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Trial Vending Machine Providing Medicine to the Elderly Case Study of Bhakti Luhur Nursing Home

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ABSTRACT

This tool is intended to reduce physical contact in the Covid-19 era and provide Indonesian people experience shopping in the modern era. In this study, a vending machine was made to provide medicines in nursing homes to make it easier for nurses in nursing homes to prepare for the needs of medicines for the elderly who have comorbid diseases such as heart, diabetes, hypertension and shorten time and physical contact in the Covid-19 era. In this research using the ESP8266 microcontroller as a microcontroller and WhatsApp IoT (Internet of Things) for media data base notifications when drugs have been taken. RFID (Radio Frequency Identification) as a card-shaped data identification tool for each elderly person has been programmed according to the diseases suffered by seniors. For the drug dispensing drive system, it uses a servo motor. For information on whether the drugs issued are appropriate, an LCD (Liquid Crystal Display) is added as a display on the vending machine. In this study, the best results were found where all drug inputs issued were in accordance with disease data that had been adjusted to the disease prescription on the RFID tag card.

Keywords: Vending Machine; ESP8266; Whatsapp BOT; RFID; ESP8266

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INTRODUCTION

This very rapid technological development makes humans create equipment that can minimize human activities, one of which is a vending machine (Jamaaluddin et al., 2019). Vending machines that are familiarly called vending machines are electronic devices that serve the diverse needs of people (Cao et al., 2023). In Indonesia, there are many types of vending machines used in the buying and selling process and others covering various things, such as food and beverages, cosmetics, equipment, and lotteries (Abdullah et al., n.d. 2022). Of course, this is based on several considerations during use, both to facilitate the buying and selling process, and to provide new experiences for consumers to reduce direct interaction after the Covid-19 pandemic (Darwin et al., 2022). Vending machines are usually in the form of iron boxes, the front is covered with glass so that consumers can see the products sold (Abdullah et al., 2022). Research on vending machine to produce machines that can operate in accordance with applicable rules and regulations. By adapting vending machine systems to a wide variety of products and objects to produce output to predetermined specifications (Hari Wicaksono et al., 2019).

Technological advances that continue to grow to date by developing internet of things-based products that can communicate with each other via the internet are applied to this vending machine through whatsapp notifications to notify elderly families and foundation leaders when drugs have been taken by elderly people (Syahririni et al., 2020).

Nutritious, healthy food and vitamins, access to basic necessities, medicines and social care are important priorities that must be considered by caregivers and other families to maintain the survival of the elderly (Lemy et al., 2021).

Given the large number of elderly who are in nursing homes and the various diseases suffered by each elderly and the limited number of nurses there (Erlin, 2021). New innovations are needed to help speed up drug delivery by providing health facilities such as drug vending machines or drug vending machines in nursing homes (Maharani, 2022). With the provision of drug vending machines as health facilities, it is hoped

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that nurses will find it easier to get medicines that must be consumed by the elderly and vitamins and shorten the time because in the Bhakti Luhur nursing home in the Tropodo village, Waru sub-district, Sidoarjo regency area which is the place of this research there is not only 1 elderly person but many therefore this tool was made (Bergizi et al., 2022).

METHOD

This research was conducted with the aim of improving and updating the research that had been done before. In a study by Ikhsanul Amal Salahudin entitled Design and Build a Traditional Hawker Vending Machine which explains about making traditional snack designs by utilizing E-KTP as a payment system using RFID (Radio Frequency Identification) sensors to identify UID and user credentials. Stepper motors and servo motors are used in the process of dispensing food, which is connected with a piral wire that serves as a food booster (Ikhlusal & Salahuddin, 2020). Then research by Satria Hafizhuddin and Hendra Kusuma entitled Design and Build an Internet of Things Based Vending Machine which explains about DC motors as a drive to push bread connected to helical wire (Hafizhuddin, n.d, 2019). This bread maker is also equipped with a heating element to maintain the temperature of the bread more durable in the machine and the last research by Martyadi Nurhidayat entitled Design of a Special Reverse Vending Machine for IOT-Based Bottle Waste in Bandung City Square which explains about the main task of reverse vending machines designed for this waste is the use of cans and plastic bottles that still have economic value through the recycling process, reduce the work of cleaners when sorting garbage. Based on these three studies, updates were made to this study, the difference is that in this study ESP8266 was used as a microcontroller which has several advantages, one of which is the availability of a wifi module so that the prototype in this study can be connected to the internet network so that it can provide notification messages to users (Nizar et al., n.d, 2020).

