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Smart Cashier with Self Service System at Supermarket

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Abstract

The increasing population growth in Indonesia also affects the need for a comfortable and safe shopping place. The increasing number of consumers at the same time causes lines, especially in the payment section. The purpose of this research is to try to develop a cashier with a self-service method to help speed up the payment process and reduce lines. This research uses a GM66 scanner to scan barcodes on product items to be purchased. While the 3200-DB TCS Sensor is used to detect the nominal money paid. Information on the price of goods that have been scanned is displayed on the LCD screen. After payment is complete, the shopping receipt will be printed. In the results of this study, a tool was obtained that can be used to automatically sum up the price of groceries. Additionally, this tool can also facilitate transactions for payment of groceries. However, in this study, the new payment transaction process can only use Rp 50.000 bills, and there is no system for returning change.

Keywords: Self Service; SUPERMARKET; Barcode; TCS3200-DB.

1. Introduction

In the list of the world's most populous countries, Indonesia ranks fourth after the United States and second after the United Kingdom [1]. Based on data from the Central Statistics Agency (BPS), Indonesia's population is projected to reach 275.77 million people in 2022. This number increased by 1.13% compared to the previous year, which was 272.68 million people [2]. As the population increases, the level of living needs also increases. Population growth can drive economic growth, and market expansion will increase the level of economic specialization. Specialization increases economic activity [3][4]. Increased population growth triggers people's needs for a convenient and safe shopping place, and has complete goods at competitive prices [5]. This has led to the growth of supermarkets in Indonesia. Supermarkets are stores that provide daily necessities, especially food and beverages. Supermarket operations include all transactions, one of which is food payment [6]. The increasing number of consumers at the same time causes queues, especially in the payment section, especially in large supermarkets. If there are many queues for a cashier, it can hinder the smooth flow of payments [7]. Queuing problems can be overcome by improving service quality [8], one way to improve service is to simplify item scanning and payment, one of which is done with self-service technology [9]. Self-service is a technology that can overcome various problems that occur in minimarkets [10]. These problems include long payment queues due to various issues at the cashier, new product offers, donations, and change that does not fit. Using self-service technology can help make the payment process faster [11].

Many studies have been conducted to support the self-service cashier system. One of them is research by (Putri & Wibowo, 2019) entitled "Prototype Smart Minimarket." This research creates a tool using a mobile application that customers use to order goods by

scanning the barcode of the item. The prototype tool includes components such as NodeMCU as the processing core, DC motor and motor driver as the drivers of goods and baskets, and laser diodes and light sensors as detectors of passing goods and baskets[12]. Research (MAULANA, 2023) in the research. The design uses the Blynk application on a smartphone as the primary medium for receiving information on goods obtained from the design work system, with the assistance of the Arduino Uno module, ESP8266 NodeMCU, GM66 scanner, IR obstacle sensor, servo motor, conveyor, and Blynk smartphone application. Which later when the goods will be sent to the intended destination, the GM66 scanner will receive QR code information, and then the servo motor will direct the destination of the goods to the intended area. Then the number of incoming goods will be calculated by the IR obstacle sensor, and the Blynk application will calculate the number of goods entering the area [13].

Based on these references, the focus is on scanning goods and still using employees for the payment transaction process. An automatic payment system is needed to speed up transactions while shopping. Alkausar and Husnaini (2021) used TCS 3200-DB as a sensor to detect money and Arduino as a control center and data processor in their research. The TCS 3200-DB sensor reads the money, and the LCD displays the amount entered. After the amount of money reaches a total of Rp. 5000 [14], some reference results that have been studied in this background are obtained from various studies that discuss the system of how to design an automatic cashier with a self-service system and how the automatic payment system works. This research starts from customers who want to pay for their groceries by scanning them in the automatic cash register that has been designed and making payments directly at the automatic cash register. The design of this final project uses a 3200-DB TCS sensor to detect the nominal money paid on the machine and a GM66 scanner to scan the barcode on the product item to be purchased by consumers who are integrated with an LCD that displays the price of goods that have been scanned. After making a payment, the printer will print a shopping cart as proof of having made a shopping transaction at an automatic cash register[15].

2. Material and methods

The tool design discussed in the text is based on the experimental method and is used in the planning process before actually creating the tool. The design includes block diagrams, circuit working principles, and hardware and software design. It serves as a guide in the design and manufacturing process to ensure that the final tool meets expectations.

