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AUTOMATED ONION PEELING AND CUTTING MACHINE

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ABSTRACT

The significance of onions in cooking cannot be overstated, but peeling and chopping them can be a complex task due to the potential eye irritation caused by onion juice. To address this issue, various onion peeling machines have been developed with advancing technology. However, these machines are typically large and expensive, designed for industrial use. Therefore, the aim of this project is to create an automated onion peeling and cutting machine that is more accessible. The project utilizes hardware components such as a motor, colour sensor, power supply, relay, and Arduino Uno. The programming aspect of the project involves using the Arduino IDE software to ensure the automation of the machine. Additionally, sensors are employed to detect the colour changes during the peeling process. The prototype successfully peels and cuts onions automatically, providing a convenient solution for users.

1.0 Introduction

Onions play a vital role as a raw ingredient in cooking and are widely cultivated and used worldwide. They are commonly cooked and served as a vegetable or incorporated into savoury dishes but can also be consumed raw or used for making pickles and chutneys. Chopping onions releases a pungent odour and chemicals that can cause eye irritation.

In Malaysia, the annual onion imports range from 150,000 to 250,000 tons. The average onion consumption per person, according to the Food and Agriculture Organization (FAO), is 12 kilograms per year. In 2009, the FAO reported an increase in Malaysians' onion consumption to 14 kilograms per year, as onions are used extensively in various cuisines.

With the advent of the industrial revolution, automated devices have become indispensable in our daily lives. Automated machines have consistently saved significant time compared to manual counterparts, leading to increased efficiency and competitiveness. In commercial kitchens, the demand for modern and efficient kitchen equipment, including cutting machines for food preparation, is particularly high in the global market.

2.0 Methodology

During the system design process, knowledge is gathered from magazines, journals, and reports related to the project. This technique involved the introduction of specific field research data that will be implemented in others to obtain the essential information for the investigations. Secondary information was acquired from library records and supporting foundations to confirm the information received.

Figure 1 shows the block diagram of the overall systems. This project consists of both hardware and software to function. The use of colour sensor to detect the colour obtained from the peeling process to determine the success of peeling process.

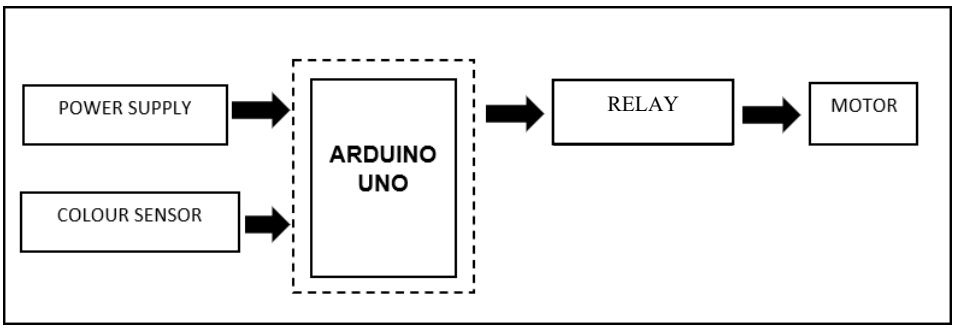

Figure 1: The Block Diagram

The whole process of the project was discussed by using the flowchart. It is a complete process as it discusses the input, process, and the output of the project. Figure 5 shows the flowchart of the prototype.

Referring to the figure 2, the prototype running based on signal from the controller which is Arduino Uno that used TCS3200 colour shaded module as the input to determine the flow of the process. The shaded module determined the completion of the peeling process by using RGB data value. Firstly, the TCS3200 recorded the RGB data to use as a reference, then after the motor peeling running for designated time, the TCS3200 read the data again and compare with the reference value and if there are any changes in the data, the TCS3200 send the signal to the controller to move the motor for cutting process. Noted that the peeling process will running again when there was no difference between the reference and the second data read from the second data.

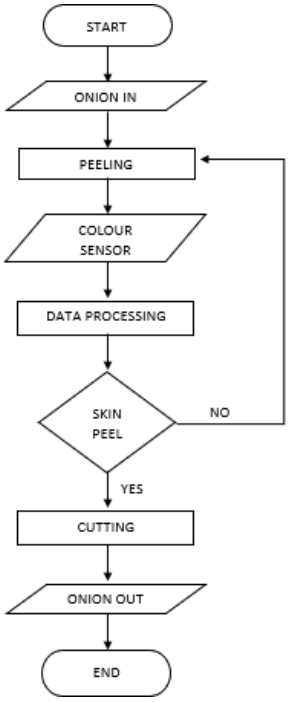

Figure 2: Project Flow Chart

3.0 Result and Discussion

3.1 RGB Data Acquisition

The TCS3200 colour sensor is widely used to detect and measure RGB values in various applications. It generates a graph showing the intensity of the red, green, and blue colour components. The graph provides valuable information about colour intensity, colour balance, and line shape. Colour intensity is represented by the height of each line on the graph, indicating the saturation or amount of each colour present. A balanced scenario is achieved when all three lines have similar heights, while significant disparities indicate an imbalance in favour of one colour.

The shape of each line conveys supplementary details about the detected colour. A narrow and tall peak suggests a purer or more saturated colour, while a broader peak indicates a combination of colours or a lower intensity. It's important to consider the lighting conditions during measurements, as they can greatly influence the shape and intensity observed in the graph. Consistent and standardized lighting conditions are crucial for accurate analysis.

Overall, the TCS3200 colour sensor and its generated graph provide valuable insights into colour detection, intensity, balance, and lighting conditions, facilitating accurate analysis and measurement in various applications.

