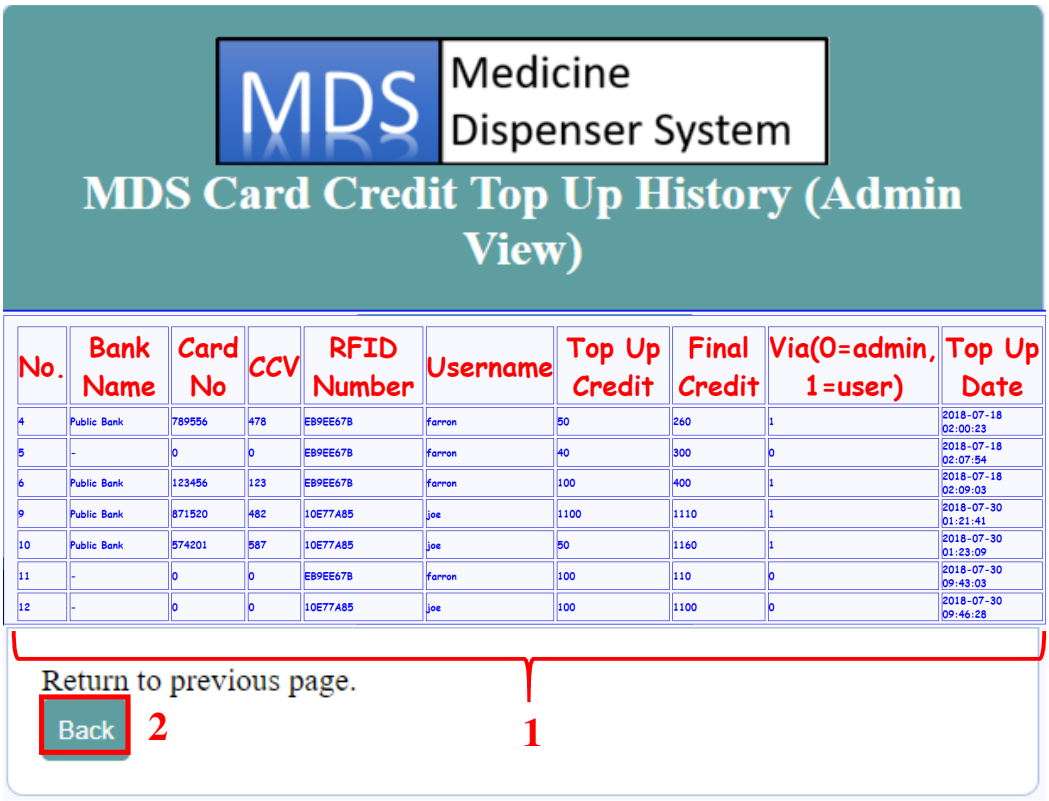


Figure 5.64 MDS Card Credit Top Up History Page (Admin View)

1. All user card list are shown here.
2. Click on Back button back to previous page.

5.20 MDS Stock Maintenance Main Page

This is the stock maintenance main page for admin to register their stock, delete existing stock, edit stock information and review stock list. Only maximum 2 stock are available to register into stock list.

Figure 5.65 MDS Stock Maintenance Main page

1. Click on Stock Register button to register stock to display for sales. (see Section 5.21)
2. Click on Delete Stock button to delete stock in the list. (see Section 5.22)
3. Click on Edit Stock Button to edit existing stock information in the list. (see Section 5.23)
4. Click on Stock List Button to view the stock list. (see Section 5.24)
5. Click on Back button back to previous page.

5.21 MDS Stock Register Page

This page is use for admin to register their new stock into the database. All the registered stock will be display at the purchase page as product choice for user. Maximum only 2 stock registration is allow in this system.

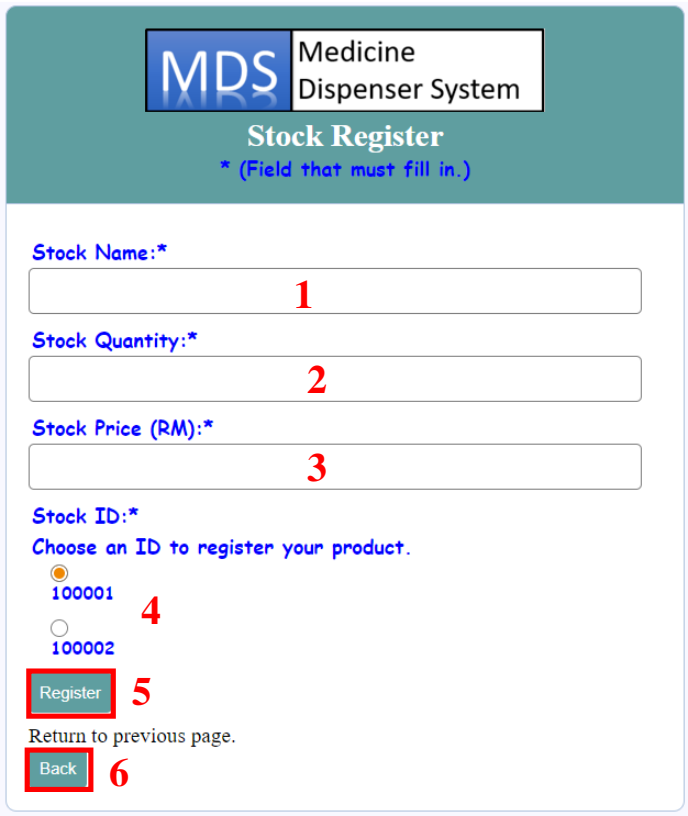


Figure 5.66 Stock register Page

1. Key in Stock Name.
2. Key in Stock Quantity.
3. Key in Stock Price.
4. Choose one of the ID as Stock ID for this particular stock.
5. Click on Register button to complete stock registration.
6. Click on Back button back to previous page.

Test Case

Assume that admin register one of the product name Panadol Activefast with 5 Stock Quantity, Price set at RM10 and Stock ID 100001 are successful register and save into Stock database.

Figure 5.67 Stock successfully registered

Stock database:

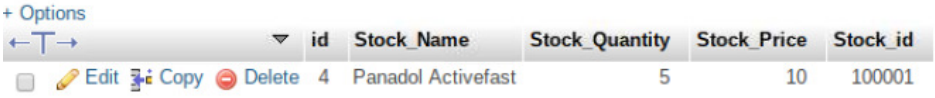


Figure 5.68 New stock information insert in Stock database

Error Test Case

a) Stock register with the same Stock ID for more than one product is not allow. Stock ID must be unique for each product. The following error message will be display if violate the rule.

