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Implementation of Arduino-Based Counting System for Kuih Ros Production Yield

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Abstract: Two technologies that have the potential to move the country's Agrofood sector ahead are mechanization and automation. The technology's implementation will provide a consistent supply of high-quality products while lowering production costs, improving production rates, and lowering labour costs. In accordance with the current demand, this research aims to develop a counting system of *Kuih Ros* production which will be the extension of the *Kuih Ros* production machine. The system proposed a counting system to keep track the production rate of *Kuih Ros* before dispensed out. It involved the control of observation systems that ease product yield monitoring. The system is implemented using an infrared sensor (IR) which is embedded at the end of *Kuih Ros* machine dispenser for counting means. The liquid crystal display (LCD) will show the current amount and all the information regarding the total product gathered in Arduino. The hardware components required are IR sensor, LCD display and an Arduino microcontroller. Therefore, it provides provision for real-time monitoring of production by automatic synchronization of the system, which eases the counting process while reducing human error due to operation does not require human intervention. The results show the system is successfully developed in comparison to manual counting.

Keywords: Kuih Ros counting machine, Arduino counting system, IR sensor

1. Introduction

The Agrofood business in Malaysia leads to a quantitative increase in the trend of industrial company innovation with the number of research publications in the food industry (Azman & Ruwaida, 2016; Rollin et al., 2011). The Engineering Research Centre of the Malaysian Agricultural Research and Development Institute (MARDI) has established mechanization and automation technologies for the country's Agrofood sector (Dardak, 2019). Changes in the nature of food demand and supply, as well as higher levels of competition, make innovation not only a necessary but also one of the most significant corporate activities for achieving overall profit improvements (Purba et al., 2018; Desarbo et al., 2005). Thus, the automatic machine invented will be able to produce a mass number of product yields and helps repeat the process with consistent product quality. At the same time automation mechanism leads to less supervision and labor effective (Carpanzano & Jovane, 2007). This includes calculating the product yields from the automatic machine operation. To keep track the production rate, the counting process which is done manually is troublesome and exposed to human error.

Image-processing-based tablet counter mechanism proposed as one of automation application (Phromlikhit et al., 2012). Initially, a digital webcam is used to capture an image of the medicine, which is displayed in the red, green and blue (RGB) color model. Then the original image is converted to grayscale. By using a median filter, the grayscale image is filtered for noise. After that, a digital binary image of the pill being captured is obtained using a threshold. Erosion and dilation are used to further enhance the image. Finally, the actual number of drugs in the image is determined by using connected component labelling and the centroid technique (Mohan et al., 2016; Zhang et al., 2012).

Other research has developed a counting machine to address the time-consuming operation of counting a large number of papers. Whereby the counter is constructed from rollers, motors, and electrical gadgets. The paper will be detected by the sensor, and the number of papers counted will be displayed on the LCD screen. The result showed a high level of accuracy in automatic paper counting (Sathishkumar et al., 2021).

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Furthermore, automation mechanisms have emerged on home machines such as juicers. The research developed a proximity sensor-based system that will track a variety of juice machine properties, including quantity, quality, and productivity. The device is designed to automatically fill juice packets while also counting the number of juice packets. The operator can use his time for other activities such as packing and dispatching while the system automatically counts in the machine hopper. Counting with an electronic sensor was more accurate than counting by hand (Shridar & Priyadarshini, 2016; Wang & Wang, 2013)). The technique will assist the company to increase and maintain its productivity and profitability. A metal detector is also used to see if the juice contains any metal (Balkrishna & Pardeshi, 2018).

'Kuih Ros' is known as a popular traditional Malaysian food. The cookie is flower in shape which is not uniform. Due to the curvy shape, the proper selection of suitable sensors capable of identifying cookies as they pass through for counting means must be considered. This project hardware is embedded on the dispenser part of the predeveloped 'Kuih Ros' production machine. The system will count the number of 'Kuih Ros' scrapped and pass through the dispenser before falling into the container. The system features an infrared sensor that is calibrated to adjust the length of detection for product counting. The output is then displayed on LCD for user observation. The project criticality is the shape of the 'Kuih Ros' which is not uniform with the curved end. Thus, the sensor must be placed at the right position and the dispensing unit should be mounted on the correct degree of inclination with a suitable size that allows only one 'Kuih Ros' to slide off at one time. While affluence the user and easing the production record automatic counting is considered an advantage. The aim of this research is to develop the automation of counting techniques it evolves into the idea of this project which is 'Kuih Ros' counting machine.