In the research made now to dispense the drug automatically according to the diseases of the elderly, so the input only uses RFID (Radio Frequency Identification) (Hamdani et al., 2019). And the microcontroller used in the current research uses ESP8266 (Fajar Wicaksono, 2017). Then the output uses a servo to push the needed medicine, after that the LCD (Liquid Crystal Display) is used to display what drugs are released and a notification will be sent via whatsapp to the head of the nursing home foundation or if you still have a family, it will be sent to an elderly family. in the input section using RFID (Radio Frequency Identification) is used to scan data for the elderly. The command data that has been entered via RFID (Radio Frequency Identification) is then processed by the microcontroller and runs a servo and pushes drug according to the data from the scanned RFID (Radio Frequency Identification) card and the results will be displayed on the LCD (Liquid Crystal Display) and send a notification via WhatsApp that the elderly have taken the drug according to the disease suffered (Royhan, 2018).

System Design

The design of this tool, there are three parts. The first part of the system design process involves wiring design, which outlines the components that will be used in the system and the connections between them. The second part is designing a block diagram, which shows the input, processing, and output components of the system and how they relate to each other. The third part involves creating a flowchart, which illustrates the system's workflow and how the various components interact with each other. These three parts provide a comprehensive understanding of the system's design and operation.

Wiring Design

The overall design view of the tool can be seen in the figure. From the picture, all components are already in a state of connection and integration. RFID (Radio Frequency Identification), Servo Motor, LCD (Liquid Crystal Display) and whatsapp are interconnected with microcontrollers ESP8266.

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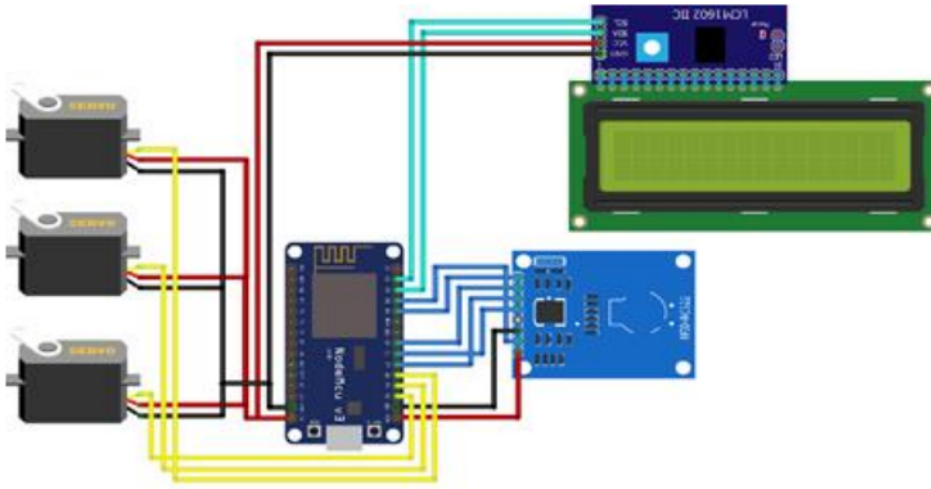


Fig. 1 Wiring Design
(source: researcher property)

Table 1
ESP8266 Port Usage

NO	ESP8266 port	Usage
1	GPIO 5	SCL (LCD I2C)
2	GPIO 4	SDA (LCD I2C)
3	GPIO 0	RST (RFID)
4	GPIO 2	SDA (RFID)
5	GPIO 14	SCL (RFID)
6	GPIO 12	MISO (RFID)
7	GPIO 13	MOSI (RFID)
8	GPIO 15	PWM (Servo)
9	GPIO 3	PWM (Servo)
10	GPIO 1	PWM (Servo)
11	GND	GND (RFID)
12	3,3 V	3,3 V (RFID)
13	GND	GND (LCD I2C)
14	Vin	VCC (LCD I2C)
15	GND	GND (Servo)
16	Vin	VCC (Servo)

