PEAT

Emergency Kit Vending Machine Using RFID

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Abstract The project proposes an automated emergency kit vending machine using RFID to assist consumers with a few pharmacy shops. This gadget will provide the medical needs. It is a type of automated pharmaceutical hoarding system that persons in crisis may get without going to any pharmacy shops or pharmacies. This project aims to design and create a low-cost prototype emergency kit vending machine that uses RFID to assist customer's access prescriptions faster. The project's processor is Arduino Uno. The RFID scanner then acts as a card reader to access the pharmaceutical vending machine. Next, the consumer can choose and select the available medicine on the machine. Finally, the servo motor rotated and pushed the medication to the collecting slot..

Keywords: Medicine Vending Machine, RFID Payment, Arduino IDE

1. Introduction

The Emergency Kit Vending Machine is a candy machine that regulates the essential medication according to the customer's preferences, as the name implies. It gives people looking for a reliable, systematic solution to minor clinical problems. In any event, this kind of undertaking may provide a crucial activity in human existence. The automated medical system is known for its cheap cost of construction, reduced operational time, and minimized requirements. It is similar to an intelligent card-based payment system that consumers could use everywhere and anywhere. A vending machine is a sort of automated machine that offers various items when a coin is deposited [1]. There is more vending machine operating around the commercial areas. Mostly of them sell the snacks, drinks, and some of electronics accessories. However, there is less presence of vending machines in rural areas because most of basic needs like simple drugs or medicine is sold in mini shop or market.

There are instances of medication vending machines (MVM) that have been operated in several nations during the last 10 years and have been applied in a variety of nations like the US, Canada, UK, Switzerland, and South Africa [2]. A comparative system is also being followed for pharmaceuticals. Medications for cold, flu, cerebral agony, and emergency care medications such Panadol, gastric medicine, pain killer, first aid emergency kits and other tablets that are routinely used can be obtained. . If the drug being supplied does not require a prescription, there is no need for a

medical professional or specific authorization [3]. At the point where the RFID card is inserted, the customer's nuances are tested and shown by the RFID. The medication list on the LCD is shown after the substantial individual is reviewed, and the user then selects the basic remedy by entering the number of recommended items chosen by means of a keyboard. The whole drug and its quantities are dictated after the necessary rundown has been entered.

1.1 Objectives

The objectives of this project are as follow
    i.   To design a low-cost medicine dispensing machine
    ii.   To implement the usage of RFID card to select and withdraw the medicine
    iii.   To develop an emergency kit vending machine to serve people at any time and wherever they are.

1.2 Problems Statement

Besides going to the hospital, most people go to drug stores or pharmacies to get the medicine they need. However, lines at retail drug stores and pharmacies can cause long waiting times, raising the disappointment of waiting. In any case, waiting to be served at the drug store is an unpreventable portion of our lives. Therefore, to bring down incessantly long waiting times, this project 'Emergency Kit Vending Machine using RFID' is built to decrease the operating time by using an RFID system and necessities to get medicines at any locations.

1.2 Project Scopes and Limitations

The developed medicine dispensing machine will be installed in rural areas and places where there are not pharmacies. Despite its benefits, the system will dispense few selected medicines such as Panadol, gastric medicine, pain killer and first aid emergency kits.

The limitation of this project is the project cannot identify the specific number of medications left on the automated medical vending machine.

2. Materials and Methods

This methodology will be focusing on the methodology of Development the Prototype of Emergency Kit Vending Machine Using RFID, it will be presenting about block diagram, flowchart, schematic diagram, equipment and software to be use on this project. Every part of discussion will be explained in detail by referring to process design.
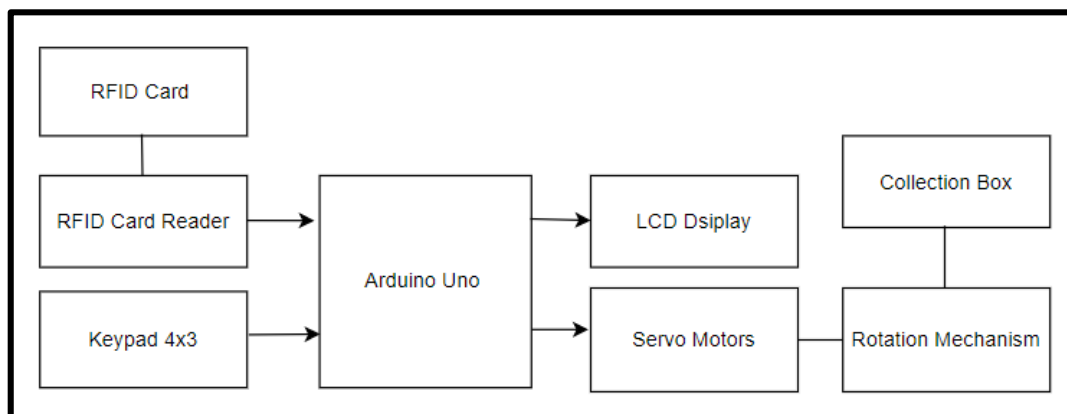
2.1 Block Diagram