The control processing center of this tool is the Arduino Uno microcontroller, which stores and processes the inputs according to the program used. The GM66 scanner is utilized for scanning barcodes on purchased items, while the 3200-DB TCS Sensor is used to detect the amount of money paid. The LCD screen displays information on the scanned item prices. Lastly, once the payment is completed, the cash register automatically prints a shopping receipt as proof of the transaction. It is important to note that the money detection system can only identify banknotes of Rp. 50,000 and does not include a system for returning the money.

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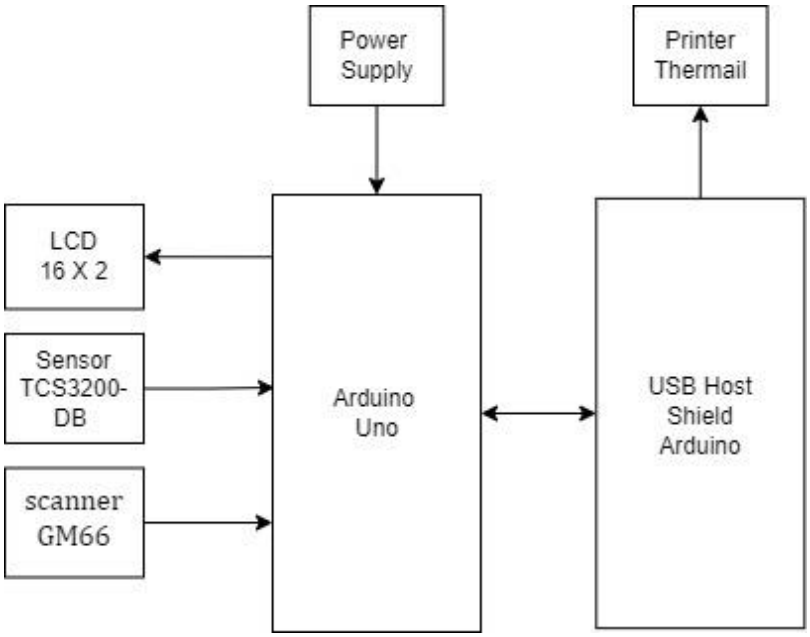


Figure 1: Block Diagram

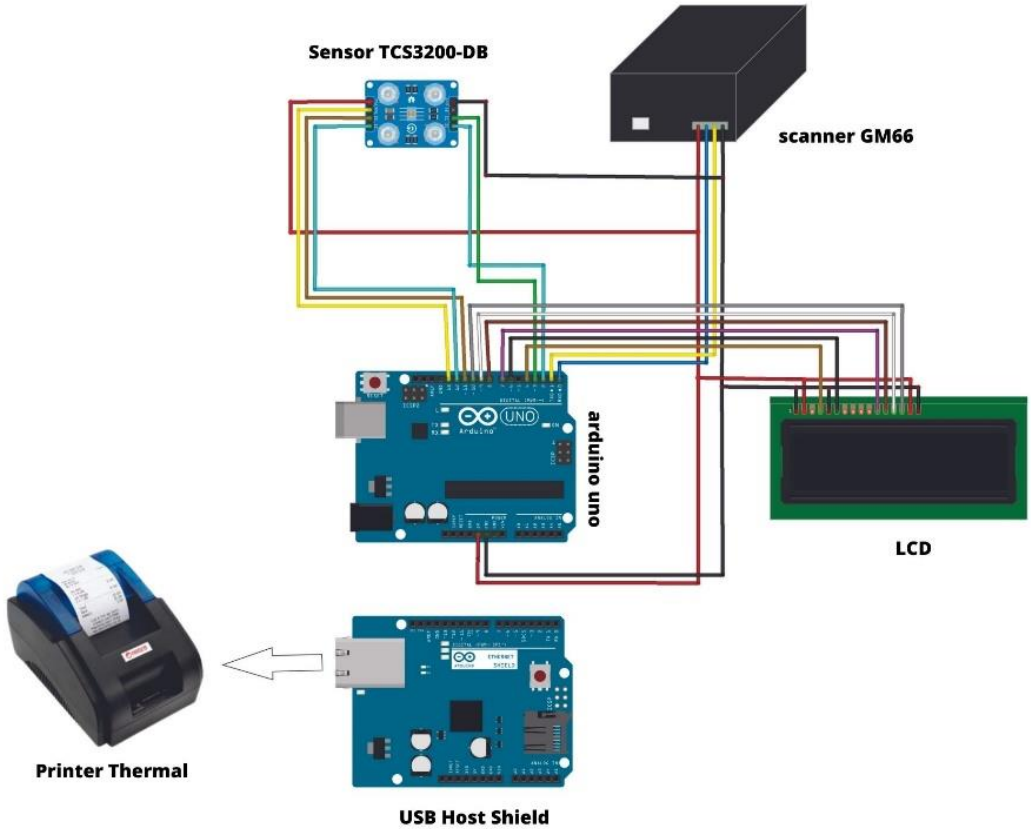


Figure 2: Hardware circuit design

In order to know the working principle of the tool as a whole, block diagrams are very important in the design and manufacture of tools.

