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Design of Automatic Goods Sorting Tool Based on Arduino Mega Based Paint Color Using TCS 3200 Sensor with IoT Monitoring

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ABSTRACT: *Technology in the industrial world is developing and being used very quickly. A shift from traditional machines and tools to modern machines and tools that are controlled automatically. Most of the sorting of goods in industry is still done manually by human workers, so automatic work control tools are needed for sorting. Sorting can be done by machine, manually, or with a bar code system. Based on several models, research on automatic item and color sorting has the same working principle. The additions made to these two references, namely adding the Internet of Things to monitor the number of objects and colors entering the sorting area or final holding container for color objects, lead to the connection method used in the tool with the addition of the Internet of Things system.*

KEYWORDS: *Mega, NodeMCU 8266, Servo Motor, Infrared, Actuator, Internet Of Things (IOT).*

I. INTRODUCTION

In the modern industrial world, there is rapid technological development with the use of modern automated machines and tools. The grouping of goods based on type, color, weight, or shape is generally still done manually in the industry. Therefore, the development of an automatic work controller for the sorting process is very important. This technology is growing rapidly because it can save time and labor in the production process [2].

Based on several research models of sorting goods and automatic colors having the same working principle, a prototype of sorting goods and automatic colors was made with the title "Design, build, sorting tool based on Arduino Mega-based warna Cat using sensor, TCS32 00 with Internet of, Things monitoring".

Additions made from existing references are adding Internet of Things as monitoring the number of objects and colors that enter the sorting place or the last container of color objects, the development is aimed at the way of connection used in the tool with the addition of the Internet of Things system.

II. THEORY

The article is the result of research that is original and the result of the researcher's thoughts. Articles are written in good and correct Indonesian. The number of article pages is between 6 – 15 pages including references.

A. ARDUINO MEGA 2560

Arduino Mega2560 is an ATmega2560-based microcontroller board equipped with 54 digital input/output pins, including 15 PWM output pins, 16 analog input pins, 4 UART hardware serial port pins, USB connection, power jack, ICSP header, and reset button. The board supports the microcontroller by connecting it to a computer via a USB cable or AC-DC adapter or battery. Arduino Mega2560 is the latest version of Arduino Mega and is compatible with most shields used for Arduino Duemilanove or Arduino Diecimila [5]. Fig 1. Arduino Mega2560.

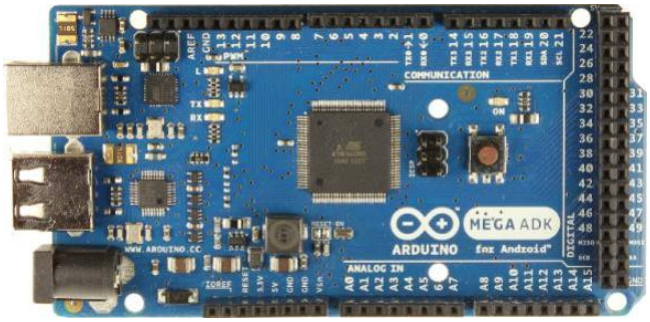

Fig 1. Arduino Mega

B. COLOR SENSOR

A photodiode is a diode-based electronic component used to detect light by converting it into an electric current. Unlike conventional diodes, photodiodes are made of semiconductor materials and can undergo resistance changes depending on the intensity of light they receive. In dark conditions, the resistance of the photodiode is high so the current flowing is small or non-existent, while in intense light conditions, the resistance drops and the current flowing becomes larger.

Fig 2. TCS3200 Sensor

Tbl 1. Color Reader Photo Diode Selection Mode

No	S2	S3	Photo Diode
1	0	0	Red
2	0	1	Blue
3	1	0	Clear (No Filter)
4	1	1	Green

connected to the internet, allowing it to communicate, control, connect, monitor, and exchange data with other devices. IoT aims to connect people and objects anywhere and anytime. It includes industrial objects and aims to make them more intelligent, programmable, and capable of interacting with humans. IoT uses sensor networks and smart objects to create self-configuring and adapTbl systems. [14] The Internet of Things (IoT) works by connecting all objects to the internet so that they have an Internet Protocol (IP).