Figure 1: Block Diagram

Figure 1 shows the block diagram of the medicine vending machine. The focus of this project is to incorporate the overseeing of solutions and clinical ringing as per the customer's necessities. An RFID card is used to act as a data sensor. The data gave by the customer by using a keypad at the vending machine will send to the microcontroller unit (Arduino Uno) to choosing the fundamental decisions and process the order. By finishing the order, the microcontroller sends the signal to the servo motor to drive the concerned prescription bureau having the medicine that the customer needs. The servo motor controls the overturn that allocates pharmaceutical products in the medicine bureau. The pharmaceutical product will be moving downwards and appears at the outlet. The LCD will reveal the balance of money after payment successful. The customer would then have the option to get the medicine from the outlet.
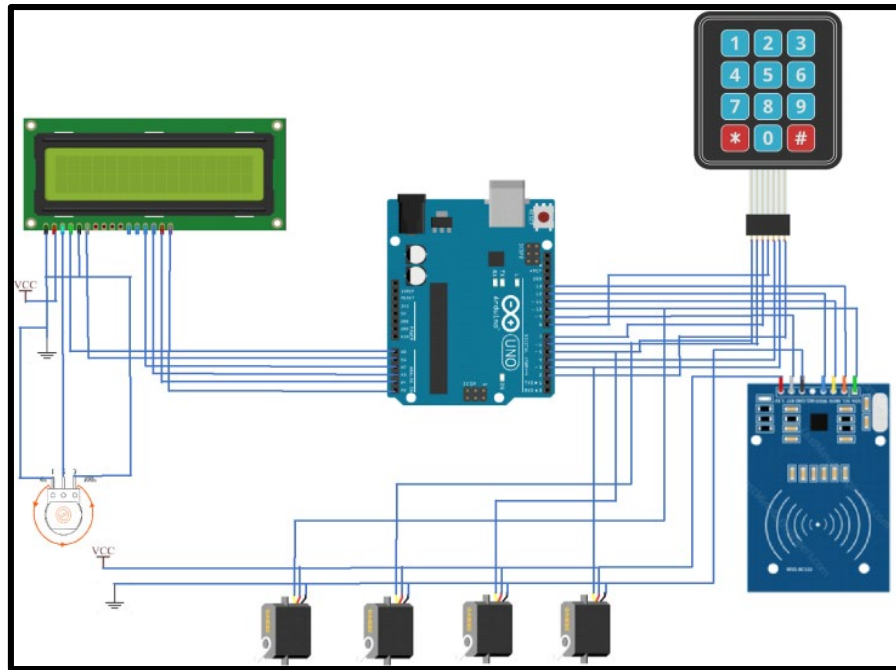
2.2 Flowchart of Emergency Kit Vending Machine Using RFID
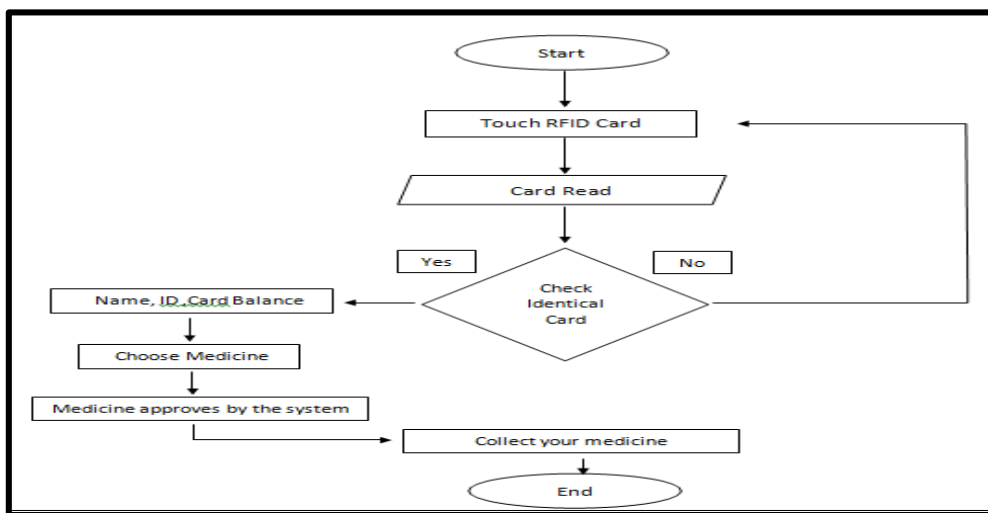
Figure 2: The Flowchart of Emergency Kit Vending Machine Using RFID

