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Web and Arduino Automatic Selling Machine Monitoring Prototype

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A B S T R A C T

A vending machine is a type of machine that is very suitable for marketing a product such as automatic sales. These machines also tend to be able to grab more attention in public places. In the beverage machinery industry, there is a lot of competition from large companies, which can make it difficult to market these machines. Many schools and universities already have agreements with companies to place automated beverage machines on site. This tool is designed using the TCS3200 sensor which functions to detect the color of the paper currency to determine the value of the currency. The dc motor functions as an actuator for withdrawing money and the servo motor functions as a container for dropping money every time money comes in. Then the pushbutton and led light function as a drink selection button after the money comes in. The web functions as a provider of information about how many drinks are sold and how many drinks are left in stock, and telegrams serve as a marker/notification when one of the drink's stock runs out. Furthermore, for the drink dropping work system using a dc motor equipped with a spiral in each drink slot. Each money that comes in with a nominal value of Rp. 5,000 or Rp. 10,000 can only make one transaction, because this tool does not accept change. Tests were carried out on currency detection, cash withdrawals, beverage dispensing, web monitoring, and telegram notifications.

1. Introduction

Vending machine is a device that can perform transactions automatically by entering a certain nominal amount of money into the machine, the machine can respond by issuing certain items or goods. In public areas such as Soekarno Hatta international airport, department stores, Trans Jakarta bus stops, we can find these vending machines, so customers can buy drinks without transacting with humans. The advantage is that it is fast, practical, clean and does not require a large space. This device can be used in automated sales systems in the form of soft drinks, newspapers, tickets or instant food [20]. Parts of a vending machine are electronic, mechanical and power supply parts. In the electronics section, there is a microcontroller to run the device workflow. Then a mechanic to deliver customer goods after being triggered by electronics. A power supply or electricity that can accommodate the vending machine's electrical power needs. The tcs3200 sensor is a device used for transaction processing, namely validation of purchase money in the form of paper [10].

This vending machine is designed based on the Atmega 2560 microcontroller. By utilizing a tcs3200 sensor known as a color sensor to detect banknotes, the money that has been determined to run the machine can be detected. This vending machine is equipped with modules that are connected to the Atmega 2560 microcontroller, so the machine can run properly [18]. The working principle of this tool is that consumers can issue drinks based on the selected button. The machine will detect incoming money based on the color detected by the tcs3200 sensor. This research stage, after the machine has been designed and manufactured, can be used for business development, especially for small and medium-scale beverage sellers in urban or rural areas because this tool will attract buyers because of its fast and practical nature [19]. With this tool, it is

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expected to be an example of the development of existing tools. In addition, this vending machine can serve consumers 24 hours, so that consumers or the general public will be able to understand the working process of the machine and make it easier to buy the drinks they want. Based on the background, the problems in this research can be formulated as: 1. How to design and implement efficient web-assisted and Arduino-assisted automatic selling machine monitoring so that it is easily understood by consumers. 2. How to display information on goods and income from goods sold on the web and test monitoring of web-assisted vending machines and arduino. The objectives to be achieved in this research are: 1. Obtain the results of the prototype design and application of prototypes of web-assisted automated sales machines and arduino that are efficient and easy to understand by consumers. 2. Obtain information on goods and income from goods sold on the web and the results of testing monitoring of web-assisted vending machines and Arduino.

2. Method

This research method is a framework for carrying out an action or frame of mind to develop an idea that is directed and related to the aims and objectives. The following is an explanation of the stages in the research method or framework :

2.1 Identification

At this early stage, an analysis of the requirements needed to design the system is carried out. At this stage, what is done is to analyze why this research was conducted. Stages of analysis are divided into two things, namely needs analysis and analysis of how the system works.

2.2 Needs Analysis

At this stage, researchers need some software and hardware to support research on web and arduino-assisted vending machine monitoring tools.

2.3 Work Analysis

Analysis of system requirements is needed to find out whether the system created is in accordance with the expected needs or not. In this study, the sensor can detect the color of the Rp. 5000 and Rp. 10,000 bills. The button will be active to indicate the DC Motor will move to choose which drink to buy from the 3 types of drinks sold at the sales machine, the LCD will display text that is read by the sensor to inform consumers/buyers of what drink to choose.