Figure 1 is a block diagram, which is a concise statement of the entire working system of the tool to be made. This is an explanation of the block diagram of the tool to be made:

1. The power supply is used as the power supply for all circuits in a system when designing a power supply or power supply unit. This circuit reduces the 220 VAC voltage to 5 VDC.
2. Arduino Uno microcontroller as a control processing center according to the input given, all inputs will be stored and processed in the microcontroller according to the program used.
3. LCD (Liquid Crystal Display) is used as an information medium that displays the price of shopping goods scarce by consumers.
4. TCS3200-DB sensor is used to detect the nominal money paid on the machine.
5. GM66 scanner is used to scan barcodes on product items to be purchased.
6. USB Host Shield Arduino is used to provide a USB host interface, which in this final project is connected to a thermal printer.
7. Thermal Printer is used to print receipts.

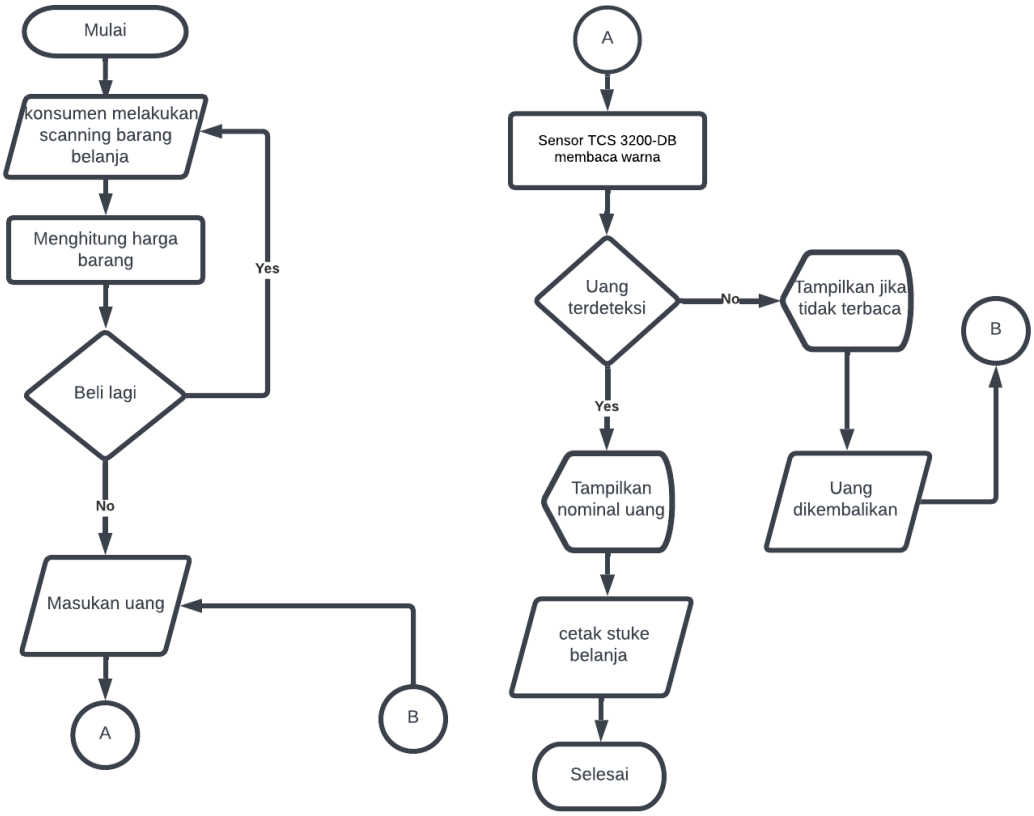
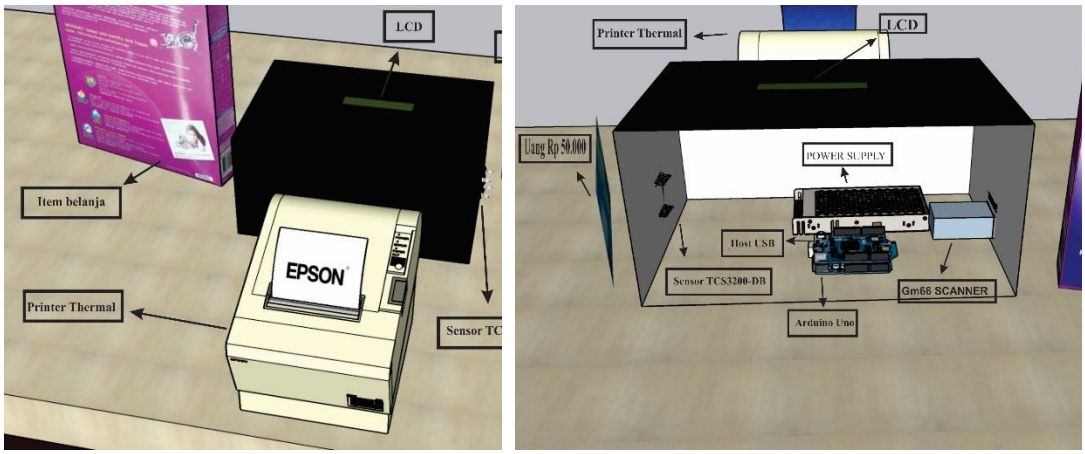