Figure 2 shows the flowchart of the Emergency Kit Vending Machine Using RFID. Initially, customers need to touch their cards on the RFID reader. Then, the RFID uses radio waves to transmit signals that activate the tag. Once activated, the tag sends a wave back to the antenna, translated into data. Then from that point onward, the customers need to make sure that the card has enough balance. Next, the user needs to enter the number of medicines that they want to buy. Finally, the payment will be deducted from the card, and after the price is successful, the user can collect their medication.

2.3 Schematic Diagram

Figure 1: Wiring Diagram of Emergency Kit Vending Machine using RFID

Based on Figure 3, Emergency Kit Vending Machine is using Arduino Uno embedded as the main processor. The overall system has been powered by connected through the Arduino Uno power connector. The LCD screen is connected to Arduino Uno analogue pins from A0-A5 and get a power supply of 5V pins and ground pins. The LCD screen will display the process of Emergency Kit Vending Machine and medicine delivery items.

3. Results and Discussion

3.1 Results

In the proposal of an automated medicine vending machine, an Arduino Uno will be the main controller of the machine along with an RFID tag and reader. In this system, there will be a four-slot compartment that will dispense the medicine. Each slot will provide continuous rotation Servo Motor connecting to the spiral spring. The process to get the medicine start with the patient touching an RFID card on a card reader. The microprocessor will process the data on the card and all information such as RFID ID number, patient information, medicine name and compartment slot number will be displayed on an LCD screen. The corresponding servo motor will rotate and dispense one medicine or item. Products or medicine can be available in the lower compartment after being released by a spiral spring.
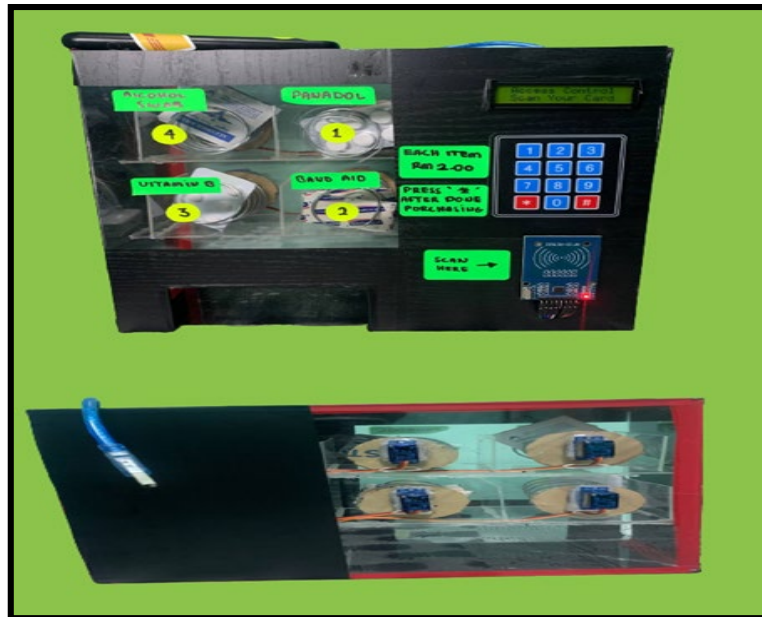
Figure 4: Prototype of Emergency Kit Vending Machine