2.4 Design

This research design contains the development of the stages of system work analysis that is converted into a block diagram, so that researchers can understand the flow or function of the design to be made. The following are the stages of this research design. The design of the hardware used in the research is carried out, the design is made in the form of block diagrams and schematic diagrams to describe interconnected devices.

2.5 Implementasi

The implementation phase applies everything that has been designed, both hardware design and network design. The implementation stage is divided into two stages, namely hardware and software implementation:

a. Implementation of Connecting Between Modules

The implementation or installation of the hardware and tools needed in the research, the implemented devices are in the form of a TCS3200, Arduino AtMega, LCD, Button, LED, Servo Motor, DC Motor, L293D Motor Shield circuit.

b. Database Implementation

Making a database to retrieve data and connected to the WEB.

c. Web Implementation

Performed programming or arduino sourcode to run performance and creation to connect to the WEB.

2.6 Function Test

At this stage, various tests that have been implemented in the previous stage will be carried out. This stage is carried out by:

a. TCS3200 sensor test.
b. LCD test using I2C LCD.
c. Testing the servo motor as a container for incoming money and dropping it into the money container/reservoir that has been placed in the automatic selling machine tool.

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b. Testing of Dc and Spiral motors.
c. Testing of beverages purchased by consumers.
d. Web testing on the entire system that has been made.

3. Result and Analysis

The results of the research stages of monitoring web-assisted vending machines and arduino. through four stages, namely the first analysis that occurs into two parts, namely problem analysis and analysis of how the system works. The two designs are further divided into two parts: hardware design and network schematic design. Third implementation or assembly of all components used. The fourth is the test results. The results of this study produced the following results:

a. Tcs3200 sensor as input and is able to detect the color of money.
b. DC motor To withdraw money that will go into the box and fall into the servo container, after that the servo will drop the money into the money reservoir.
c. The dc motor that is in the drink holder serves to push the drink to fall to the place where the drink has been made.
d. LCD as a measurement of the performance of the Tcs3200 sensor as a color detector for incoming money and the selected drink, after the nominal text and drinks will be displayed on the LCD.
e. Prototype Circuit of Web-Assisted Automated Selling Machine Monitoring Tool and Arduino can send information data via WEB.

3.1 Analysis of How it Works.

In the process of analyzing how it works, it will explain how the system works in this research. The following picture will explain the analysis of how this system works