Table 1 shows the cable connection or pin connection of ESP8266 Microcontroller, Servo Motor, LCD (Liquid Crystal Display) I2C and RFID (Radio Frequency Identification). In the three positive and negative line servo motors, jumper connections are made on the + and – pins on the ESP8266 so that they become one cable line. Then for the PWM pin line of the three servo motors connected to different pins on ESP8266, namely PWM servo motor 1 connected to GPIO pin 15, Then for the PWM pin line of the three servo motors connected to different pins on ESP8266, namely PWM servo motor 2 connected to GPIO pin 3, Then for PWM pin lines of the three servo motors connected to different pins on ESP8266, namely PWM servo motor

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3 connected to GPIO pin 1. The + line RFID sensor is connected to 3.3 V while – is connected to the GND of ESP8266, while the RST pin of RFID is connected to GPIO pin 0 of ESP8266, while the SDA pin of RFID is connected to GPIO pin 2 of ESP8266, while the SCL pin of RFID is connected to GPIO pin 5 of ESP8266, while the MISO pin of RFID is connected to GPIO pin 12 of ESP8266, while the MOSI pin of RFID is connected to GPIO pin 13 of ESP8266. The + line LCD component is attached to the Vin and GND line on the ESP8266 GND, while the SCL pin on the LCD is attached to GPIO pin 5 on the ESP8266, while the SDA pin on the LCD is attached to GPIO pin 4 on the ESP8266. Connections to pin data need to be listed for the purpose of designing the hardware system to be better and correct.

3.1 Block Diagram

The system diagram block can be seen in Figure 2

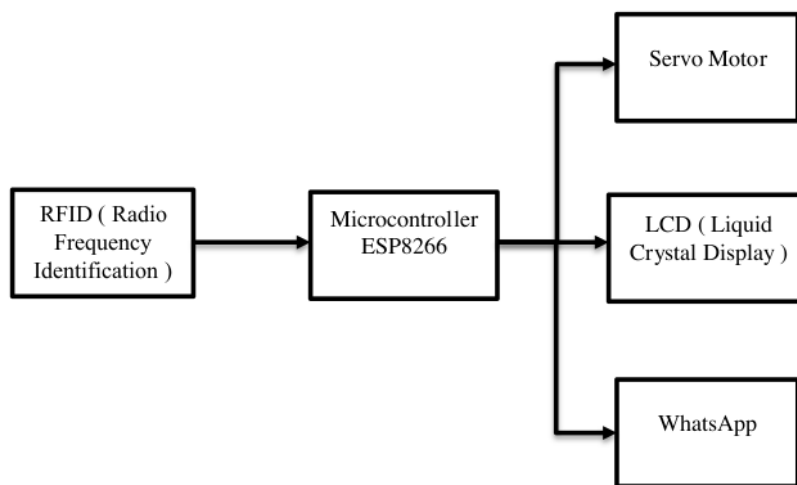


Fig. 2 System Block Diagram
(source: researcher property)

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It can be seen from the block diagram above, in the input section using RFID (Radio Frequency Identification) used to scan data for the elderly. The data command that has been entered via RFID (Radio Frequency Identification) is then processed by the microcontroller and runs a servo motor and pushes the drug according to the data from the RFID (Radio Frequency Identification) card that is scanned and the results will be displayed on the LCD (Liquid Crystal Display) and send a notification via WhatsApp that the elderly have taken the drug according to the disease suffered (Sibanda et al., 2020).

System Flowchart

The initial step was carried out in the use of a Prototype Vending Machine for Drug Providers in Nursing Homes by connecting a voltage source to the ESP8266 microcontroller. If the device is turned on, the ESP8266 microcontroller connects to the whatsapp until the microcontroller is connected to the whatsapp. After that, the nurse attaches the elderly RFID (Radio Frequency Identification) card to the RFID (Radio Frequency Identification) Reader for identification of drugs needed by the elderly according to the illness suffered by the elderly.