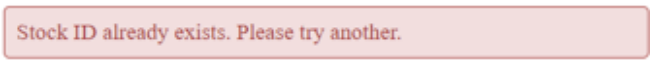


Figure 5.69 Register with existing Stock ID

b) Only maximum 2 stock are register inside the list. More than 2 stock register into the list is restricted.

Figure 5.70 Full item list

5.22 MDS Delete Stock Page

This page is use for admin to delete the existing stock in the list. The stock will be delete from Stock database.

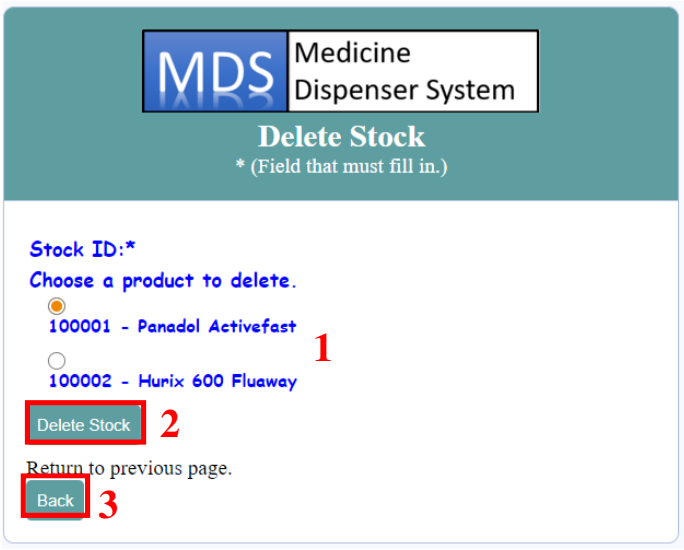


Figure 5.71 Delete Stock Page

1. Select one of the product that admin wish to delete.
2. Click on Delete Stock button to complete stock deletion.
3. Click on Back button back to previous page.

Test Case

Assume that admin are delete 100001-Panadol Activefast from the list and the deletion in database was successfully done.

Figure 5.72 Stock delete successful

Stock database:

Before

+ Options

	id	Stock_Name	Stock_Quantity	Stock_Price	Stock_id
Edit Copy Delete	5	Hurix 600 Fluaway	5	10	100002
Edit Copy Delete	6	Panadol Activefast	5	10	100001

After

+ Options

	id	Stock_Name	Stock_Quantity	Stock_Price	Stock_id
Edit Copy Delete	5	Hurix 600 Fluaway	5	10	100002

Figure 5.73 Comparison in Stock database before and after delete

Error Test Case

a) If user try to click on Delete Stock button with the empty list. The following error message will be prompt out at the stock maintenance main page.

Figure 5.74 Empty Stock List

b) Delete on the ID with non-assign product must not able to do any delete function and error message will be display at the Delete Stock Page.

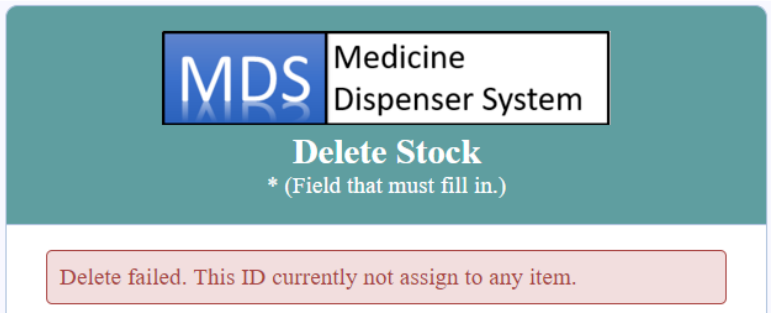


Figure 5.75 Delete on non-assign product Stock ID

5.23 MDS Stock Update Page

This page is for admin to edit current existing stock information in the list. Admin just need to choose one of the product that he/she want to edit, update the particular and click on Update button to complete the edit.

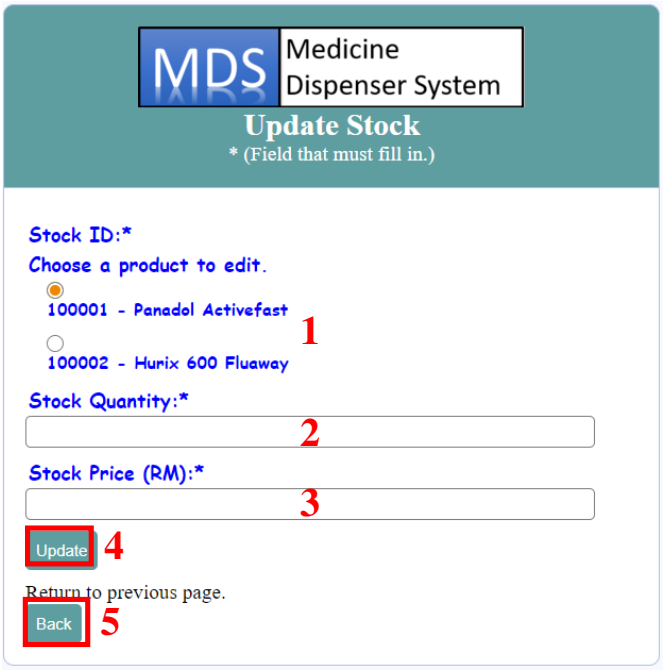


Figure 5.76 Update Stock Page

1. Choose one of the product to edit.
2. Key in Stock Quantity.
3. Key in Stock Price.

Test case

Assume that admin edit on the first product and set the stock quantity to 1. The stock price change to RM5. The system should able do the database update according to user input type. Assume that update is success and update into correct row on Stock database.

Figure 5.77 Stock successfully update

Stock database:

Before

	id	Stock_Name	Stock_Quantity	Stock_Price	Stock_id
Edit Copy Delete	7	Panadol Activefast	5	10	100001
Edit Copy Delete	8	Hurix 600 Fluaway	5	10	100002

After

	id	Stock_Name	Stock_Quantity	Stock_Price	Stock_id
Edit Copy Delete	7	Panadol Activefast	1	5	100001
Edit Copy Delete	8	Hurix 600 Fluaway	5	10	100002

Figure 5.78 Comparison in Stock database before and after update

Error Test Case

a) Assume that admin click on Edit Stock button in the stock maintenance main page with the empty stock list. The system will not allow admin to process this page and error message will display at the header.