2. Methodology

The process of modernization in technology leads to innovation which helped in the development and progress towards the Agrofood sector. Fig. 1 presented an automated 'Kuih Ros' machine. The automation of the dipping, frying, lifting, and dispensing process mimics the traditional method resulting in minimization of human supervision and less laborious. The automatic dispensing system with preset fried time and sequence motor movement flow assured consistent product quality.

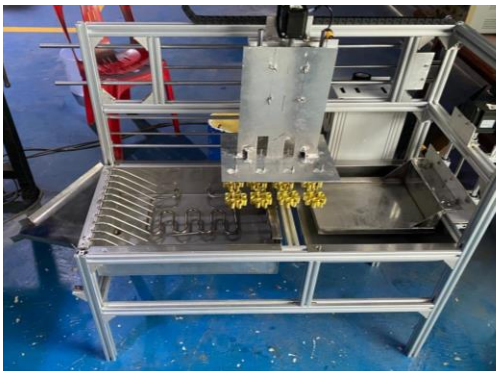


Fig. 1: Kuih Ros automatic machine

The automatic counting system will aid in production convenience rather than manual counting. Thus, an automatic counting system is proposed to calculate the total number of productions in real-time (Tian et al., 2020). The system is embedded to work compatibly with the existing 'Kuih Ros' machine. The proposed design mainly consists of an infrared sensor, Arduino and LCD display. Fig. 2 shows the block diagram of the project. This project initiates with the input from the IR sensor which is used to detect the presence of 'Kuih Ros' flowing out of the dispenser. The second block is the Arduino mega 2560. It acts as the microcontroller which processes all the information gained and gives direction to the output to perform the desired action. The Arduino will be like the communicator to read the information from the sensor and send the collected data to the LCD to be displayed.

Fig. 2: Block diagram

Infrared sensors are also referred to as IR sensors. It is made up of infrared light emitting diodes (LEDs). The emitter is a simple IR LED (Infrared Light Emitting Diode), while the detector is a simple IR photodiode. When the IR transmitter sends out radiation, some of it reaches the object and is reflected back to the IR receiver. The sensor output is determined by the intensity of the IR receiver's reception. The infrared sensor used in this project as shown in Fig. 3 presents an active low sensor type.

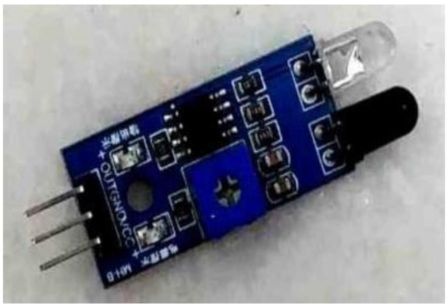


Fig. 3: Infrared sensor

Arduino mega 2560 as shown in Fig. 4, used as the brain of the entire process is known as a low-cost, flexible, and easy-to-use open-source programmable microcontroller board that may be used in a wide range of electronic applications. It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. This board can operate relays, LEDs, servos, and motors as output and can be interfaced with other Arduino boards, Arduino shields, and Raspberry Pi boards.

Fig. 4: Arduino MEGA 2560

The output which is displayed through a liquid-crystal display (LCD) is a flat-panel display or electronically modified optical device that uses liquid crystals and polarizers to manipulate light. Liquid crystals do not directly emit light instead, they use a backlight or reflector to create color or monochrome images. With an I2C interface, a 16x2 LCD display screen can display 16x2 characters on two lines, with white characters on a blue background. Fig. 5 presented the LCD display.

Fig. 5: LCD display

As shown in Fig. 6 the flowchart shows the workflow of the project for the whole process which is implying the order of the programming steps. Whenever the sensor detects objects that hinder the light reflection, the sensor sends logic low (0V) to Arduino. While if there is no object detected it will send logic high (5V). The Arduino recorded each time the output low is received and start the counting (Ribaric & Younker, 2013). The number will be added and increased if there is another output low later received from the sensor. The LCD will show the Arduino data on the current state.