C. CONVEYOR

A commonly used means of transportation in the assembly and production industry is the conveyor. Conveyors are used to transport semi-finished production materials and production products from one place to another. Conveyor systems are highly preferred for their ability to increase efficiency and speed up the process of material or product transportation, especially in the packing process. The Fig displays four types of conveyors designed to meet various industrial needs, including belt, screw, and chain [12].

Fig 3. Types of Conveyors

D. INTERNET OF THINGS

The Internet of Things (IoT) is a concept where an object is equipped with sensors and software for connected to the internet, allowing it to communicate, control, connect, monitor, and exchange data with other devices. IoT aims to connect people and objects anywhere and anytime. It includes industrial objects and aims to make them more intelligent, programmable, and capable of interacting with humans. IoT uses sensor networks and smart objects to create self-configuring and adaptable systems. [14] The Internet of Things (IoT) works by connecting all objects to the internet so that they have an Internet Protocol (IP).

E. ARDUINO IDE

An IDE (Integrated Development Environment) such as the Arduino IDE is used to create, edit, and manage commands or source code. This includes performing error checking, compilation, uploading the program, and testing the Arduino's work through a serial monitor. Arduino program files are called "sketches" with the .ino file format. The initial appearance of the Arduino IDE can be seen in Fig 4. [15].

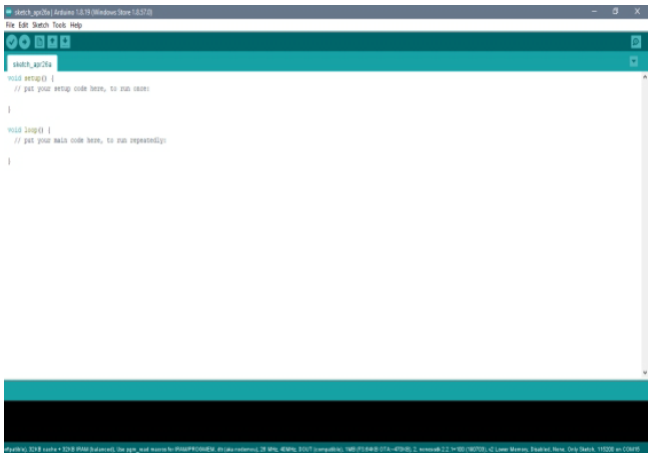

Fig 4. Arduino IDE

F. NODEMCU 8266

One of the open source Internet of Things platforms is the ESP8266 MCU Node [17].

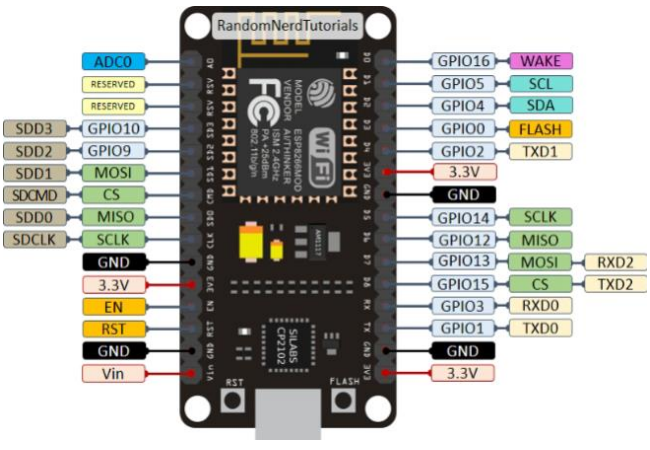

Fig 5. ESP8266 NodeMCU

The pin configuration contained in the NodeMCU ESP8266 is shown in Tbl 2. below [17].