Figure 5.79 Empty stock list

b) Edit on the Stock with the non-assign product Stock ID are not allow to process any edit function.

Figure 5.80 Update on non-assign product Stock ID

5.24 MDS Stock List Page

This page is use for admin to view the current registered stock information list. (Data retrieve from stock database)

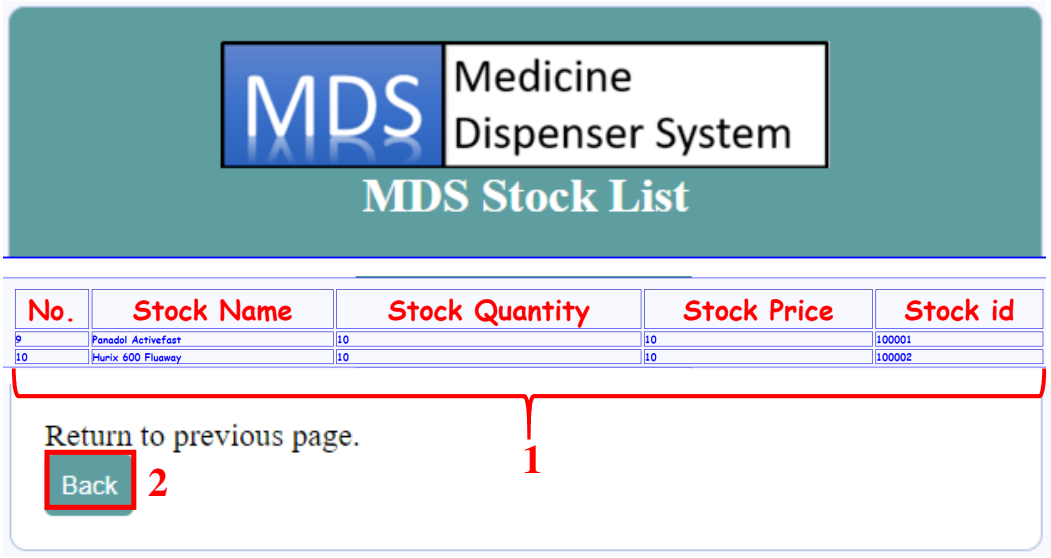


Figure 5.81 MDS Stock List Pagw

1. Stock information list are shown here.
2. Click on back button back to previous page.

5.25 MDS Customer Transaction List Page

This page is convenience for admin to retrieve their customer transaction report. Admin can also use this page as generate transaction report purpose use. (Data retrieve from Transaction database)

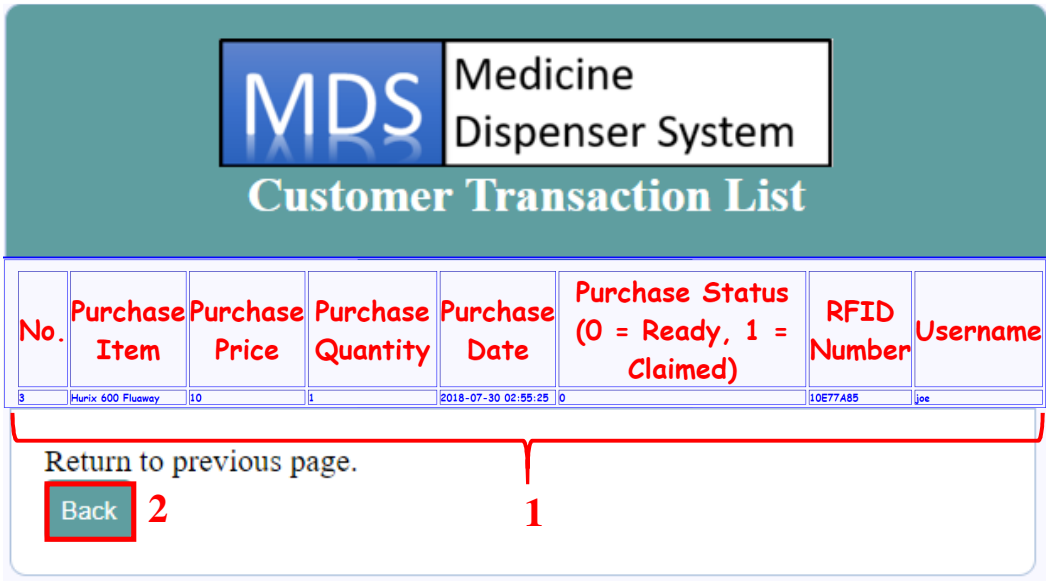


Figure 5.82 Customer Transaction List Page

1. Customer transaction list are shown here.
2. Click on back button back to previous page.

5.26 MDS User Account List Page

This page is for admin convenience to retrieve customer MDS Account data. Account Register Date, Last Login Date and Last logout Date will also include in the list. This record are very useful when user account are fraud by unknown third person people. Admin can check back the record and check whether their account are really been fraud by unknown user. If fraud, user have to delete the account immediately to avoid user account abuse use.