Figure 3 : Flowchart

The tool's mechanical design was created using 3D modeling or 3D parametric software, specifically SketchUp: 3D Design Software 2023. The design takes into account the materials and costs involved.The figure below displays the overall design of the tool, including a description of each component's mechanical design.along with a description of the mechanical design of each component used.



(a) (b)

Figure 4. Mechanical design (a) front view, (b) inside view

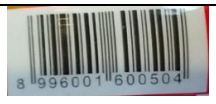
3. Results and discussion

In this section, some testing and analysis is performed on the input and output parts. Barcode testing and analysis is performed to determine if the sensor is functioning properly as an input as intended.

A. Barcode Scanner GM66 reading testing

To evaluate the barcode sensor's object detection capabilities, we tested it on various products with different barcode codes. Table 1 presents the results of testing barcode scanners on food items in the designed system support components.

Table 1. Barcode scanning test

NO	Barcode Images	Shopping items	Price	Bazzer sound
1		Nextar	Rp 2.500	YES
2		Aqua	Rp 3.000	YES
3		Lemineral	Rp 3.500	YES
4		Saos ABC	Rp 7.000	YES
5		Milo	Rp 3.000	YES
6		Teh pucuk	Rp 3.000	YES

7		Soya Master	Rp 7.000	YES
8		Yupi	Rp 4.500	YES
9		Indomie	Rp 3.500	YES
10		Pocky	Rp 4.000	YES

B. Thermal Printer Testing

This test aims to determine whether the thermal printer can produce clear and accurate receipts. Figure 5 shows an example of the printed receipt displaying the purchased items at the checkout counter.

Figure 4. Printout on Thermal Printer

During thermal testing, the system generates results for purchases of 10 items. The printout includes the total price, quantity, and overall cost of the purchase.

C. Testing Money Detector with TCS 3200-DB color sensor

The TCS 3200-DB color sensor was tested to determine its ability to detect currency used for payment. The test involved multiple attempts to detect the currency and determine if it was successfully read by the system.

Table 2: TCS 3200-DB color sensor testing of IDR 50,000 bills.

paper money	Experiment-	Experiment result	Description
	1	failed	USB host failed initialize
	2	failed	USB host failed initialize
	3	succeed	USB host unit OK
	4	succeed	USB host unit OK
	5	succeed	USB host unit OK
	6	succeed	USB host unit OK
	7	succeed	USB host unit OK
	8	succeed	USB host unit OK
	9	succeed	USB host unit OK
	10	succeed	USB host unit OK

According to Table 2, the test results for Rp.50,000 show an 80% success rate in reading.

D. Hardware design results

The system control center of the design utilizes an Arduino Uno microcontroller. The system will control the TCS32000-DB sensor and the GM66 Barcode scanner, and will be packaged in a box as shown in Figure 5.a (front view) and Figure 5.b (inside view).

(a) (b)

Gambar 5. Mechanical design results (a) front view, (b) inside view

4. Conclusion

After testing and analyzing this research, the results of testing tools that can be used to be able to help shoppers in calculating the total shopping items they want to buy. In the results of this test obtained barcode reading data on shopping items can be read by a barcode scanner system using a GM66 scanner. In this shopping item experiment with items such as Nextar, aqura, lemineral, saos, milo, the pucuh, soya master, yupi, indomie and pocky. In addition, the price that is read also corresponds to the price entered in the programming. The system can also add up the number of prices of scanned goods. The payment system in this final project also runs as expected where in experiments conducted with money of Rp.50,000, - can be read in the rocess of paying for shopping items that have been scanned, but there are still some shortcomings in this study including in the process of new payment transactions can use money Rp.50,000, - and there is no system for returning the money entered.

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