If the elderly have a history of diabetes, then servo 1 containing diabetes drugs will come out and display

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on the LCD (Liquid Crystal Display) screen that the medicine for diabetes has been taken by the nurse and send a whatsapp notification that the patient has taken the medicine to the family or to the head of the nursing home foundation. If not, it will detect the next disease, namely hypertension, if you have a history of hypertension, servo 2 containing hypertension drugs will come out and display on the LCD (Liquid Crystal Display) screen that the medicine for hypertension has been taken by the nurse and send a whatsapp notification that the patient has taken the drug to the family or to the head of the nursing home foundation.

If not, it will detect the next disease, namely the heart, if you have a history of heart disease, then servo 3 containing heart medicine will come out and display on the LCD (Liquid Crystal Display) screen that the medicine for heart disease has been taken by the nurse and send a whatsapp notification that the patient has taken the medicine to the family or to the chairman of the nursing home foundation. If RFID (Radio Frequency Identification) does not detect any disease it will return to RFID (Radio Frequency Identification) detection and If all steps are completed properly, then the program can be used and successfully executed.

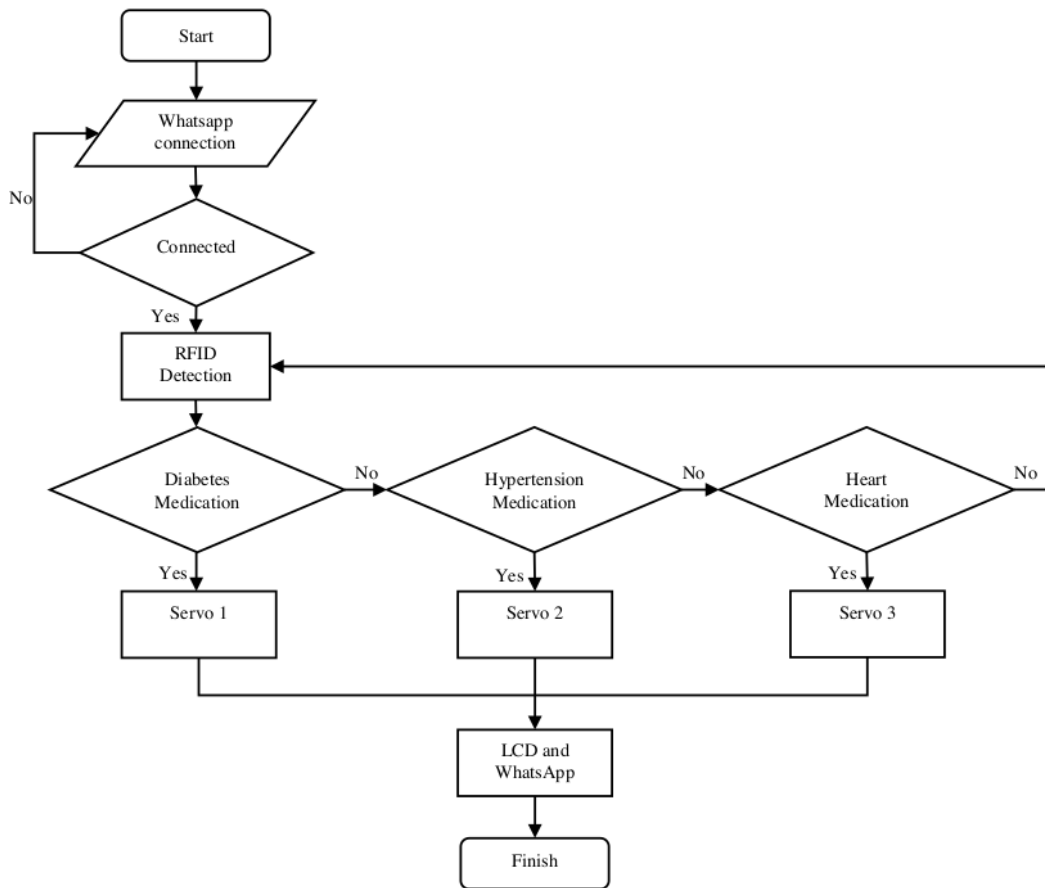


Fig. 3 Master Flowchart Program
(source: researcher property)

RESULT

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Here are the results of the realization of the tool. In Figure 5, it is the result of the realization of the tool. The components of such a tool will be described by numbering as follows: 1. Power Supply 5 volt DC, 2. Testing Connection of Wifi Internet Network on ESP8266 microcontroller as data communication, 3. Motor Servo Mg90s Testing, 4. RFID (Radio Frequency Identification) Testing, 5. LCD (Liquid Crystal Display) I2C 16x2 Testing, 6. WhatsApp Notification Testing.