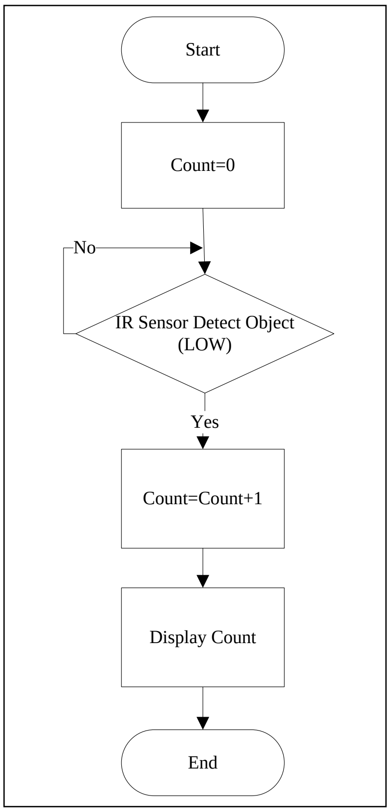


Fig. 6: Flowchart of system

2.1 Hardware and Software Development

Based on the application of the electronic and electrical components used in this project, the connection between components was set up according to the pins defined in Arduino. Fig. 7 shows the connection between the electronic components of the product.

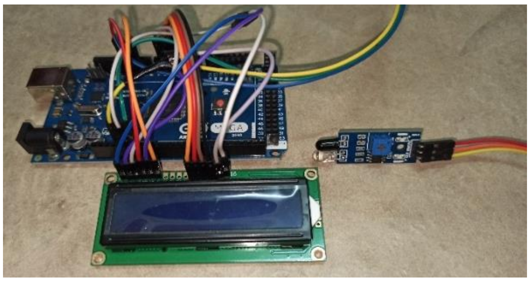


Fig. 7: Connection of the system

Fig. 8 shows the hardware connection of overall project. The IR sensor is mounted on the dispenser unit and the distance of detection is adjusted to the desired length. The Arduino and LCD is placed inside the system box for organizing purposed.

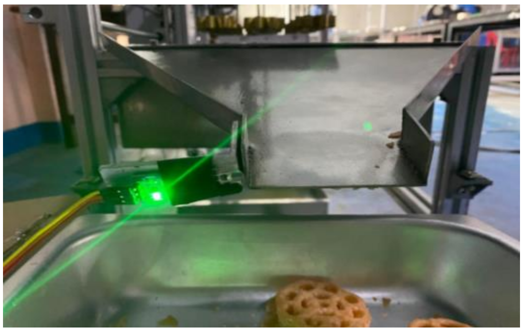
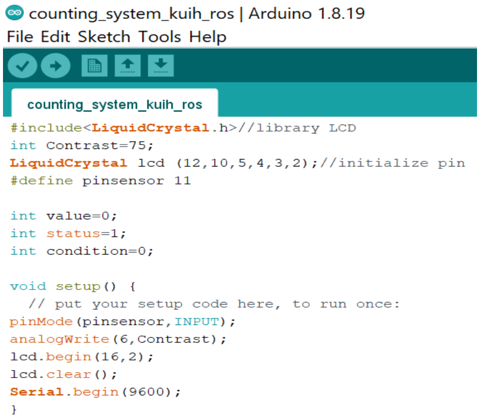


Fig. 8: Counting system

Arduino IDE software was used to construct the system operation. Arduino is programmed to count the 'Kuih Ros' slide off from the dispenser based on the product existence sensed by the IR sensor. Firstly, all the parameter is initialized and the required library is included in the programmed code as shown in Fig. 9. This comprises all the values entail in the system. While the location of the other components connected to the Arduino pin which is the LCD and IR sensor is defined.