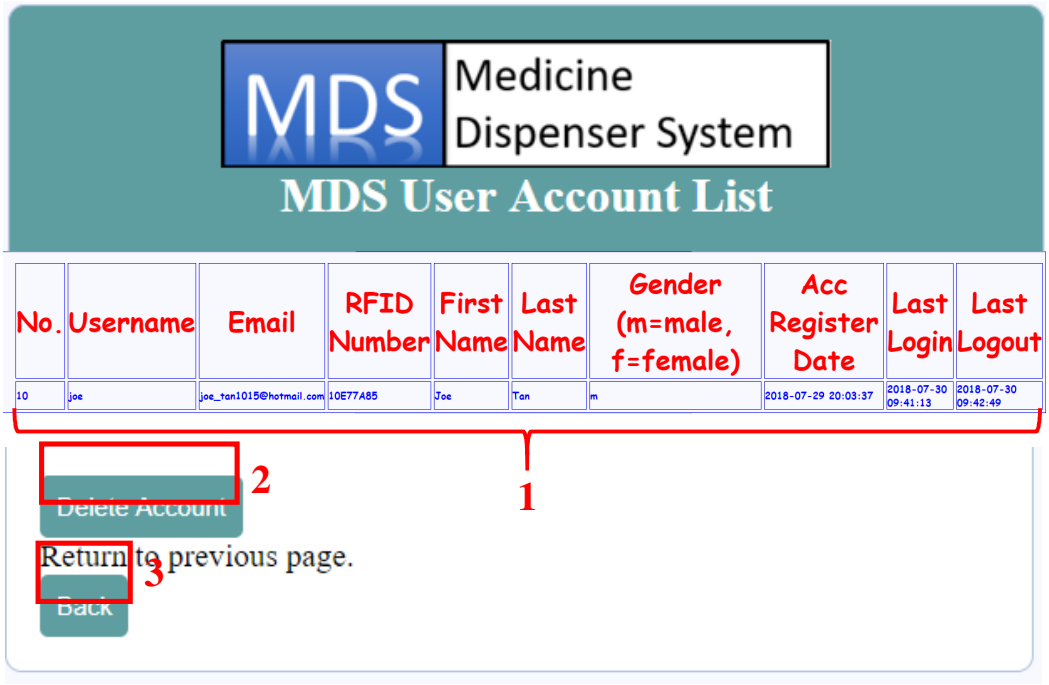


Figure 5.83 MDS User Account List Page

1. MDS User Account list are shown here.
2. Click on Delete Account to delete certain user account. (see Section 5.27)
3. Click on back button back to previous page.

5.27 MDS Delete Account Page

Admin can delete certain user account through this page. All the data inside the database (Registration, Card, Payment and Transaction) that related to this user must be delete clearly.

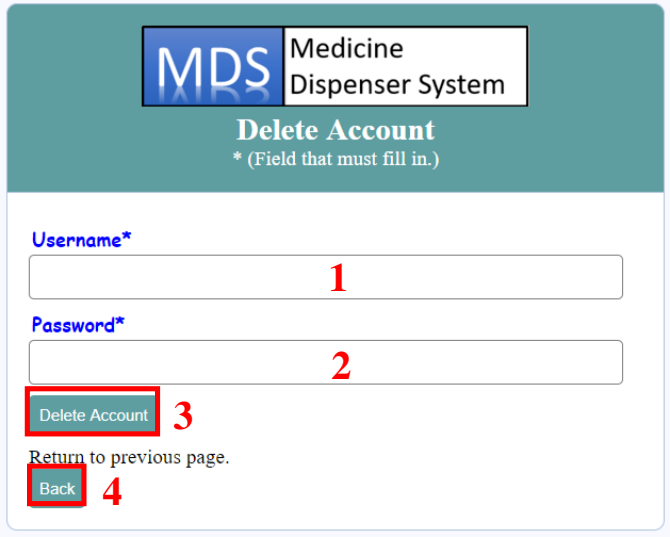


Figure 5.84 Delete Account Page

1. Key in user MDS Account username.
2. Key in user MDS Account Password.
3. Click on Delete Account button to complete the account deletion process.
4. Click on Back button back to previous page.

Test Case

Assume that admin try to delete one of the user account, all the information in the database that related to this user must delete clearly. The combination of username and password must be correct otherwise the error message will be display at the header.

Figure 5.85 Account delete successful

Error Test Case

Click on Delete Account button with the empty textbox or wrong combination username and password will prompt an error message at the admin main page.

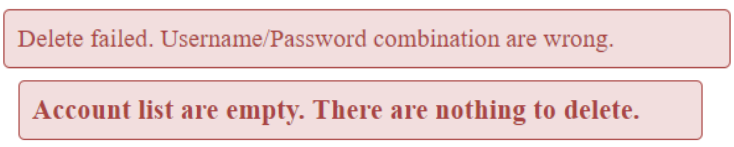


Figure 5.86 Error message 2

Chapter 6: Implementation and testing

6.1 Implementation

Figure 6.1 Prototype for FYP1

Figure 6.2 Prototype FYP2

In FYP1, Arduino Board has been used as our master device in our project which means that Arduino Board was used to control all the hardware inside the system and all transaction data are save into EEPROM from the Arduino Board. However, there is a limitation on saving data inside the EEPROM since the space of EEPROM only 4K byte space available and it may store only not more than 100 customer data. Most serious problem is user MDS Card doesn't have user full name assign. This is due to the difficulty on storing string character into the EEPORM due to the limitation space onto it. One full name may use to 10-20 byte from the EEPROM. To overcome this problem, all the related data storage are moved into the database with MYSQL platform in Raspberry Pi. Database can provide larger space to store our related data. Besides that, admin and user request data from database are easily to retrieve and display on the webpages. With the help of database, the MDS Card are more secure and the card are more identified with the user name assign, admin can easily identify that this card are belong to which customer.

Changing to non-button system are done in FYP2 which means that customer can went through MDS webpage to purchase the product they want, after that just scan the card through the card reader in the system and system will dispense the correct product to the customer. With the elimination of button function, this can save a lot of memory space and provide faster speed configuration on the Arduino Board. Besides that, this elimination also bring a lot of convenience in provide small code size and easily debug on the system. This also able to eliminate the complex process flow and provide simple and user-friendly system.

To connect Raspberry Pi and Arduino Board and carry out function on serial communication between them, connect them with the USB type B serial port is necessary as shown in Figure 6.3.

