Automatic Packaging Conveyor Tracking System Based On Arduino Uno Using Photodiodes and SRF04 Ultrasonic Sensors

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Abstract

Tracking Conveyor in this packaging is a system whose mechanics work to move an item that is on the conveyor from one place to another, basically this conveyor is widely used in the industrial world which is used for the transportation of very large goods. In order to achieve a large number of products to be produced, a fairly good and efficient movement is needed in order to achieve the production target, at this time there is still a lot that is still relatively manual carried out by human labor, while the movement to move goods quickly requires tools to move products to other places. in the box. This study aims to produce a conveyor tracking system in automatic packaging based on AU (Arduino Uno) using an ultrasonic sensor SRF04 and a photodiode sensor. The method used is a quantitative type method, which is a research method that uses numerical values, this type of research has many approaches that use numerical values, ranging from data collection and display of research results. With the above shortcomings, the authors encourage research and development of the use of appropriate and efficient technology, by combining ultrasonic sensors and photodiode sensors with conveyors. The result of this research is the sensor combination with the addition of a photodiode sensor combination to detect the presence of objects that have been applied to run the conveyor. In running this conveyor, two sensor requirements must be met, namely the distance to the object with the ultrasonic sensor should not be less than 5 cm and not more than 11 cm. The second requirement is that the distance between the object and the photodiode sensor should not be more than 11 cm. If both conditions are met, the conveyor will run.

Keywords: Conveyor, photodiodes, SRF04 ultrasonics

I. PRELIMINARY

Tracking Conveyor is a mechanical system that works to move a product to another place. To facilitate the transfer, a conveyor is needed that will be used in industry as a transportation or transfer of goods in large enough and sustainable quantities.

This packaging of goods is a routine activity carried out by macro-scale industries, from the large number of goods produced by industry, good and efficient packaging is needed in order to meet production targets, at this time packaging is still a lot classified as manual carried out by humans, while many requests to speed up the movement to move the product to the carton. As a company that is carrying out the process of producing goods based on orders or requests from consumers, it will require timeliness in completing a product that can produce quality production which is very important for companies in completing an order (SPRAY, 2018).

According to (Sukmawati, 2020), conducting research that the SRF04 Ultrasonic sensor in use at a distance to water has a low accuracy of 4.3% and has good sensitivity to detect distance.

According to (Ni Made D. Ryaumariastini, 2012), conducted a study that for the propagation of ultrasonic waves in the form of a pinston and has the accuracy of the simulation and experimental results it has a difference of 3.35% in output voltage and 0.17% for travel time.

With the research above, the authors encourage to conduct research and develop the use of appropriate and efficient technology, by combining ultrasonic with a conveyor. With the above researchers, the authors took the title of the thesis, namely "Tracking Conveyor System in Arduino Uno-Based Automatic Packaging Using Ultrasonic Sensors Srf04 and Photodiodes". Therefore, the authors need a more detailed study to understand the use of automatic packaging using SRF04 Ultrasonic sensors and Photodiodes.

II. LITERATURE REVIEW

Arduino which is a single board micro system controller that is open source, and comes from the Wiring platform on Arduino. To facilitate the use of the Arduino language in electronics in various fields, which have an Atmel AVR processor and the software has its own programming language, the language used on the Arduino itself, the assembler is relatively difficult, so it uses simplified C language with the help of the Arduino library.

The system that will be developed later on this conveyor uses microcontroller hardware, namely

Arduino Uno as the main control tool to run this conveyor. Arduino Uno itself is a board on a microcontroller based on the ATmega328 (Handoko, 2017). Arduino Uno has 14 input pins from its digital output where 6 input pins are used as PWM outputs and 6 input pins are analog, 16 MHz crystal oscillator, there is a USB connection, there is a power jack, ICSP header, and a button to reset. To support this microcontroller, so that it can be used by connecting the board on the Arduino Uno to a computer using a USB cable, AC power connected to a DC adapter or a battery to run the Arduino.