Fig. 4 Result of tool realization
(source: researcher property)

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How to use this tool is as follows :

1. Connect to a power source using a 5 volt DC adapter.
2. Connect with wifi until the LCD (Liquid Crystal Display) releases the words Prototype Vending Machine.
3. Attach the RFID (Radio Frequency Identification) Tag card to the RFID (Radio Frequency Identification) reader above the LCD (Liquid Crystal Display), then the drug will automatically be issued according to the disease suffered by the elderly who have been programmed in the RFID (Radio Frequency Identification), Tag using the ESP8266 microcontroller.
4. After it has been taken, an inscription will appear on the LCD (Liquid Crystal Display) of the name of the drug issued, as well as a notification via whatsapp on the cellphone that the elderly have taken the drug according to their disease.

Power Supply 5 Volt Testing

Table 2 shows 5 times 5 volt step down tests with a multimeter. This test obtained a deviation of 0.0 and an accuracy of 100%, and it can be concluded that the voltage used of 5 volts in this tool is accurate. This 5 volt voltage will be used for the power supply of the output control circuit (Fajria, 2017).

Table 2. 5 Power Supply Testing

Testing to	Voltage needed	Multimeter	Deviation	Accuracy
-	(V)	(V)	(V)	(%)
1	5	5	0	100
2	5	5	0	100
3	5	5	0	100
4	5	5	0	100
5	5	5	0	100
Average	5	5	0	100

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Testing Connection of Wifi Internet Network on ESP8266 microcontroller as data communication

For testing the connection of the internet wi-fi network on the ESP8266 Microcontroller was carried out to find out how fast and how long ESP8266 can be connected to the internet network for data communication in the initial start. From the steps above, ESP8266 testing can be seen connected to the internet network as data communication in early starting (Nugroho, n.d.). To be able to find out whether ESP8266 is connected to the internet or not, then experiment by calculating the time when connecting the server 5 times.

Table 3 Testing Connection of Wi-Fi Internet ESP8266

Testing to-	Hotspot Connection on ESP8266		Speed
	Condition	Waiting Time (s)	
1st Test	Connected	5	Medium
2nd test	Connected	5	Medium
3rd test	Connected	5	Medium
4th test	Connected	5	Medium
5th Test	Connected	5	Medium

Motor Servo Mg90s Testing

In servo motor testing itself aims to measure the degree that will be used at the time of inspection and also at the specified time. Testing servo motors with experiments of specified degrees thus makes 5 times the experiment. Why test the degree more in the vending machine research is because what is used for the research of this vending machine tool uses the degree focus as an influence for the dispensing medication. Testing starts from 0-360 degrees. If at the time of the command how many degrees will come out the same as the ordered can be said to be successful. For research, this tool uses 90 ° to remove the drug from the medicine tube (Hidayatulloh et al., 2022).

Table 4 Servo Motor SG90 Testing

Testing to-	Servo Motor SG90		Description
	INPUT	OUTPUT	
1st Test	0°	0°	Success
2nd test	45°	45°	Success
3rd test	90°	90°	Success
4th test	180°	180°	Success
5th Test	360°	360°	Success

RFID (Radio Frequency Identification) Testing

Table 5 shows 4 tests with different RFID (Radio Frequency Identification) card tag codes. From the test results, it was found that the RFID (Radio Frequency Identification) tag card used for seniors to take medicine was appropriate and read by the RFID (Radio Frequency Identification) reader without any problems (Lubis, n.d., 2018).

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Table 5 RFID (Radio Frequency Identification) Testing

Testing to-	RFID (Radio Frequency Identification)		Description
	INPUT	OUTPUT	
1st Test	BA D0 36 7A	BA D0 36 7A	Success
2nd test	5E 96 36 7A	5E 96 36 7A	Success
3rd test	FE 0C 36 7A	FE 0C 36 7A	Success
4th test	32 A9 BA 21	32 A9 BA 21	Success

LCD (Liquid Crystal Display) I2C 16x2 Testing

Table 6 show 5 tests with LCD (Liquid Crystal Display) I2C 16x2 shows the results of the input scan from the RFID (Radio Frequency Identification) tag showing the results in accordance with RFID (Radio Frequency Identification) commands.