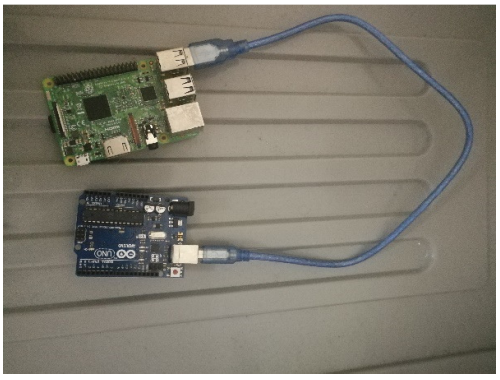


Figure 6.3 Serial Port Communication of Raspberry Pi with Arduino Board

6.2 Testing

6.2.1 Purchase Testing

1. User have to log into their own MDS Account.

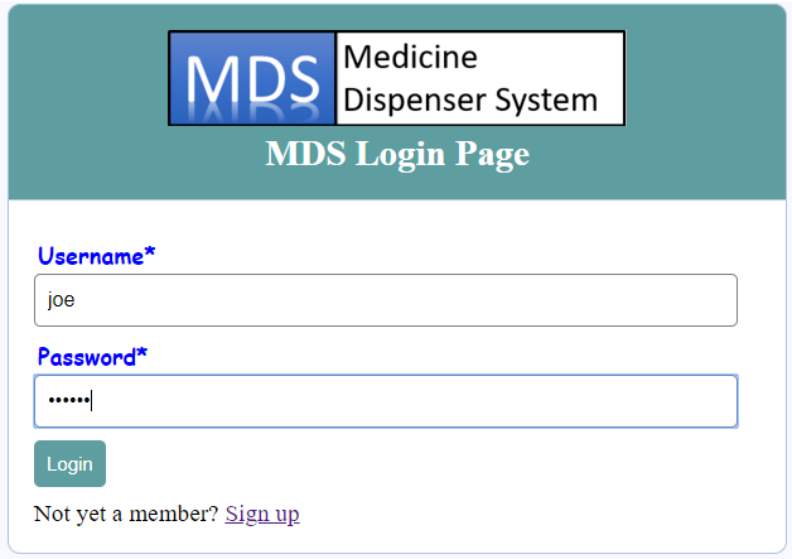


Figure 6.4 Login Account Step

2. Click on Purchase Item button to start purchase process.

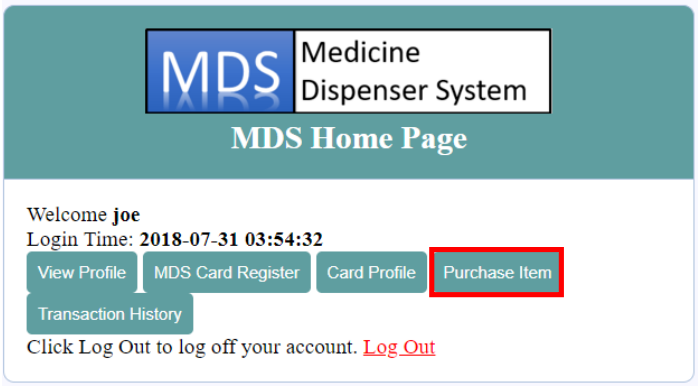


Figure 6.5 Go to purchase page step

3. Choose one of the product from the drop down list then click on Find button to view the stock information.

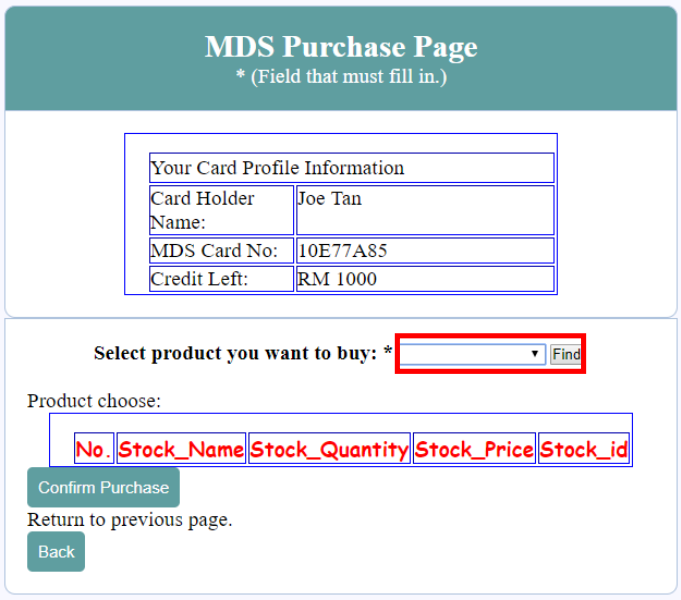


Figure 6.6 Choose product step

4. If user confirm to buy this product, click on Confirm Purchase button for confirmation purchase process.

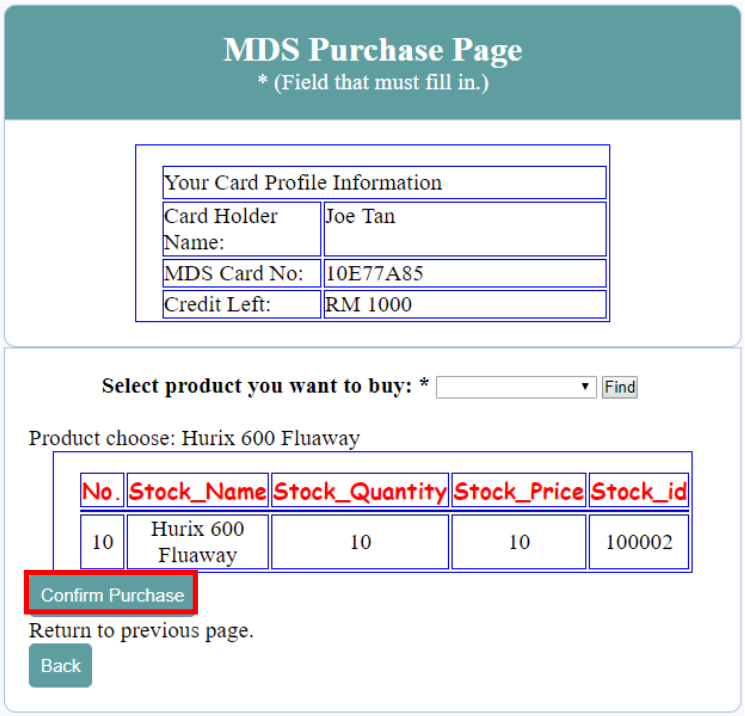


Figure 6.7 Process to confirmation page

5. Click on Yes button to complete the transaction process.

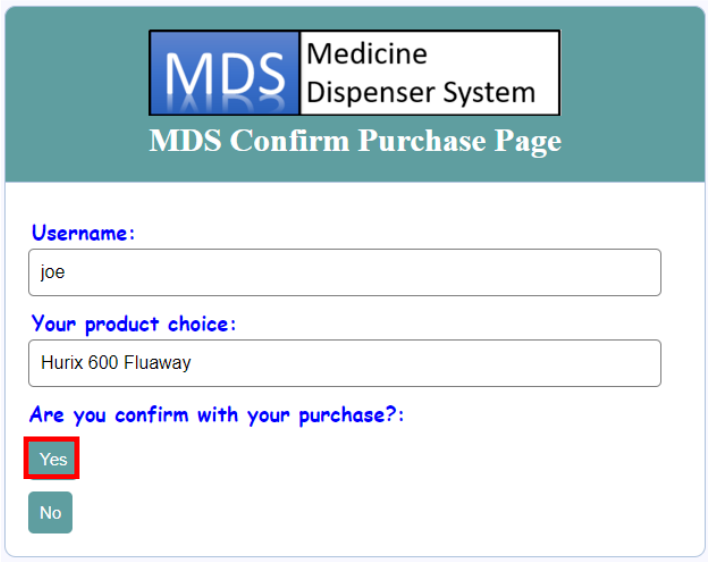


Figure 6.8 Complete transaction process step

6. Transaction successful message will be display at the MDS User Home Page if the transaction was successfully done without any error occur.