Figure 4 shows the front view and back view of this Emergency Kit Vending Machine. Customers may pick from the medications displayed in the illustration above, including alcohol swabs, Panadol, Vitamin B, and Band-Aids, among others. We have determined the prices for each item based on the drug chosen. As seen above, before the consumer scans their card on the RFID card reader, the message 'Access Control Scan Your Card' will be shown on the LCD display.
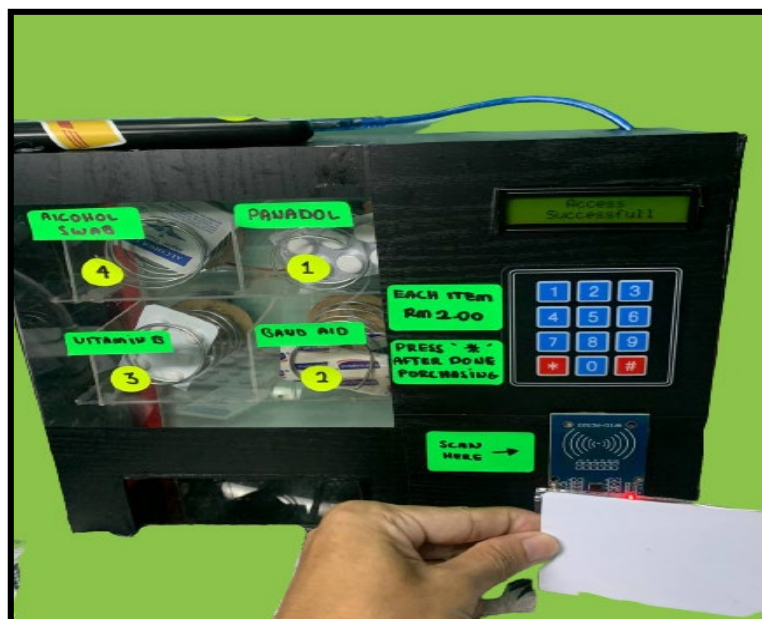
Figure 5: RFID Card Detection

Figure 5 shows the customers will use an RFID card with an operating recurrence of 13.56 MHz. When a consumer puts his RFID card within the range of an RFID reader, the card will have their own unique identification number (UID). As a result of the UID number, Arduino programming may establish an information base for each RFID client that comprises data such as the buyer's character, the current card balance, and the balance that will be accessible once the transaction has been completed. The LCD will display the amount of money the shopper currently has in the account. If the

RFID reader successfully reads the customer's card, the user will be able to access the vending machine's services.
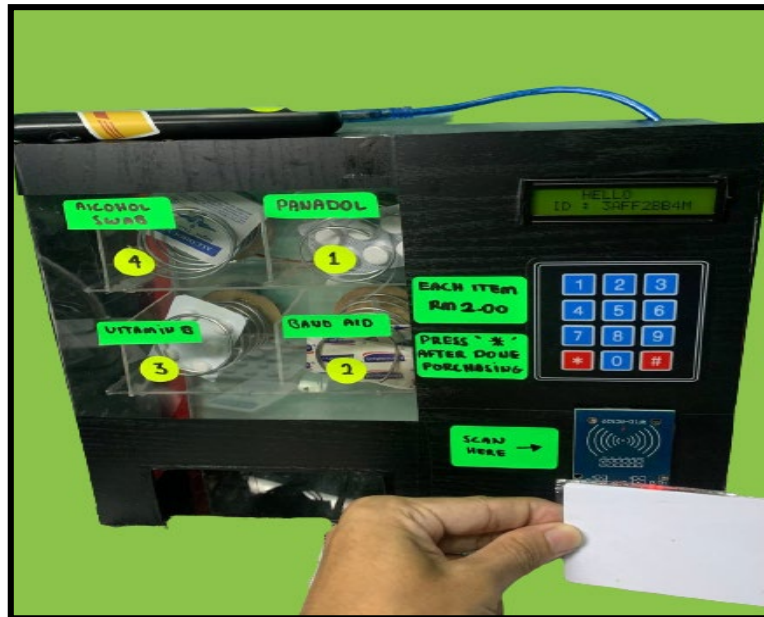

Figure 6: LCD Display

Figure 6 shows that after the machine has identified the card, it will display the name of the cardholder as well as the unique ID on the card that they are now using on the LCD display. Every customer's card will have the name of the card's owner as well as their unique ID number. This approach is similar to making a purchase once the card identification procedure has been completed successfully.

Figure 7: Prototype of Emergency Kit Vending Machine

Figure 7 shows that as soon as the card is successfully scanned by the RFID reader, the LCD will show the balance of the card, followed by the cardholder's name and their unique ID number. Customers may eventually choose their goods when the whole procedure has been completed and

approved. Whenever the consumer has completed their purchase, they must hit the '*' key on the keypad to return to the main menu.