Tbl 2. Pin Configuration on ESP8266

No	Pin	Name	Function
1	Source	3.3V and Vin	Vin is the input voltage on the arduino which is used to turn on the arduino. 3.3V is a pin used to provide a 3.3V voltage source.
2	Ground	GND	This is pin used as a ground on arduino
3	Reset	EN and Reset	Pin RESET is used to resetting arduino
4	Analog Pin	Pin A0	Used as analog input on arduino
5	Digital Pin	GPIO1-GPIO16	Used as digital input and output on arduino
6	Serial Pin	RX and TX	This pin is used to perform serial communication between Arduino or other microcontrollers.
7	SPI Pin	SD1, CMD, SD0, and CLK	SPI pins are used for SPI communication with the help of a library. SPI pins include.
8	Reserved Pin	RSV	Unused pins

G. *POWER SUPPLY*

A power supply is an electrical device that provides energy to electronic or other electrical devices by converting a source of electrical energy into the required form of electrical energy. In this context, Power Supply is also known as Electric Power Converter.

Fig 6. Switching Power Supply

H. *DC MOTOR*

A DC (Direct Current) electric motor requires a direct current (DC) voltage input to its field coils to convert it into mechanical motion energy. This motor consists of a stator (non-rotating part) and a rotor (rotating part), which is also known as the armature coil.

1) DC Motor Symbol

The two parts that make up a DC type electric motor are the stator and rotor or the stationary part and the moving parts. The stationary part is the motor body or brushes. The moving part is the winding anchor contained in the motor. Fig 7. DC motor symbol [19].

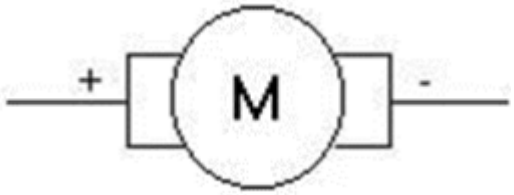

Fig 7. Symbol of DC Motor

2) Working Principle of DC Motor Type Electric Motor

When an electric current is applied to the coil of a DC motor, the polarity of the magnet in the coil, which originally faced north or south, will change to face the opposite magnet. When the opposite magnetic poles meet, there will be an attraction that moves the coil. To maintain movement, repulsive movement is required in the coil. The working principle of a DC motor can be seen in Fig 8.

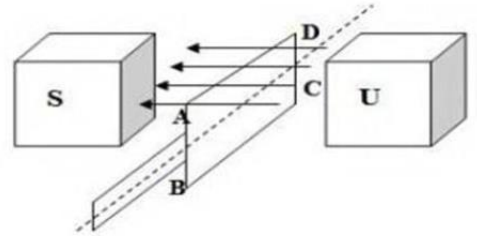

Fig 8. Working Principle of DC Motor

3) Main Components of DC Motor

A) The main component present in DC Motors is the field pole, usually having a south and north pole.

B) The second main component is the DC Motor Coil which functions to be electromagnetic when there is current entering the motor coil.

C) The third is a DC motor commutator which is useful for reversing the direction of the electric current in the coil.

Below is a Pig. 8 of picture DC Motor parts [19].

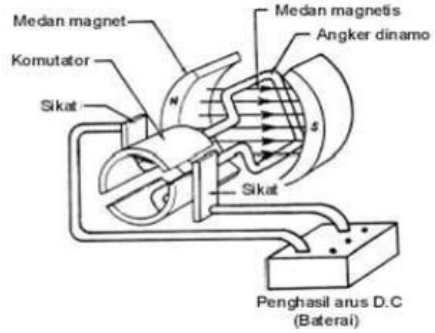

Fig 9. DC Motor Parts

I. *SERVO MOTOR*

A servo motor is a motor that uses a closed feedback system, where the position of the motor is returned to the control circuit inside the motor. A servo motor consists of a motor, a series of gears, a potentiometer, and a control circuit. The potentiometer is used to set the angle limit of the servo rotation, while

the axis angle of the servo motor is controlled by the width of the pulses sent through the signal cable.
In the Fig, if the pulse has a duration of 1.5 ms in a period of 2 ms, the axis of the servo motor will be at the center position. The longer the duration of the OFF pulse, the greater the axis movement will be in the clockwise direction, while the shorter the duration of the OFF pulse, the greater the axis movement will be in the counterclockwise direction. [20].