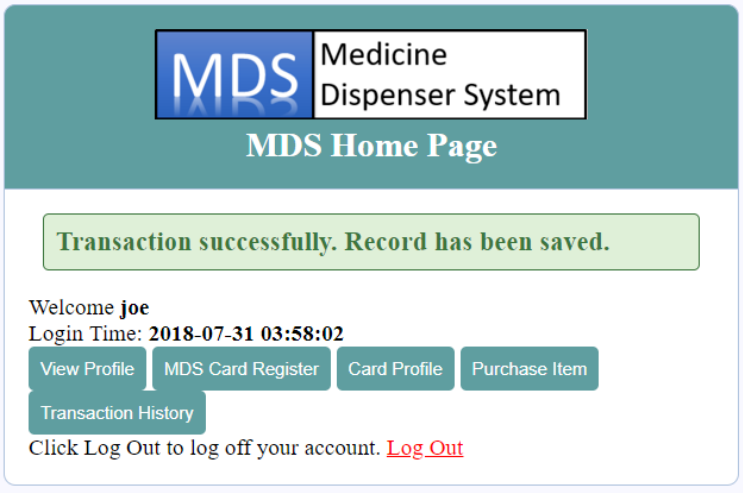
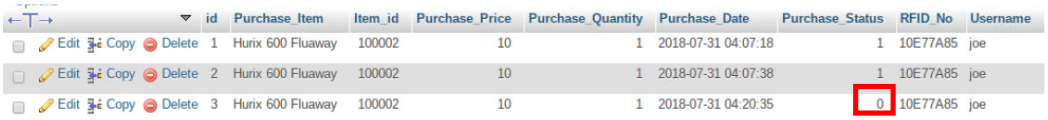


Figure 6.9 Transaction successfully done

7. The transaction details will be save into Transaction database of the system. Purchase_Status with 0 mean the medicine are not claim yet from the machine.



	id	Purchase_Item	Item_id	Purchase_Price	Purchase_Quantity	Purchase_Date	Purchase_Status	RFID_No	Username
Edit Copy Delete	1	Hurix 600 Fluaway	100002	10	1	2018-07-31 04:07:18	1	10E77A85	joe
Edit Copy Delete	2	Hurix 600 Fluaway	100002	10	1	2018-07-31 04:07:38	1	10E77A85	joe
Edit Copy Delete	3	Hurix 600 Fluaway	100002	10	1	2018-07-31 04:20:35	0	10E77A85	joe

Figure 6.10 Transaction database

8. Scan your MDS Card at the RFID Card Reader at the machine to claim your medicine.

Figure 6.11 Scan MDS Card at card reader place

9. After the card scanned, the system will now check this MDS card whether has the medicine that not yet claim.

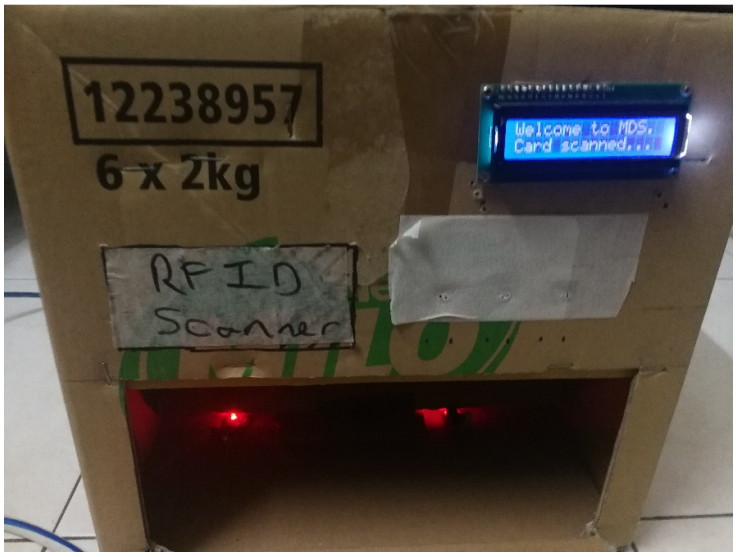


Figure 6.12 System checking on database

10. If Purchase status is zero, the system will display message “Transaction Found” on the LCD screen and start dispense the correct medicine to the user.

Figure 6.13 “Transaction found” message display

11. When the system scan the medicine drop from the machine, the system will display “Product is Ready” message on LCD screen and customer can get their medicine from the door.

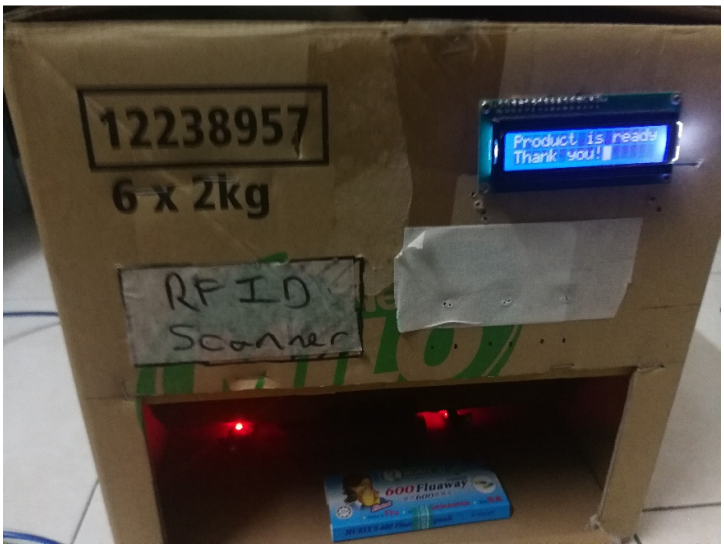


Figure 6.14 Medicine is ready and can get from door

12. The Purchase_Status in database will change to one and indicate that medicine has been claimed from the machine.

+ Options

	id	Purchase_Item	Item_id	Purchase_Price	Purchase_Quantity	Purchase_Date	Purchase_Status	RFID_No	Username
Edit Copy Delete	1	Hurix 600 Fluaway	100002	10	1	2018-07-31 04:07:18	1	10E77A85	joe
Edit Copy Delete	2	Hurix 600 Fluaway	100002	10	1	2018-07-31 04:07:38	1	10E77A85	joe
Edit Copy Delete	3	Hurix 600 Fluaway	100002	10	1	2018-07-31 04:20:35	1	10E77A85	joe