Figure 8: Choosing Items

Figure 8 shows the customer may touch an RFID card in this system and then select the item by pressing a keypad button on the vending machine. The keypad allows the customer to choose items from among four different chambers. The data and instructions for operating the automated vending machine will be shown on an LCD screen. The medical vending machine will provide the corresponding item to the customer on their order from that point onward. This Emergency Kit Vending Machine based on RFID is comprised of six components, which include an Arduino Uno, four servo motors, an LCD, an RFID card, a keypad, and a 5 V power source, in addition to the RFID card.

Figure 9: Insufficient Balance

Figure 9 shows that if the customer does not have enough balance on their card, the system will display the remaining amount and immediately return to the system's main menu, as seen in the LCD display. Customers will be notified by the notification display on the LCD, which will indicate that their card does not have a balance and that they must use other card payments instead.

Figure 10: Collecting Items

Figure 10 shows when the products have been correctly dispensed from the vending machine, the LCD will display the name of the product and the price on the screen. Customers may get their medication from the machine's bottom slot, located at the bottom of the machine. Every successful purchase will result in dispensing one item at a time. If the consumer wishes to buy another item from the machine, the same procedure will be followed again.

3.2 Discussions

Distance of RFID Card from RFID Detection (cm)	RFID Detect Card				
	1st	2nd	3rd	4th	Percent of successful RFID detect
1.0 cm	Detect	Detect	Detect	Detect	100%
1.5 cm	Detect	Detect	Detect	Detect	100%
2.0 cm	Detect	Detect	Detect	Detect	100%
2.5 cm	Detect	Detect	Detect	Detect	100%
2.7 cm	Not Detect	Detect	Not Detect	Detect	50%
3.0 cm	Not Detect	Not Detect	Detect	Not Detect	25%
3.5 cm	Not Detect	Not Detect	Not Detect	Not Detect	0%

Table 1: Accuracy of RFID Card from RFID Detection

Table 1 shows the test record of accuracy RFID card from RFID detector from distance 1.0 cm until 3.1 cm. A measuring tape is used in this experiment to test the accuracy and ability of RFID card

detection. The accuracy of the RFID card is recorded in the range from 1.0 cm until 3.1 cm with intervals of 0.3 cm to 0.5 cm depending on RFID card detection. The RFID reader is placed at the end of the measuring tape, and the RFID card is located based on the distance being tested. The step of swapping the RFID card to an RFID reader will repeat four times to find the accuracy of RFID detection. According to the result above, the range between 1.0 cm to 2.5 cm have 100.00 % of success with all tests of RFID card be able to detect. For the range between 2.7 cm to 3.0, the test show inconsistency in RFID detection with a rate decrease of 50.00 % to 25.00 %. RFID cards are unable to read by RFID reader start from 3.5 cm with a rate of successful 0.00 %. In conclusion, the rate accuracy of RFID card detection will be 100.00 % operated if the RFID card detection in a allowed distance.
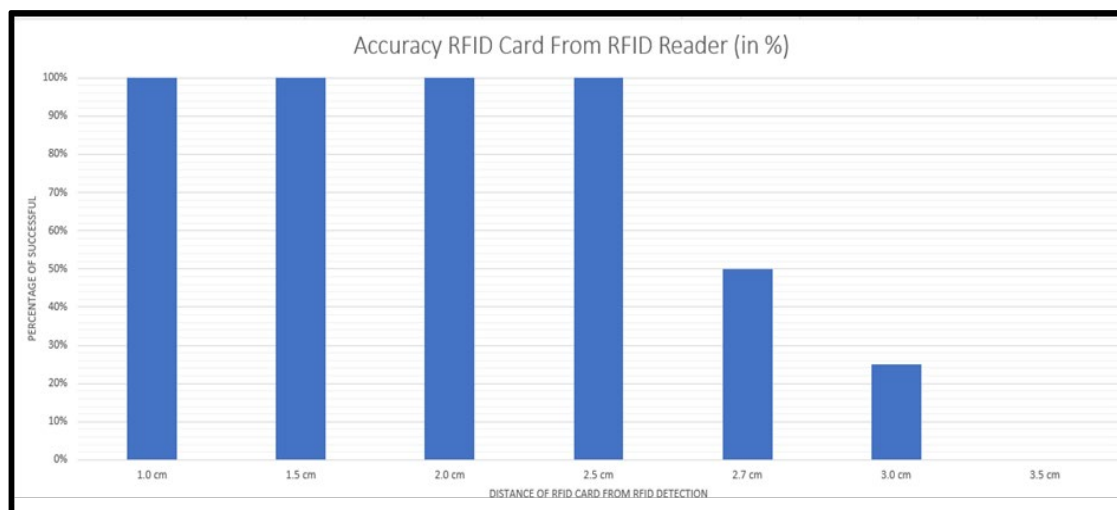