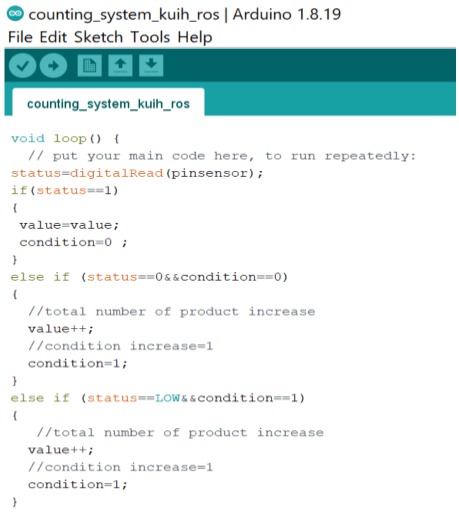

```
#include<LiquidCrystal.h>//library LCD
int Contrast=75;
LiquidCrystal lcd (12,10,5,4,3,2);//initialize pin
#define pinsensor 11

int value=0;
int status=1;
int condition=0;

void setup() {
  // put your setup code here, to run once:
pinMode(pinsensor,INPUT);
analogWrite(6,Contrast);
lcd.begin(16,2);
lcd.clear();
Serial.begin(9600);
}
```

Fig. 9: Initialization of program

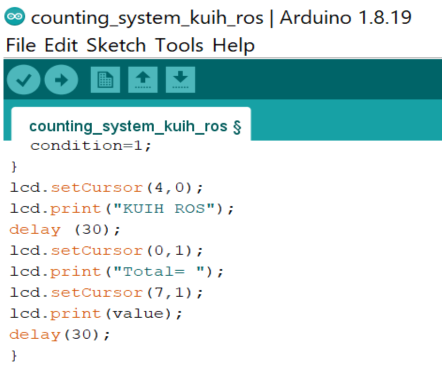
Fig. 10 depicts the counting process programming code. If the condition received from the sensor is low, the total number of counts will increase. Otherwise, the current number of counts will be maintained.




```
void loop() {
  // put your main code here, to run repeatedly:
status=digitalRead(pinsensor);
if(status==1)
{
 value=value;
 condition=0 ;
}
else if (status==0&&condition==0)
{
  //total number of product increase
  value++;
  //condition increase=1
  condition=1;
}
else if (status==LOW&&condition==1)
{
   //total number of product increase
  value++;
  //condition increase=1
  condition=1;
}
```

Fig. 10: Counter programming

Finally, the number of 'Kuih Ros' counted by the system instructed to be displayed on the LCD as shown in Fig. 11. The LCD is programmed with what and where it should display on the two available lines. In this situation the second line of LCD monitor presents the total value.




```
  condition=1;
}
lcd.setCursor(4,0);
lcd.print("KUIH ROS");
delay (30);
lcd.setCursor(0,1);
lcd.print("Total= ");
lcd.setCursor(7,1);
lcd.print(value);
delay(30);
}
```

Fig. 11: LCD displayed the total number

3. Results and Discussion

With the information retrieved by the IR sensor, arduino will count the number of 'Kuih Ros' passes through the dispenser each time a signal low is received. Then the number will be displayed on LCD and updated in real-time. Fig. 12 shows the total number counted for the current time presented on LCD.

Fig. 12: Displayed number on LCD

For the reliability test purpose, the result was collected from the recorded LCD display for each 5 minutes. The result is then compared to the manual count as shown in Table 1 for comparison. For a total of 40 minutes, this test was conducted and data was gathered.

Table 1: Number of 'Kuih Ros' production

Time (minutes)	Number of products counted by system	Number of products counted manually
5	24	24
10	48	48
15	72	72
20	96	96
25	120	120
30	144	144
35	168	168
40	192	192

By referring to Table 1 the number of 'Kuih Ros' shows an increasing trend as time passed for both counting methods. The machine is able to produce 24 pieces of 'Kuih Ros' every 5 minutes. The total number of products also appears to be equal each time data is recorded for 5 minutes intervals. Therefore, it is found that the counting accuracy is 100% when compared to manual count.

4. Conclusion

As for conclusion, this project has successfully achieved its objective. The core of this project is to build the automatic counting machine for 'Kuih Ros' production. Whereby it consists of a system that builds up using the arduino as the microcontroller with the infrared sensor as input and an LCD for the monitoring purpose. During the testing, the manual count shows an equivalent number to the system's automatic count. This proving the data gained by the system is accurate and reliable. Thus, the automatic counting process can be done quickly and efficiently as can be with the least amount of effort with minimizing human error.