Fig 10. Servo Motor

J. *INFRARED SENSOR MODULE*

Infrared sensors are optoelectronic components sensitive to radiation in the infrared wavelength range, which is 780 nm to 50 µm. These sensors are widely used in motion detectors to activate lights or alarm systems to detect the presence of people. Although invisible to the naked eye, infrared radiation can be detected by these sensors. This sensor consists of an IR LED as a light source and an IR photodiode as a detector that is sensitive to IR light of the same wavelength. A change in the infrared radiation detected by this sensor results in a comparable change in resistance and voltage output.

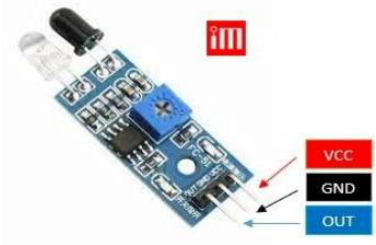

Fig 11. Infrared Sensor

K. *L298N DRIVER MODULE*

The motor driver module uses the L298N IC to regulate the speed and direction of rotation of the DC motor. This module is commonly used with Arduino microcontrollers because its H-Bridge circuit construction allows control of inductive loads on the motor coil. The L298N IC is also equipped with transistor-transistor logic (TTL) that uses a NAND gate to change the direction of rotation of the motor. Fig 12 L298n driver module below [22].

Fig 12. L298n Driver Module

L. *BLYNK*

Blynk is a platform for quickly building interfaces for controlling and monitoring hardware projects from iOS and Android. The Blynk app allows the creation of project dashboards with various controls such as buttons, sliders, graphs, and other widgets. The platform is suiTbl for simple projects such as temperature monitoring or r e m o t e control of lights [21],
Here is fig 13. of the blynk application display [21].

Fig 13. Blynk App View

M. *ERROR ANALYSIS*

The components in the instrument have a crucial role in converting analog signals obtained from outside into digital signals that can be processed by a computer. The quality of these components also determines how accurate the measurement results are compared to the actual value measured by the measuring instrument. Equation 2.1 shows the accuracy of the tool measured during testing: [23]
Here is Equation 2.3 of the accuracy of the tool, namely: [25]

$$Average\ Accuracy = \left(\frac{Voltase\ Input}{Work\ Voltase}\right) x100\% \quad (1)$$

Description:
Average accuracy (%) = Precentage accuracy of the tool.
Correct experiment (VDC) = DC voltage of input voltage measurement result.
Experiment (VDC) = DC voltage of working voltage measurement result.

N. PROTOTYPING METHOD

Prototyping or design-build methods are used to build new systems or improve existing systems, focusing on the analysis, design, and implementation phases. This approach involves repeated iterations between users and developers to produce a prototype system that will be evaluated before final system implementation. This method refers to an iterative process in system development where requirements are transformed into a working system and continuously improved through collaboration between users and analysts. [24]

O. HOW THE WHOLE TOOL WORKS

The way this tool system works, where this tool uses an electricity source from PLN then converted into Dc electricity using a power supply to produce 12V output and lowered again using a step down module with an output of 5 to 6V which will be used as a power source to turn on Arduino Mega, NodeMCU, L298n driver module, Dc motor, TCS 3200 sensor, infrared sensor. NodeMCU is connected to a smartphone using the internet of things where the smartphone functions as monitoring the counting of objects that enter the 3 containers with predetermined colors.

The design of the prototype of the automatic goods color sorting tool begins by using the Arduino Mega microcontroller and the ESP8266 MCU Node. Arduino Mega acts as the main data processor and controller, while the ESP8266 MCU Node functions as an Internet of Things (IoT) device. The design process is divided into two main parts: software design and hardware design. Furthermore, a power supply circuit is also designed to transfer electrical energy to all components in the prototype.