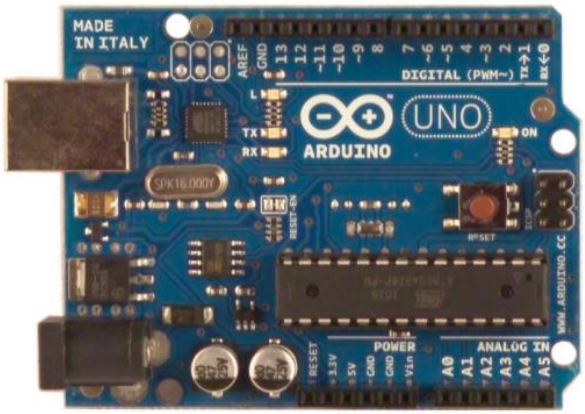

Figure 1. AU(Arduino Uno)
(source:https://en.wikipedia.org/wiki/Arduino_Uno)

An ultrasonic sensor is a sensor that functions to convert a physical quantity (sound) into an electrical quantity. The workings of this sensor is based on the principle of a reflected sound wave so that it can be used to interpret the existence (distance) of an object with a certain frequency. This sensor uses ultrasonic waves (ultrasonic sound) which is why it is called an ultrasonic sensor. As a data retrieval material that will be needed is an ultrasonic sensor. The ultrasonic sensor consists of two parts, namely the circuit for the transmitter on ultrasonic waves (transmitter) and the circuit for the receiver on ultrasonic waves (receiver) (Wiharto, 2016).

Figure 2. ultrasonic sensor

(source:https://www.andalanelektro.id/2018/09/cara-kerja-dan-karakteristik-sensor-ultrasonic-hcsr04.html)

The photodiode sensor is an electronic component whose way of working is based on changing the intensity of light into an electric current. This photodiode is an active component made of semiconductor material. As in general, this photodiode has two terminal legs, namely the cathode terminal and the anode terminal, but this photodiode has a lens and optical filter attached to its surface as a light detector.

This type of photodiode is included in the type of diode whose resistance value will change when exposed to light. The value of this resistance is influenced by the intensity of light that will be received, the more light that will be received, the smaller the resistance value and vice versa if the less light intensity value is received, the greater the resistance value (December, 2017).

The light in question can be detected by photodiodes including visible light, light from the sun, infrared light, X-rays to ultraviolet light.

Figure 3. Photodiode Sensor
(source:https://widuri.raharja.info/index.php?title=SI1231472025)

The L298N motor driver is a type of driver that has a current of up to 4A with a PWM function, the L298N Motor Driver is suitable for this final task, because the PG45 motor itself has a fairly large current of 3 Ampere.

The advantage of the L298N motor driver itself is that it is very precise enough to control the motor on the conveyor which is easy to control so that the speed and direction of the motor can be adjusted (Widiarto, 2018).

Table 1. L298N . Motor Driver Datasheet

Specification	Information
Current	*Up to* 4A (*Ampere*)
Voltage	5-46V
Model	L298N
Input Level	3,3V-5V.
Control Mode	*PWM (Pulse Width Modulation)*

for more details, here is a picture of the L298N Motor Driver.

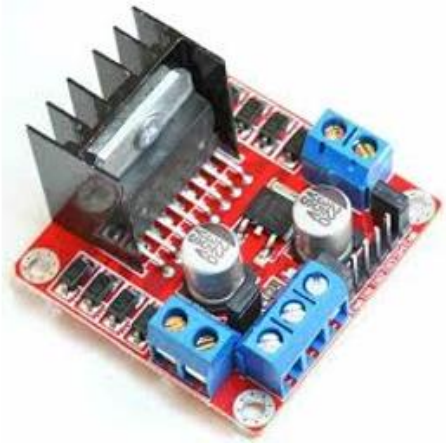

Figure 4. L298N . Motor Driver
(source:https://www.nyebarilmu.com/driver-motor-l298n/)

Conveyor is a device whose control is carried out by motors, and certain machines. Conveyors have a very important role in industry and mining to facilitate work. This conveyor is a mechanical system that serves to move goods to another place (Handoko, 2017). For more details, the following is a picture of the conveyor which can be seen in the image below.