Acknowledgement

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References

Azman, H., & Ruwaida, A. W. (2016). Availability of Malaysia traditional food process mechanization produced by MARDI. In *3rd International Conference on Agricultural and Food Engineering/Seri Pacific Hotel, Kuala Lumpur, Malaysia*.

Balkrishna, M. T. S., & Pardeshi, S. A. (2018). Model Design and Simulation of Automatic Counting Machine Using Proximity Sensor. *JournalNX-A Multidisciplinary Peer Reviewed Journal*, 217-219. *Scribbr.* https://media.neliti.com/media/publications/342700-model-design-and-simulation-of-automatic-18c22111.pdf

Carpanzano, E., & Jovane, F. (2007). Advanced automation solutions for future adaptive factories. *CIRP Annals*, *56*(1), 435-438. https://doi.org/10.1016/j.cirp.2007.05.104

Dardak, R. A. (2019). Malaysia's Agrofood Policy (NAP 2011-2020)-Performance and New Direction. *FFTC Agricultural Policy Platform*, 1-13.

DeSarbo, W. S., Anthony Di Benedetto, C., Song, M., & Sinha, I. (2005). Revisiting the Miles and Snow strategic framework: uncovering interrelationships between strategic types, capabilities, environmental uncertainty, and firm performance. *Strategic Management Journal*, *26*(1), 47-74. https://doi.org/10.1002/smj.431

Mohan, V. M., Kanaka Durga, R., Devathi, S., & Srujan Raju, K. (2016). Image processing representation using binary image; grayscale, color image, and histogram. In *Proceedings of the Second International Conference on Computer and Communication Technologies: IC3T 2015, 381,* 353-361. Springer India. https://doi.org/10.1007/978-81-322-2526-3_37

Purba, H. H., Maarif, M. S., Yuliasih, I., & Hermawan, A. (2018). Innovation typology in food industry sector: A literature review. *International Journal of Modern Research in Engineering and Technology*, *3*(2), 8-19.

Phromlikhit, C., Cheevasuvit, F., & Yimman, S. (2012, December). Tablet counting machine base on image processing. In *The 5th 2012 Biomedical Engineering International Conference* (pp. 1-5). IEEE. https://doi.org/10.1109/BMEiCon.2012.6465508

Rollin, F., Kennedy, J., & Wills, J. (2011). Consumers and new food technologies. *Trends in Food Science & Technology*, *22*(2-3), 99-111. https://doi.org/10.1016/j.tifs.2010.09.001

Sathishkumar, C., Selvakumar, J., Venkatesh, S. R., & Thoufeekahamed, M. (2021). Design of Compact Paper Counting Machine. In *Advances in Materials Research*, *5,* 987-992. Springer, Singapore. https://doi.org/10.1007/978-981-15-8319-3_98

Shridar, S., & Priyadarshini, M. (2016). Counting System using Smart Sensors. *Frontiers of Current Trends in Engineering and TechnologyAt: ChennaiVolume*, *1*(2), 67-70. *Scribbr*. https://www.acetcbe.edu.in/fctet.acetcbe.edu.in/files/issue2/5.pdf

Ribaric, T., & Younker, J. (2013). Arduino-Enabled Patron Interaction Counting. *code4lib Journal*, *20*. *Scribbr*. https://journal.code4lib.org/articles/8200

Tian, H., Wang, T., Liu, Y., Qiao, X., & Li, Y. (2020). Computer vision technology in agricultural automation—A review. *Information Processing in Agriculture*, *7*(1), 1-19. https://doi.org/10.1016/j.inpa.2019.09.006

Wang, X. L., & Wang, B. (2013). The Electronic Counting System Design Based on Single Chip Microcomputer. *Advanced Materials Research*, *717*, 608-612. https://doi.org/10.4028/www.scientific.net/AMR.717.608

Zhang, B., Mei, K., & Zheng, N. (2012). Reconfigurable processor for binary image processing. *IEEE transactions on circuits and systems for video technology*, *23*(5), 823-831. https://doi.org/10.1109/TCSVT.2012.2223872