Next, make a series of L298n driver modules that have a function to regulate the speed of the DC motor (conveyor) assisted by a signal from the infrared sensor which triggers the object to stop right on the TCS3200 light sensor.

This sensor will provide RGB color signals to the servo motor which will sort the colors automatically according to the color and place according to the program that has been made. Then to count objects that enter the container using 3 infrared sensors by placing the sensor in front of the three containers that have been provided, infrared sensors have the ability to recognize light in infrared form. Its working principle is based on distance and range, using two main components: an infrared transmitter and an infrared detector. This sensor emits infrared of a certain intensity and receives back reflected infrared. Detection by the sensor depends on the amount of infrared received back.

To receive data from the infrared transmitter, the infrared sensor requires the same transmission rules on the receiver side. If these rules are obeyed, the receiver will decode the received data into binary data.

After that, it will be displayed on a smartphone using the Blynk application to find out the number of objects and colors that have entered the three containers, namely red blue and green, the Blynk application functions as a server that connects the device with an Android device via a WiFi network or router to enable communication between the server and the smartphone.

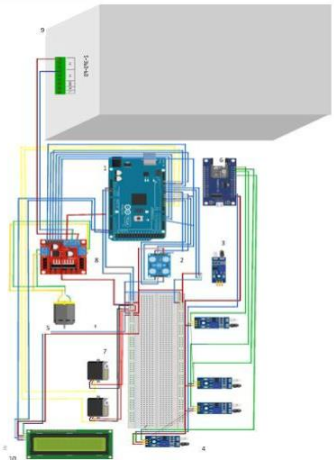

Fig 14. Overall Tool Set

P. PROTOTYPE DESIGN

The first design of the automatic color sorting prototype starts with designing the physical structure of the prototype. Here is a picture of the physical structure of the automatic color sorter in Fig 15. Below.

Fig 15. Prototype Automatic Pain Color Sorting

III. METHODOLOGY

The research method used in making this design is the Hardware Programming Method. This method goes through several stages of making, namely:

A. CONCEPTUAL DESIGN

1) Identification of needs: Analyze the needs to formulate tool design specifications.
2) Tool concept: Initial concept design based on needs analysis by considering ergonomic and functional factors.

B. DETAIL DESIGN

1) Design plan development: the development of a design plan that includes details of materials, components, and tool dimensions.
2) 3D Design: Implementation of detailed design into 3D using CAD (Computer-Aided Design) software.

C. PROTOTYPE ASSEMBLY

1) Component assembly: Assemble all components of the device in accordance with the design, and with attention to the necessary connections and adjustments.
2) Initial testing: Perform initial testing to ensure each component can function properly and in accordance with expectations.

D. FUNCTIONAL TESTING

1) Performance testing: Evaluate the performance of the tool using test scenarios in real use.
2) Accuracy measurement: measuring the accuracy of This research method describes the steps taken from the conceptual design stage to documentation to ensure the successful development of the tool prototype in the context of the research.
3) the tool by comparing the standard tool in the field.

E. DOCUMENTATION

Report writing: compile a research report that includes

IV. RESULTS AND DISCUSSION

A. POWER SUPPLY TESTING AND ANALYSIS

The device uses a 220 VAC voltage source from PLN which is converted to DC current through adapters to produce the 12 VDC and 5 VDC voltages required for the device. Tbl 3 in the previous chapter shows the results of the voltage and current measurements taken.

1) PLN Voltage 220 VAC

Tbl 3. Measurement Result of PLN 220 VAC Voltage 10 Times.

Trial Number	Device	VAC Measurement Result
1	PLN Voltage 220 VAC	213V
2		213V
3		213V
4		213V
5		213V
6		213V
7		213V
8		213V
9		213V
10		213V
Average Measurement Result		213

From the results of 10 measurements of PLN voltage at home on Monday, November 21, 2023 at 14.00, the average AC voltage obtained was 213 Volts.