Figure 6.15 Transaction database update

6.2.2 Invalid Access Testing (Transaction not found)

1. If unknown card or unregister MDS Card scanned, the system will display "Transaction Not Found" and "Invalid Card Scanned" message on the LCD screen.

Figure 6.16 Transaction Not Found

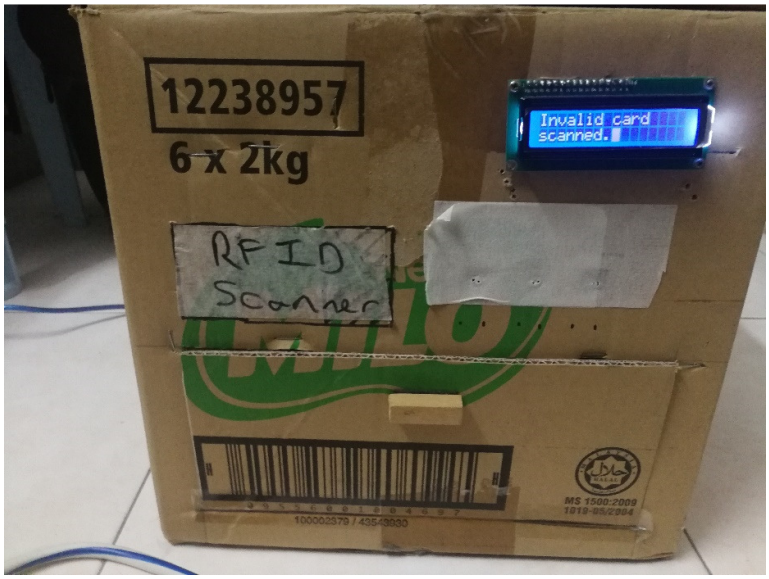


Figure 6.17 Invalid Card Scanned

6.2.3 Out of stock testing

The system able to define whether which stock in the machine is out of stock and the system will send an email to the admin and alert them that restock is necessary to be done immediately.

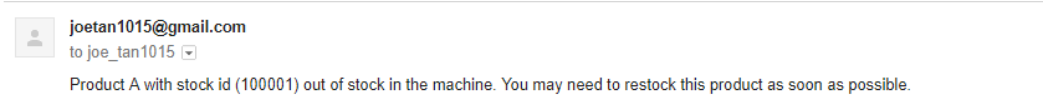


Figure 6.18 Product A are out of stock

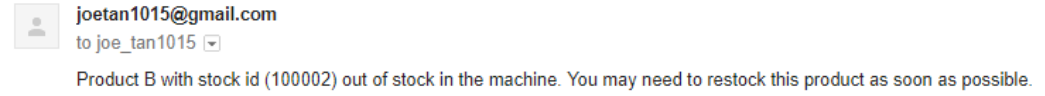


Figure 6.19 Product B are out of stock

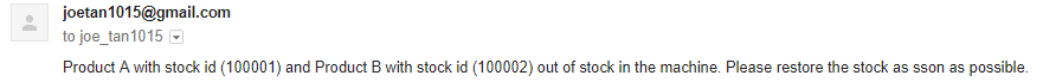


Figure 6.20 Product A and Product B are out of stock

Chapter 7: Conclusion

This report is written about the overall design and implementation of the Medicine Dispenser System.

Mostly haven't see Medicine Dispenser System (a.k.a Vending Machine) in our real-life. People always need go to pharmacy or clinic which is far away from home. Sometimes, people always doesn't have first aid kit prepare in the house or even office. When someone is need the medicine immediately but realize that particular medicine was finished used, more to worst card is they don't have extra in the home or office. This may risk the patient life due with didn't get the first aid immediately.

Therefore, this is the most motivation for this project to be implement. With this project implement, it can give a lot of convenience to everybody, people doesn't need go far away pharmacy to buy the medicine. This system can implement at anywhere like office, apartment, and even in university. This system also can represent as first aid kit for us to get the treatment in time.

Appropriate hardware and software are needed to implement this project. Besides that, a good programming skill also needed to programming on the coding implementation. Technical knowledge also needed for design and implement a good quality of prototype and system. The main hardware used in this project like Arduino Uno Board, MFRC522 Card Reader, Servo Motor, LCD Display and Buttons. Software needed in this project is Raspberry Pi 3.

The purpose of implementing RFID Card System is to replace the traditional way of transaction system which is coin/cash payment system. RFID Card system can provide many advantages to customer and improve security of the system. With the combination work of hardware and software implementation, this can provide more user-friendly to the system and ease to use by customer. Besides that, it can store a lot of information inside the software database instead of hardware memory which are very limited space and space size is small. Elimination of button choice system can provide faster speed configuration, small process flow, ease to use and small code size in the system.

There might be some improvements and further developments need to be done in this project. User/customer need to connect with the local Wi-Fi then only able to access the webpages. User/customer that doesn't connect to the local Wi-Fi are not able to access the webpages. More to worst case is, if the Wi-Fi was shut down, the whole system will not able to function and user/customer cannot access to the webpages.

In conclusion, this project will serve to be a convenient tool and able to be used in our daily life. Project are completed in FYP 2.