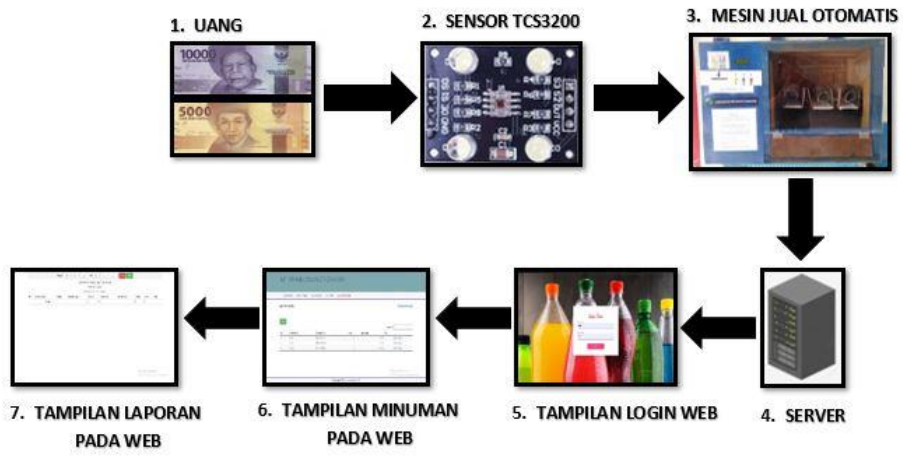

Fig 1. Analysis of How it Works**.**

Figure 1 explains how the system works in this study, starting with (1) the user inserts paper money into the machine and the machine will withdraw the money entered by the user. (2) The TCS3200 sensor will detect the color of Rp. 5000 or Rp. 10,000, then the TCS3200 sensor will send commands to the Arduino Atmega and Ethernet Shield, the source code that has been created is stored on the server. (3) After the money is detected, the button can be pressed according to the price of the drink purchased and when the button is pressed the led on the button that was pressed earlier will light up, then the L293D motor shield driver connected to the dc motor will push the drink that has been selected by the user by pressing the button. (4) The server will communicate with the web after some drinks are sold. (5) There is a login form on the web for owners to see the progress of sales every day. (6) The display of drinks on this web serves as monitoring for the owner because there are stock items in each drink. (7) The report display on this web serves to store daily transaction reports sent by the server.

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3.2 Hardware Design.

At this stage, hardware design is carried out in accordance with the research conducted, overall this research is divided into several hardware system designs which are described in the following block diagram:

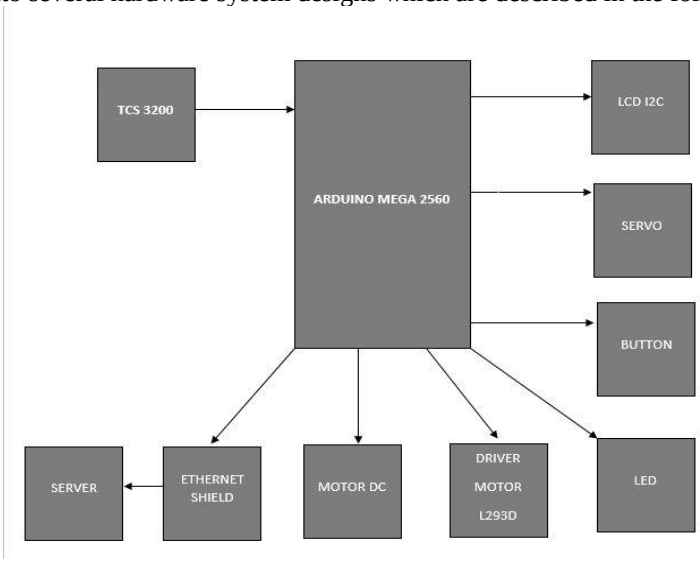

Fig 2. Hardware Design

Based on the block diagram shown in Figure 2, the whole system is divided into parts. Sensor as input, Arduino as receiver and sender and LCD as display output. Battery to drive the dc motor as a banknote puller, servo motor as a place to store money when it enters the machine, Arduino, Ethernet Shield, L293D Driver Motor Shield, source code that has been created stored on the server with program instructions, the server will communicate with WEB.

3.3 Implementation.

At the implementation stage, namely the assembly or installation of all components that were previously implemented, the system is actually implemented. The following are the implementation stages that will be carried out using the System Workflow as follows.