To calculate the accuracy of the 220 VAC PLN voltage with 10 measurements, you can use equation (1) below:

$$Average\ Accuracy = \left(\frac{Voltase\ Input}{Work\ Voltase}\right) x100\%$$

$$Average\ Accuracy = \left(\frac{213\ volt}{220\ volt}\right) x100\% = 98\%$$

2) Power Supply Voltage 12 VDC

Power supply testing is done to measure the output voltage at the terminal pin without load. The results of voltage measurements from the power supply carried out 10 times can be seen in Tbl 4 below.

Tbl 4. DC Power Supply Voltage Measurement Results

Trial Number	Device	VAC Measurement Result
1	12VDC Power Supply	11,7V
2		11,7V
3		11,7V
4		11,7V
5		11,7V
6		11,8V
7		11,7V
8		11,7V
9		11,7V
10		11,7V
Average Measurement Result		11,7V

From the results of measuring the voltage at the output of a 12 Volt DC power supply with 10 measurements, an average of 11.7 Volts DC was obtained. the location when the measurement was carried out at home on Monday, November 21, 2023 at 14.30.

To calculate the accuracy of the 12 Volt DC power supply voltage with 10 measurements, you can use equation (1) below:

$$Average\ Accuracy = \left(\frac{Voltase\ Input}{Work\ Voltase}\right) x100\%$$

$$Average\ Accuracy = \left(\frac{11{,}7\ volt}{12\ volt}\right) x100\% = 97\%$$

B. TCS 3200 COLOR SENSOR TESTING

TCS3200 color sensor testing is done by monitoring the RGB value displayed on the Arduino IDE software serial monitor. The TCS3200 sensor detects the lowest intensity or lux of the detected color object, for example green, which causes the red, green, and blue (RGB) intensity values to be displayed on the serial monitor. For example, when a green object is detected, the green intensity value will be lower than the red and blue intensity values.

Tbl 5. Green Object Test Result Data

No	Intensity R	Intensity G	Intensity B	Description
1	57 Lux	41 Lux	71 Lux	Green
2	55 Lux	41 Lux	70 Lux	Green
3	56 Lux	42 Lux	72 Lux	Green
4	58 Lux	43 Lux	73 Lux	Green
5	54 Lux	42 Lux	74 Lux	Green
6	57 Lux	41 Lux	73 Lux	Green
7	58 Lux	43 Lux	74 Lux	Green
8	56 Lux	42 Lux	71 Lux	Green
9	57 Lux	45 Lux	70 Lux	Green
10	53 Lux	44 Lux	70 Lux	Green

Tbl 6. Blue Object Test Result Data

No	Intensity R	Intensity G	Intensity B	Description
1	104 Lux	74 Lux	49 Lux	Blue

No	Intensity R	Intensity G	Intensity B	Description
2	112 Lux	76 Lux	50 Lux	Blue
3	106 Lux	75 Lux	51 Lux	Blue
4	104 Lux	74 Lux	49 Lux	Blue
5	106 Lux	74 Lux	50 Lux	Blue
6	112 Lux	76 Lux	50 Lux	Blue
7	107 Lux	75 Lux	52 Lux	Blue
8	106 Lux	75 Lux	50 Lux	Blue
9	107 Lux	76 Lux	52 Lux	Blue
10	112 Lux	76 Lux	50 Lux	Blue

Tbl 7. Blue Object Test Result Data

No	Intensity R	Intensity G	Intensity B	Description
1	32 Lux	102 Lux	84 Lux	Red
2	32 Lux	98 Lux	79 Lux	Red
3	31 Lux	98 Lux	83 Lux	Red
4	33 Lux	101 Lux	84 Lux	Red
5	31 Lux	99 Lux	79 Lux	Red
6	32 Lux	102 Lux	80 Lux	Red
7	31 Lux	98 Lux	82 Lux	Red
8	32 Lux	99 Lux	83 Lux	Red
9	32 Lux	101 Lux	84 Lux	Red
10	31 Lux	99 Lux	79 Lux	Red

C. *DRIVER MODULE TESTING AND ANALYSIS*

Motor driver testing has the aim of knowing the quality of the voltage on the motor driver when the motor is in Off and ON conditions.