Table 6. LCD (Liquid Crystal Display) I2C 16x2 Testing

Testing to-	LCD (Liquid Crystal Display) I2C 16x2		Description
	INPUT	OUTPUT	
1st Test	Prototype Vending Machine	Prototype Vending Machine	Success
2nd test	Diabestes	Diabestes	Success
3rd test	Medicine Taking Hypertension	Medicine Taking Hypertension	Success
4th test	Medicine Taking Heart	Medicine Taking Heart	Success
5th test	Medicine Taking Acces Denied	Medicine Taking Acces Denied	Success

WhatsApp Notification Testing

Table 7 shows 4 tests, where WhatsApp notification test results have been obtained from RFID (Radio Frequency Identification) tags. The test found that the whatsapp notification delivery was successful with a delivery time of 3 seconds (Sohor et al., 2020).

Table 7 WhatsApp Notification Testing

Testing to-	WhatsApp	Description
	INPUT	
1st Test	The taking of heart medicine has been taken!	Success
2nd test	The taking of hypertensive medicine has been taken!	Success
3rd test	The taking of diabetes medicine has been taken!	Success
4th test	Card not registered, medicine not issued	Success

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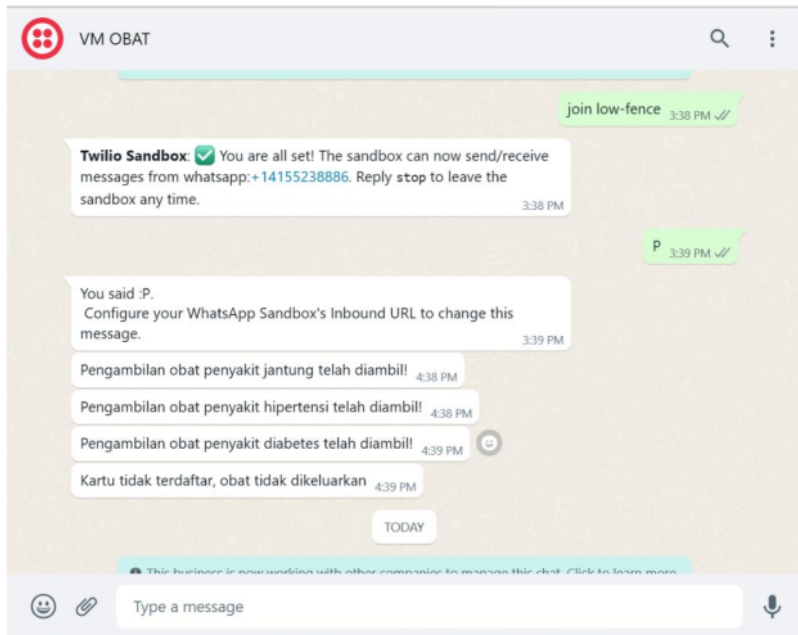


Fig. 5 Drug collection notification
(source: researcher property)

DISCUSSIONS

For further research, there are several suggestions that can be taken into consideration in the study, such as making a vending machine tool that is more complete in terms of drug stock with various other diseases and creating a web server for data collection about drug stocks available through an application connected to the head of the related orphanage foundation.

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CONCLUSION

Based on the results of the tests that have been carried out, it can be concluded that: (1) Testing of the 5 volt DC adapter obtained the results that this adapter can be used as a power source for this tool because it has a voltage of 5 volts and a 5 volt multimeter. (2) Testing the speed of wifi connection to ESP8266 obtained the result that the speed takes 5 seconds with medium speed. (3) Mg90s Servo testing obtained results below the degree of measurement obtained maximum results for this device of 90° to remove the drug from the tube. (4) RFID sensor testing was carried out 4 different experiments and it was produced that the sensor was working properly. (5) I2C LCD testing results that the output produced on the display shows text that matches the RFID tag input. (6) WhatsApp notification testing obtained notification input results corresponding to RFID tags. From the results of research that has been done that this tool can be developed by adding data sheets, more types of diseases, and tubes where drugs are more sterile.

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