Figure 11: Bar Graph of Accuracy RFID Card from RFID Reader

Accuracy Product Deliver

Type of Medicine	10 Deliver Test		20 Deliver Test	
	Successful Deliver	Percent Accuracy	Successful Deliver	Percent Accuracy
Panadol	7	70%	16	80%
Band Aid	8	80%	17	85%
Vitamin B	7	70%	17	85%
Alcohol Swab	9	90%	18	90%

Table 2: Performance of Accuracy Product Deliver

Table 2 shows the accuracy product delivers when patient selected medicine from the machine is recorded. The experiment is made to test the accuracy of product delivery especially when the patient made multiple selections. The accuracy test is made by counting the rate of successful product delivery and comparing it with the number of tests made. The experiment is repeated with ten times deliver product and twenty times deliver a product. Based on the results recorded, all tests have more than 70.00 % of the success rate of delivering a product with 90.00 % being the highest rate. For product Panadol, the successful rate of delivering the product has been increased from 70.00 % to

80.00 % for both tests. Band aid recorded a success rate between 80% to 85% of a delivered product while vitamin B is recorded 70.00 % to 85.00 % of successful rate deliver a product. Alcohol Swab shows the highest success rate of product delivery around 90.00 %. The test shows the inconsistency of the rate of product delivery for each item because of spiral spring connected with the servo motor does not have a constant measurement of length and diameter.
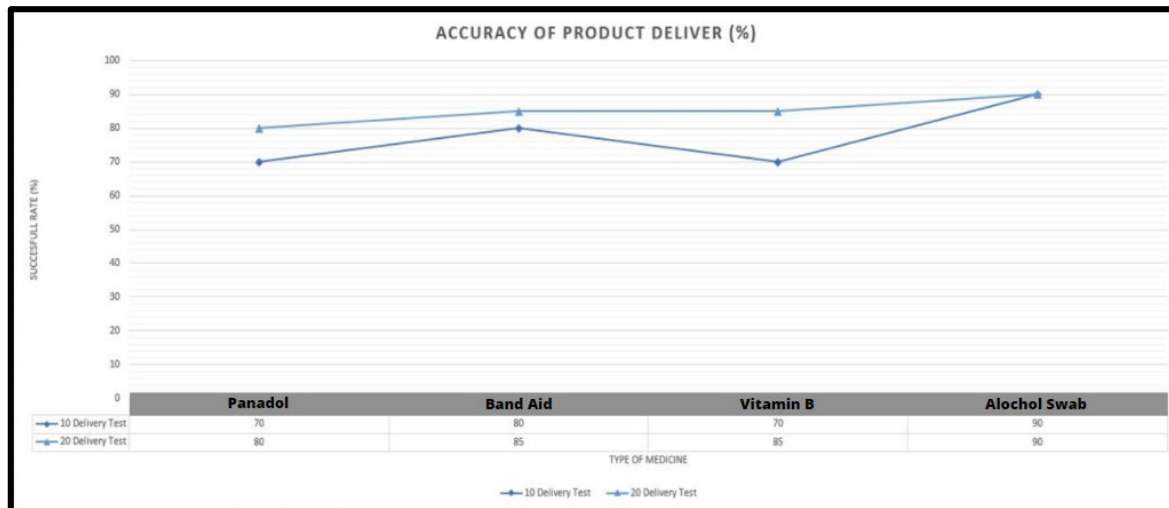

Figure 12: Lines Graph of Accuracy of Product Deliver

4. Conclusion

As a result of this project, the customer will be able to use the Emergency Kit Vending Machine at any time of day or night. Depending on the location, this machine may be positioned at bus terminals, railway stations, and on city streets. It is possible to make medicine accessible at a reasonable cost. This technology is inexpensive, uses less energy, is portable, and can be made readily accessible so that consumers may take use of the automated vending machine system whenever they want. Therefore, this type of machine can save and have a practical impact on customer's time to get their medicines in time.

Acknowledgement

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