Figure 5. Conveyor Drawing Sketch
(source:https://fikhaglobalteknik.com/store/p1/conveyor cikarang.html)

A servo motor is a rotating device or actuator (motor) designed with a closed loop feedback control system (servo). This AC Servo Motor is a type that can handle high voltage or heavy loads. This type of AC servo motor is very suitable to be applied to industrial machines that aim to be able to control and run conveyors (Sujarwata, 2013)

Figure 6. Servo motor
(source: https://www.webstudi.site/2020/01/Motor-Servo.html)

III. METHOD

This research utilizes a quantitative approach type method, because this type of method is a research method presented with numerical values whose research uses a lot of numerical values, which begins with data collection and the appearance of the final results. Research methods that rely on the value of the sensor, and the speed of the conveyor motor and only a few numerical values from the sensor, do not rely on numerical measurements. The data taken is not very significant in this study. This research method performs many stages of data collection and strategies to obtain flexible data in the research process.

This research approach was initially carried out through a literature study by collecting from various sources of international and national journals as reference material in previous research. The first collection is done by looking for the datasheet and collecting the respective components that will be used to design the Tracking Conveyor after that it is continued with the design of the Conveyor hardware, in this conveyor hardware design a block circuit diagram is made as shown in Figure 7.

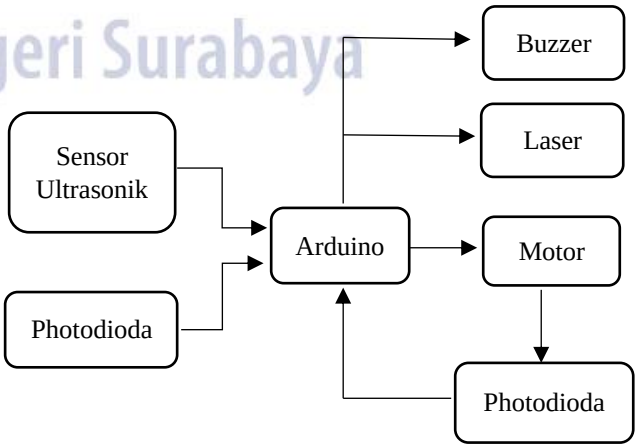

Figure 7. Block Circuit Diagram

In the Tracking Conveyor system, this research uses Arduino as an open single board micro controller, which has ATMEL AVR and the software on Arduino has its own programming language designed to facilitate the use of electronics in various fields.

This conveyor data retrieval begins by installing Arduino Uno, after it is successfully installed, it is continued by making a distance detection program on the ultrasonic sensor and photodiode sensor as desired by using this Arduino program, if the program on the Arduino is successful it will be uploaded to Arduino Uno to run The actuator goes through several stages, namely, the SRF04 Ultrasonic sensor and PhotoDiode Sensor which are programmed via Arduino Uno and forwarded to the actuator via the L298N motor driver for hardware support to drive the Servo motor, the following is a further explanation after monitoring the proximity and light sensors and proceed to the actuator.

IV. RESULTS AND TESTS

The results of the discussion of this study discuss the movement of the conveyor which is determined by the distance of the object when detected by ultrasonic and photodiode. However, before testing the conveyor movement, the first test is to ensure the accuracy of the distance detected by ultrasonic. This is done to ensure that the sensor is working properly before being combined with the conveyor.

In testing the accuracy of the distance on the ultrasonic sensor, the distance detected by the sensor will be compared with a ruler measuring instrument. This test was carried out 5 times.

Table 2. Object Distance Test Results

Trial	Distance (cm)	Ultrasonic (cm)
1.	3	3
2.	5	5
3.	7	7
4.	9	9
5.	11	11

Table 2 shows that the five test results carried out between the distances of objects detected by ultrasonic have the same distance when compared to the distances of objects with sensors measured using a ruler. This shows that the ultrasonic sensor already has the same accuracy as the ruler and is ready to be combined with the conveyor. The process of installing ultrasonic sensors with conveyors.