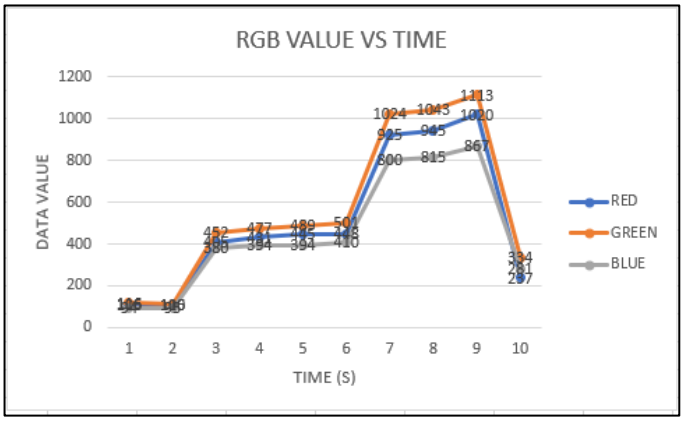

Figure 3: RGB Data Acquisition

TCS3200 RGB value graph provided by the colour sensor is a valuable tool for understanding and differentiating colours. It enables colour-based decision-making processes. The changes observed in the graph indicate the colour sensor's ability to detect colour changes over time. The system relies on the colour sensor data to send signals to the Arduino Uno controller, determining the completion of the peeling process before proceeding with the cutting process.

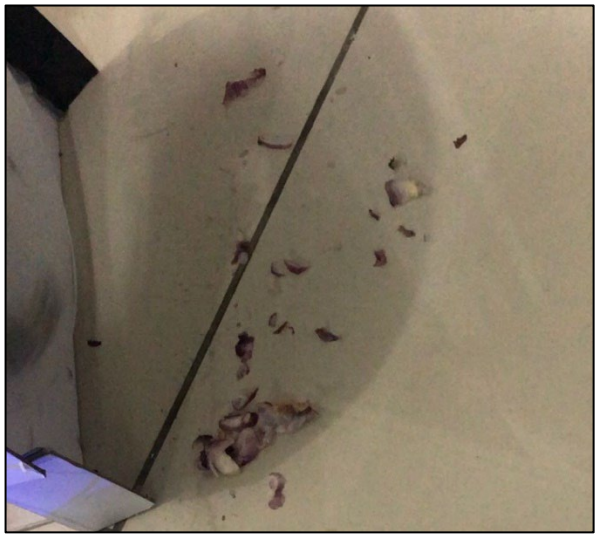

Figure 4: Product

Figure 2 displays the result of the machine's peeling and cutting process. The effectiveness of the product relies on the accurate distinction made by the colour sensor detection system between peeled and unpeeled onions. Through multiple trials and prototype enhancements, the machine successfully cuts the onions without their skin, indicating the successful implementation of the peeling and cutting mechanism.

3.2 Time taken to complete the process.

The time required for the automatic onion peeling and cutting machine is affected by the weight of the onions being processed. Factors such as processing capacity, cutting efficiency, feeding, and loading, peeling complexity, and machine design all play a role in determining the processing time. Heavier onions generally require more time due to their larger size and thicker skin. Proper adjustments and considerations in the machine's design can optimize its performance for different onion weights, ensuring efficient processing times.

Table 1: Data Collection for Time Taken vs Weight.

No.	Onion weight (Gram)	Time taken (Sec)
1.	6	68
2.	8	75
3.	7	69
4.	6	67
5.	7	73
6.	7	74
7.	5	67
8.	8	70
9.	7	72
10.	8	77

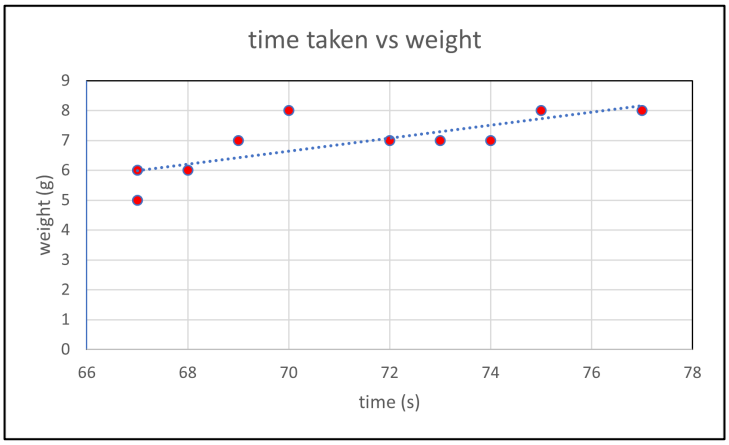

Figure 5: Graph Time Taken vs Weight.

The data collected shown in the table 1 converted into graph. Based on the trend recorded by the graph shown in the figure 3 above, the weight of the onions does influence the time taken to complete the process. The conclusion that can be made from the graph was the heavier the weight of the onions, the longer the time taken to complete the peeling and cutting process.

4.0 Conclusion

The implementation of the automated onion peeling and cutting machine has shown promising results. It incorporates a DC motor for precise cutting and peeling, an Arduino Uno controller for smooth operation, and a TCS3200 colour sensor for detecting peeled onions. The reliable DC motor ensures accuracy and consistency in onion processing, while the Arduino Uno controller effectively coordinates the machine's components for accurate task execution. The TCS3200 colour sensor adds value by detecting whether onions are adequately peeled, ensuring quality assurance. This automated system offers several advantages over manual onion processing, including increased efficiency, productivity, and reduced labour costs. By minimizing human error and improving throughput, the machine streamlines onion processing. With further improvements, this automated system has the potential to revolutionize the onion processing industry, providing enhanced productivity, quality assurance, and cost savings.

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