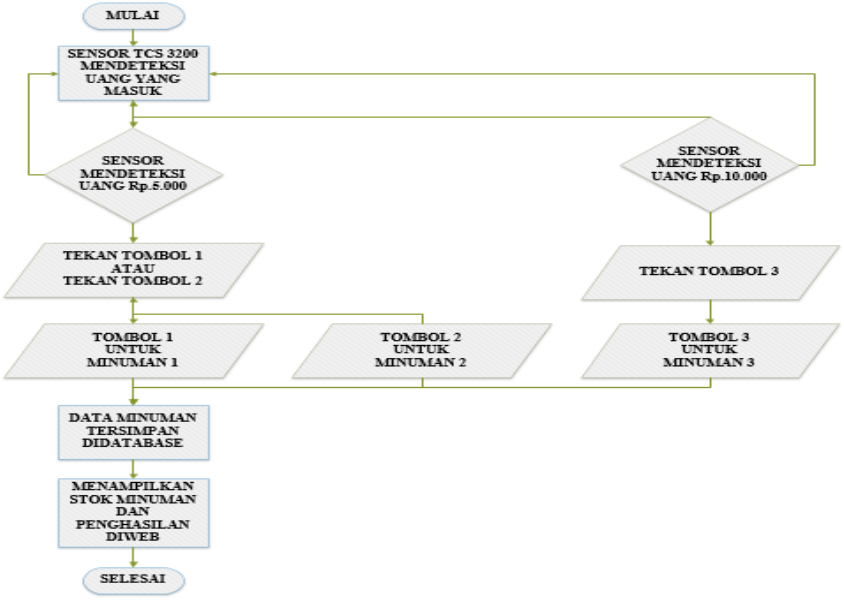

Fig 3. System Workflow

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3.4 Implementation of Notification Display Via Telegram for Out of Stock Drinks.

Implementation of notification display via telegram for out-of-stock drinks containing a telegram message, which functions as a notification when the stock of drinks on the web runs out. Notification display via telegram for out-of-stock drinks is shown in Figure 4.

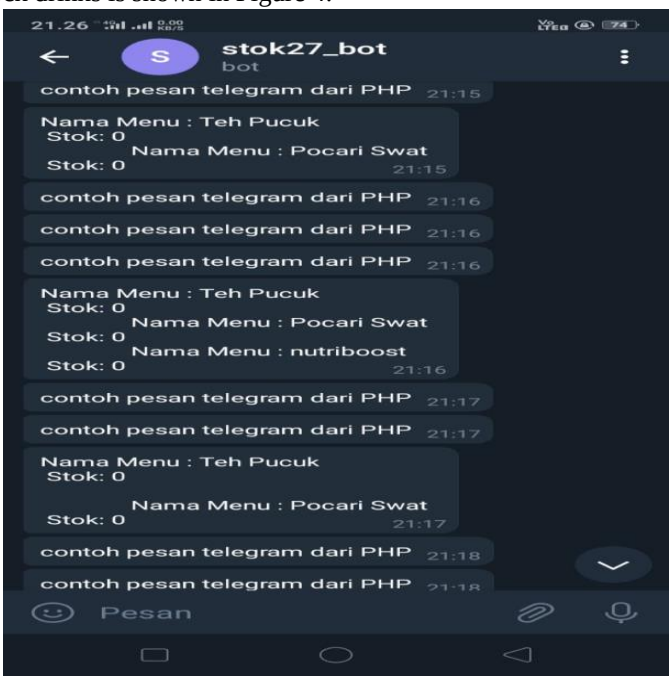

Fig 4. Implementation of Notification Display Via Telegram for Out of Stock Drinks.

The code used to generate a notification display via telegram for drinks that are out of stock on the system is as follows:

```
<?php
    $token = "1601132927:AAH2Vj52B0yn5a-itz9A8gtAfwirumaURFQ"; // token
bot

    $data = [
        'text' =>"Stok Habis",
        'chat_id' => '1461321708'  //contoh bot, group id -442697126
    ];

    file_get_contents("https://api.telegram.org/bot$token/sendMessage?" .
http_build_query($data) );

?>
```

3.5 Testing.

The results of the test of Rp. 5000 and Rp. 10,000 Uang. In this test, we will test the machine by testing the time it takes for the tool to detect money once, the success of detecting a sample of money which also affects the amount it gets, ambient light also affects the sensor reading process. The money that will be tested is Rp. 5000, and Rp. 10,000, with periodic detection. Ten tests, for ten samples of money. That way we will know more about the accuracy of the machine being made.

a. Money Test Time

Conduct time testing starting from the money being placed in the money container until the money is read by the sensor to detect until the last time the money enters the container.