Bibliography

Jasit (2014) *CONVERT YOUR POP/DRINK MACHINE TO USE RFID WITH ARDUINO*
(Accessed 23 July 2018)
Available from:
< http://www.instructables.com/id/Convert-your-POPDrink-Machine-to-use-RFID-with-Ard/>

Kamalanathan.P, Irshath Ahmed. R, Mohamed Aamir. M, Kalaiselvan. P (2015) *AUTOMATIC PAPER VENDING MACHINE* Vol.4 Issue-4, April 2015 p.634 – 639 (Accessed 21 July 2018)

Lelan Bosch, Igor Simanovich, Kyle Thorson (May 2015)
VOICE-ENABLE VENDING MACHINE WITH RFID CONTROL
(Access by 8 Aug 2018)

S. S. Desai, Sayali Maruti Jadhav, Priya Shivaji Patil, Giri Neeta Sambhaji (2017) *Automatic Chocolate Vending Machine By Using Arduino Uno* Vol.5 Issue-2, March 2017 p.226 – 229 (Accessed 21 July 2018)

Sevenmojoe (2017) *SNACKS VENDING MACHINE POWERED BY ARDUINO*
(Accessed 21 July 2018)
Available from:
<http://www.instructables.com/id/Snack-Vending-Machine-Powered-by-Arduino/>

Software development methodologies (2016) [Online]
Available from:
<http://www.itinfo.am/eng/software-development-methodologies/>
(Accessed 25 July 2018)

Vishal Tank, Susmita Warrier, Nishant Jakhiya (2017)
MEDICINE DISPENSING MACHINE USING RASPBERRY PI AND ARDUINO CONTROLLER
(Accessed 1 Aug 2018)

"What Is Prototyping Model? - Definition From Whatis.Com".
Available from: <http://searchcio.techtarget.com/definition/Prototyping-Model>
(Accessed 24 July 2018)

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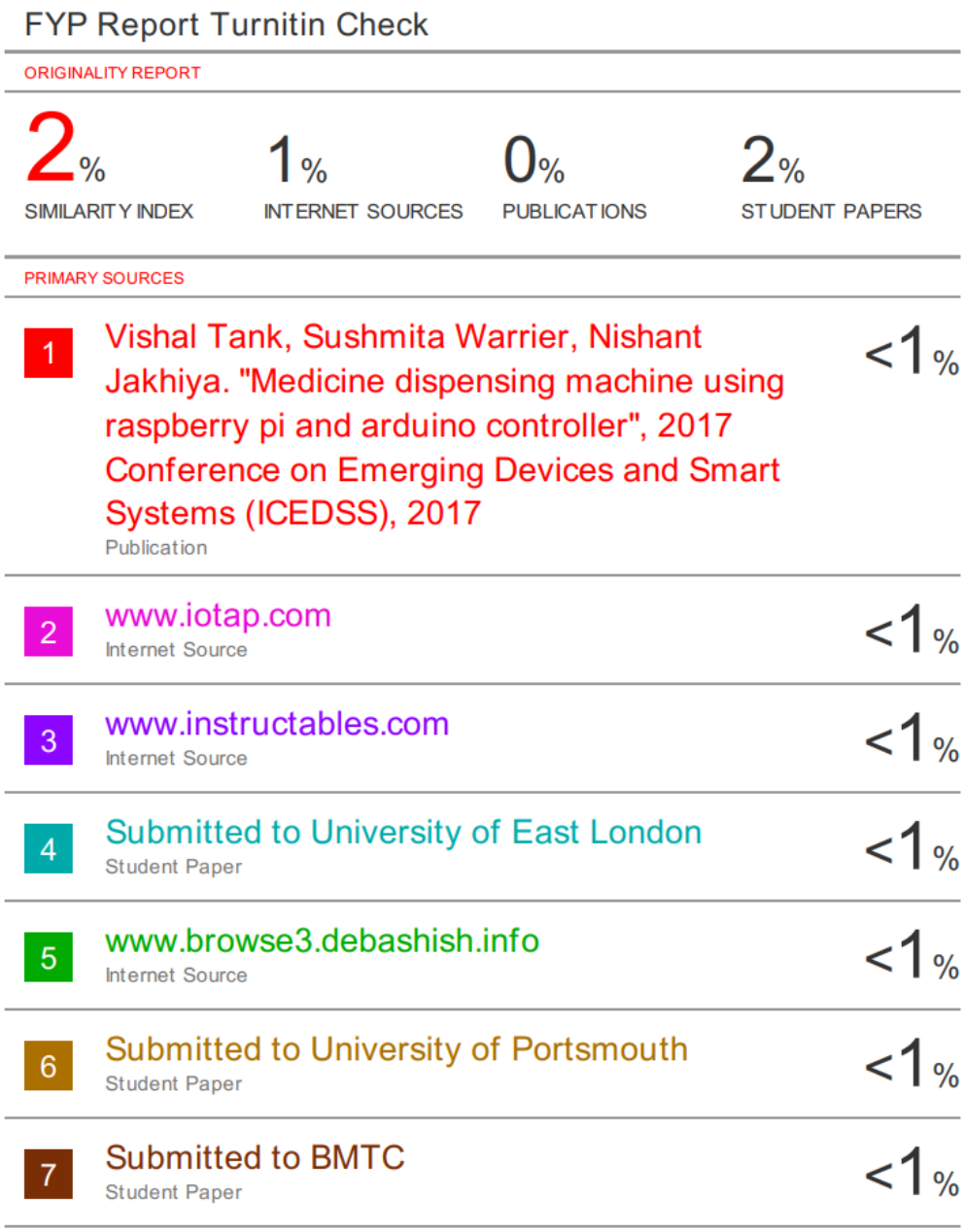

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Similarity	**Supervisor's Comments (Compulsory if parameters of originality exceeds the limits approved by UTAR)**
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Note Supervisor/Candidate(s) is/are required to provide softcopy of full set of the originality report to Faculty/Institute

Based on the above results, I hereby declare that I am satisfied with the originality of the Final Year Project Report submitted by my student(s) as named above.

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Name: _____

Date: _____

_____ Signature of Co-Supervisor

Name: _____

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FACULTY OF INFORMATION & COMMUNICATION TECHNOLOGY (KAMPAR CAMPUS)

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	Front Cover
	Signed Report Status Declaration Form
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	Signed form of the Declaration of Originality
	Acknowledgement
	Abstract
	Table of Contents
	List of Figures (if applicable)
	List of Tables (if applicable)
	List of Symbols (if applicable)
	List of Abbreviations (if applicable)
	Chapters / Content
	Bibliography (or References)
	All references in bibliography are cited in the thesis, especially in the chapter of literature review
	Appendices (if applicable)
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