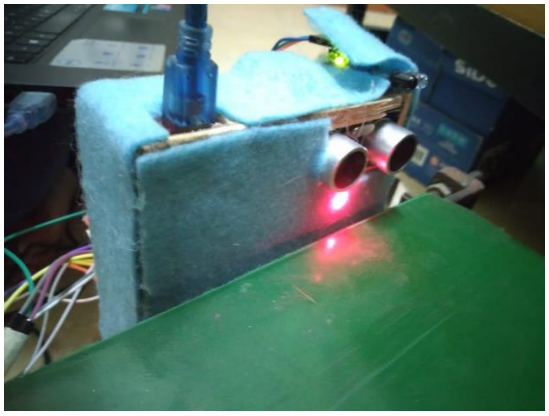

Figure 8. Ultrasonic Installation Process

After performing the ultrasonic test, the next step is to test the condition of the distance between the object and the photodiode. Taking the results of the object distance test with a photodiode carried out 5 times. The test results can be seen above.

Table 3. Test Results for the Existence of Objects

Trial	Photodiode (cm)	Condition on object
1.	3	V
2.	5	V
3.	7	V
4.	9	V
5.	11	V

Table 3 shows that the position of the object to the photodiode with a distance of 3 cm to 11 cm is able to detect its presence. This indicates that the photodiode is able to detect the presence of objects within a distance of 3 cm to 11 cm and can be combined with ultrasonic and conveyor.

The last thing in this research was done by assembling ultrasonic, photodiode, and conveyor into one. After the three components have been assembled, the test is ready to be carried out. The last test was carried out by testing the movement of the conveyor which was influenced by the distance between the object and the photodiode. The test was carried out 10 times and the results can be seen in Table 4.

Table 4 shows the results of the movement of the conveyor which is influenced by objects detected by ultrasonic and photodiode. It can be seen in the 1st test, the distance of the object with ultrasonic is 1 cm and the photodiode catches the object, but the conveyor does not run, this is because the ultrasonic is still reading objects with a distance of 1 cm. Ultrasonic will give logic 1 to Arduino if objects and sensors have a distance of 5 cm to 11 cm, if the object distance is past 11 cm, Arduino will read logic 0 from the ultrasonic sensor. In the second test also experienced the same thing, the conveyor did

not experience movement because the ultrasonic still detected the object distance below 5 cm.

Table 4. The results of the movement test on the two sensors

Testing to	Ultrasonic Distance (cm)	Photodiode	Condition on conveyor
1.	1	V	X
2.	3	V	X
3.	5	V	V
4.	7	V	V
5.	9	V	V
6.	11	V	V
7.	13	V	X
8.	15	X	X
9.	17	X	X
10.	19	X	X

The difference occurs when the object distance from ultrasonic is 5 cm as in the 3rd test. The conveyor is successfully moving because both ultrasonic sensors and photodiode send logic 1 to Arduino and make Arduino activate the actuator movement, namely the conveyor. Table 4 shows that the 4th to 6th tests of the conveyor are still able to run because the logical conditions of the photodiode and ultrasonic sensors meet the necessary requirements, namely the ultrasonic distance from the object should not be less than 5 cm and should not be more than 11 cm, while the distance between the object and the photodiode should not be more than 11 cm. When these two conditions are not met, the conveyor will not run as in the 7th to 10th tests. The testing process in Table 4 can be seen in the image below.

Figure 9. Conveyor Testing Process

V. CONCLUSION

From what has been done, in this study it can be said that the sensor combined with an additional photodiode sensor to find an object has been applied as a conveyor for packing goods. In running this conveyor there must be a distance between the object with the ultrasonic sensor and the object with the photodiode with this condition, then the conveyor will run according to the instructions, by reading the command according to the programming language on the AU (arduino uno).

In this study, there are still several things that need to be improved, namely the form of a small conveyor. This causes the object distance to the sensor can only be up to 11 cm. The second thing is that complicated cable placement makes the tool less practical, further research is expected to use a PCB so that it can be neater.

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