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Table 1
Test Time for Money and Types of Drinks

Amount of Money and Type of Drink	Time (Second)	Average(Second)
Rp.5000 (Drink 1) 1	20	
Rp.5000 (Drink 2) 2	22	21
Rp.5000 (Drink 1) 3	21	
Rp.5000 (Drink 1) 4	21	
Rp.5000 (Drink 2) 1	21	
Rp.5000 (Drink 2) 2	23	23
Rp.5000 (Drink 2) 3	24	
Rp.10.000 (Drink 3) 1	24	
Rp.10.000 (Drink 3) 2	24	23
Rp.10.000 (Drink 3) 3	22	

Based on the results of testing the time it takes for the machine to do one time identification starting from the money being placed in the money container until the last money enters the container in the machine, it is obtained that the time it takes to identify Rp. 5000 (Drink 1) is 20 seconds for money. IDR 5000 (Drink 1) 1, 22 seconds for IDR 5000 (Drink 1) 2 , 21 seconds for the third IDR 5000 (Drink 1), and 21 seconds for IDR 5000 (Drink 1) 4 Thus, it can be calculated that the average time needed to detect IDR 5000 (Drink 1) is 21.

Meanwhile, for the test results, the time required for the machine to carry out one time identification is obtained for the time required to identify Rp. 5000 (Beverage 2) is 21 seconds for Rp. 5000 (Beverage 2) 1.23 seconds for Rp. 5000. (Drink 2) 2 , and 24 seconds for the 3rd Rp. 5000 (Drink 2) 3. Thus it can be calculated the average time needed to detect Rp. 5000 (Drink 2) money is 23. And for the results Testing the time required to identify IDR 10,000 (Drink 3) is 24 seconds for IDR 10,000 (Drink 3) 1 , 24 seconds for IDR 10,000 (Drink 3) 2, and 22 seconds for IDR 10,000 (Drinks 3) 3. In the second test, this money will test the machine by testing the success rate of detecting IDR 5000 and IDR 10,000 successfully or not 3 types of drinks falling into the container that has been made.

b. Monitor Serial Value

The results of testing the output value generated by the color sensor to detect Rp. 5000 and Rp. 10,000 Drinks 1, Drinks 2, Drinks 3.

Table 2
Output Values

Price & Beverage Type	Color Range		
	R	G	B
Rp.5000 (Drink 1)	31-32	37-38	32-33
Rp.5000 (Drink 2)	31-32	37-38	32-33
Rp.10.000 (Drink 3)	34-35	39-40	30-31

Table 2 is the result of reading and displaying the output frequency on the serial monitor detected by the TCS3200, color sensor. At this stage the researcher needs to write down the frequency value itself when the money is under the sensor, then enter the frequency value in the source code according to the color of the Rp. 5000 bill and IDR 10,000 is detected, so the sensor can distinguish various colors.

c. Presentation of success

The results of testing the Rp. 5000 and Rp. 10,000 coins are successful or not 3 types of drinks fall into the containers that have been made.

Table 3
Presentation of success

Beverage Type	Succeed	Not successful	Success Percentage(%)
Rp.5000	8	2	80%

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Beverage Type	Succeed	Not successful	Success Percentage(%)
(Drink 1) 1 Rp.5000	9	1	90%
(Drink 1) 2 Rp.5000	9	1	90%
(Drink 1) 3 Rp.5000	7	3	70%
(Drink 1) 4 Rp.5000	10	0	100%
(Drink 2) 1 Rp.5000	8	2	80%
(Drink 2) 2 Rp.5000	9	1	90%
(Drink 2) 3 Rp.10.000	10	0	100%
(Drink 3) 1 Rp.10.000	7	3	70%
(Drink 3) 2 Rp.10.000	9	1	90%
(Drink 3) 3	Average		94%

Based on table 3 on the presentation of success in the money and drink category that has been determined on the container, the percentage of success is 94% and there are some money and drinks that are not successful at the time of identification because the sensor does not focus on detecting money and drinks

4. Conclusions

Based on the discussion of the results of this study, several conclusions were obtained as follows: 1. Physical design has been made and implemented a machine from a tool entitled monitoring of web-assisted vending machines and Arduino to detect money and buy drinks in a modern way, can display information incoming money and drinks sold and displaying text of Rp. 5000 or Rp. 10,000 bills and drinks for tea shoots, pocarisweat, and nutriboost LCD. 2. Obtaining the results of the implementation of prototypes of web-assisted automated selling machines and arduinos that are efficient and easy to understand by consumers and Obtaining total income and sales of beverages on monitoring web-assisted vending machines and Arduino which have been made to function properly according to their functions.

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