The results of the test data can be seen in Tbl 8 with five tests Tbl 8.

Tbl 8. Motor Driver Test Result Motor Off Condition

No	Device	Conditions	Voltage on Driver Motor (VDC)
1	3Volt Dc Motor	Off	11,7 V
2	3Volt Dc Motor	Off	11,8 V
3	3Volt Dc Motor	Off	11,7 V
4	3Volt Dc Motor	Off	11,7 V
5	3Volt Dc Motor	Off	11,7 V
	Average		11,7 V

Tbl 9. Motor Driver Test Result Motor on Condition

No	Device	Conditions	Voltage on Driver Motor (VDC)
1	3Volt Dc Motor	On	
2	3Volt Dc Motor	On	11,6 V
3	3Volt Dc Motor	On	
4	3Volt Dc Motor	On	11,5 V
5	3Volt Dc Motor	On	11,6 V
	Average		11,6 V

D. *SERVO MOTOR TESTING AND ANALYSIS*

The results of testing this tool to see whether the degree of the servo motor matches the color of the object that has been detected by the color sensor can be seen in Tbl 10 below:

Tbl 10. Servo Motor Accuracy Testing Results

Motor Servo				Accuracy		Description
Servo1	Busur	Servo2	Bow	Servo1 (%)	Servo2 (%)	Color
55°	53°	0°	0°	-3,64	0	Green
55°	53°	0°	0°	-3.64	0	Green
0°	0°	0°	0°	0	0	Red
0°	0°	0°	0°	0	0	Red
0°	0°	60°	58°	0	-3,33	Bule
0°	0°	60°	58°	0	-3,33	Blue

The summary of the test results is as follows: The servo motor rotates to place the goods according to the color detected by the sensor. When the green color comes in, servo one will move on the arc 550 and servo two stays on arc 00. If the blue color comes in then servo motor one will remain on arc 00 and servo two will move on arc 600. Then if the red color enters and is detected by the color sensor, then the two servos will be on arc 00. Errors in the placement of goods are caused by RGB values that do not match.

The range of values that have been determined by the sensor. Factors causing the error include the faded color of the item, improper positioning of the item, and light from outside the sensor box that affects the light intensity received by the sensor. BLYNK Display on Smartphone.

The FC-51 infrared sensor module is used to detect obstacles in front of it. This module consists of two main parts, an IR transmitter that emits infrared radiation at the object or obstacle, and an IR receiver that detects the radiation reflected by the object. If this FC-51 sensor is connected to an IoT device, the data obtained from the sensor can be processed and displayed anywhere.

An entry counter can refer to any device or system that functions to count or detect objects that enter a certain place or path, a counter for the number of people entering a certain area, or even a machine in industry that counts the number of products that pass through a point on a production line.

The display on blynk uses four indicators, namely: the indicator of the number of green items, the indicator of goods blue color and red color item indicators. Then one indicator is used to count the incoming color goods as a whole. Below is a 16 Blynk image display as follows:

Fig 16. Blynk display on smartphone

E. OVERALL TESTING

In the process of testing this overall tool is testing the work results on the tool whether it is appropriate. Where testing is done 6 times. However, the test is carried out by entering the goods and colors onto the conveyor one by one, because the TCS 3200 sensor takes some time to send color data to Arduino mega, so it must complete one program or color first, then followed by the next color. When more than one item and color is tried to be inserted into the conveyor, only the item in the first position will be detected. The next item will enter the container in the position of the first item. The following are the results of Fig 17 testing items that enter the conveyor simultaneously.

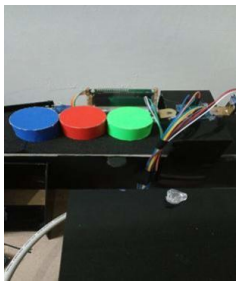

Fig 17. Simultaneous testing of goods entering the coveyor

Below is a picture of the LCD display when the test is carried out by entering the goods simultaneously.

Fig 18. LCD display

So for overall testing is done by entering goods into the conveyor one by one including: green color, blue color, and red color. It is done from entering one by one the goods to the conveyor until the entry of the goods into each container, the process of which passes through several sensors. Can be seen according to the overall tool testing as shown in Tbl 11. below:

Tbl 11. Overall Test Results

No	Color Detected	Ultrasonic Sensor	Sensor TCS 3200	Servo	Result	Description
1	Red	Detected	Readable	0°	succeed	Servo motor 1 and 2 do not respond when a red object is detected by the sensor
2	Blue	Detected	Readable	60°	succeed	Servo motor 2 responds when the blue item is detected by the sensor, pushing the item exactly after servo delay 2,5s
3	Red	Detected	Readable	0°	succeed	Servo motor 1 and 2 do not respond when a red object is detected by the sensor
4	Red	Detected	Readable	0°	succeed	Servo motor 1 and 2 do not respond when a red object is detected by the sensor
5	Green	Detected	Readable	55°	succeed	Servo motor 2 responds when the green item is detected by the sensor, pushing the item exactly after servo delay 2,5s
6	Green	Not Detected	Not Readable	0°	Faild	Servo motor 2 responds when the green item is detected by the sensor, pushing the item exactly after servo delay 2,5s
7	Blue	Detected	Readable	60°	succeed	Servo motor 2 responds when the blue item is detected by the sensor, pushing the item exactly after servo delay 2,5s
8	Green, blue, and red	Detected	Readable	55°	succeed	Servo motor 1 responds when the green object is detected by the sensor by pushing the object after servo motor 1 delays 2.5 seconds, but when trying to insert more than one object, the object that will be detected is the object at the front.
9	Blue, red and green	Detected	Readable	60°	succeed	Servo motor 2 responds when the blue object is detected by the sensor by pushing the object after servo motor 2 delays 2.5 seconds, but when trying to insert more than one object, the object that will be detected is the object at the front.
10	Red, green and blue	Detected	Readable	0°	succeed	Servo motors 1 and 2 do not respond when the object is detected by the sensor, but when trying to insert more than one object, the object that will be detected is the object at the front

V. CONCLUSION

The conclusion from the testing and analysis of the Design of Automatic Goods Sorting Tool Based on Arduino Mega Based Paint Color Using TCS3200 Sensor with Internet of Things (IoT) Monitoring, there are several points of conclusion. The following are the conclusion points of the planning that has been made:

1) From 10 measurements, the 12 Volt DC power supply voltage reached 97% of the expected value. However, there was a slight voltage drop from 12 Volts DC to 11.7 Volts DC. The data sheet shows the voltage range that the power supply can accept, from a maximum of 12.6 Volts to a minimum of 11.4 Volts. To improve a good power supply, it is recommended to use high-quality components.
2) From the test results on the motor driver when it is on or when the motor is working and shows a good reading according to its function, which shows an average value of 12.02 VDC, because this motor driver will work if the minimum voltage is 12 VDC and does not experience a voltage drop below 12 VDC, when there is a voltage drop of less than 12 VDC, it is certain that the components in the driver module have decreased the quality of the measurement results.
3) Testing he composition of RGB values on the TCS3200 color sensor shows that the lowest intensity value of the RGB composition is the result of the color detected by the sensor.
4) Testing is done by entering goods and colors onto the conveyor one by one, because the TCS 3200 sensor takes some time to send color data to Arduino mega, so it must complete one program or color first, then followed by the next color. When more than one item and color is tried to enter the conveyor, only the item in the first position will be detected. The next item will enter the container in the position of the first item.

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Muhammad Ilham Pratama, S.T., is an engineering graduate who has completed his studies at the Electrical Engineering Study Program at Pakuan University. Born in Cianjur, July 26, 2000. Who is also active in vocational organization activities, namely Pakuan University Electrical Engineering student association. In this research the authors concentrate on the use of tools that are useful and easy to understand by utilizing the Internet of Things (IoT).