International Journal of Multidisciplinary Approach Research and Science
E-ISSN 2987-226X P-ISSN 2988-0076
Volume 2 Issue 01, January 2024, Pp. 194-200
DOI: https://doi.org/10.59653/ijmars.v2i01.394

Design Smart Trash Based On the Inductive Proximity Sensor

Rindi Wulandari[1*], M. Riyad Ariwibowo[2], Taryo[3], Galieh Ananda[4]
Faculty of Engineering, Swadaya Gunung Jati University, Indonesia | rindi.wulandari@ugj.ac.id[1]
Faculty of Engineering, Swadaya Gunung Jati University, Indonesia | ari.riyad07@gmail.com [2]
Faculty of Engineering, Swadaya Gunung Jati University, Indonesia | taryo927@gmail.com [3]
Faculty of Engineering, Swadaya Gunung Jati University, Indonesia | wulandarindi@gmail.com[4]
Correspondence Author*

Received: 18-11-2023 *Reviewed: 21-11-2023* *Accepted: 27-11-2023*

Abstract

Smart waste management, including a waste sorting system based on type, strongly supports the "Intelligent waste management and categorization system" program to support the development of modern cities. Therefore, this research is related to the design of smart waste based on an inductive distance sensor that uses Arduino Uno as a microcontroller. The method used in this research is research and development which consists of mechanical design and control system programming. The results obtained from this research are an intelligent waste design based on an inductive distance sensor that uses Arduino Uno as a microcontroller and uses a conveyor system as a waste transporter. The test results on the ultrasonic sensor were that several objects could be detected at a distance of 15 cm and the conveyor stopped for 0.5 seconds. The test results on the proximity sensor are that the object is read by the proximity sensor when the object is 2 cm from the sensor, and if the object is metal waste then the servo motor moves 30 degrees to the right, if it is non-metallic waste then the servo motor moves 30 degrees to the left

Keywords: Segregation Waste, Smart Trash, Sensor Inductive Proximity, Arduino Uno.

Introduction

Solid waste is one of the most significant problems and is a hot issue in the world, solid waste will increase along with the increase in human population (Emmanuel Atta Williams, 2016). Garbage has a bad impact on the environment, such as aesthetic value, air pollution, land pollution and water pollution, while for human health, garbage is a nest for several diseases, even garbage can destroy the population in an ecosystem, such as dumping waste in the sea, which will damage the ecosystem in the sea (Oktami Puadi, 2022).

Another problem is that people do not throw rubbish in the rubbish bins that have been provided, even when the rubbish bins have been separated between metal and non-metal rubbish bins, there is still a lot of rubbish mixed together, which makes it take a long time for rubbish cleaning officers to separate metal and non-metal rubbish. which are mixed and pollute the environment (Rionopagel Pardede, 2022). The waste sorting process is an important process in the waste processing system. Waste that has been classified according to its type will be easy to treat according to its characteristics.

Smart waste management, including a waste sorting system according to type, really supports the "Smart trash management and categorization system" program to support modern city development (Mohammad Kamrul Hasan, 2022). The introduction of waste categories can start from providing environmental education for all ages with the aim of saving the environment from air, water and land pollution (Fatima Betul Demir, 2023).

Based on the background above, this research intends to build a conveyor-based Smart Trash system using inductive proximity sensors that can automatically sort metal and non-metal waste and provide information regarding trash bins that are over capacity. The microcontroller used is Arduino Uno and there are several sensors used in the system (Widodo, 2020). Capacitive proximity sensors and inductive proximity sensors to read the type of waste entering the system (Rosiana & Perdana, 2022). Ultrasonic sensor as a reader of trash bin conditions.

Literature Review

Several previous studies related to the topic of Smart Trash Design Based on the Inductive Proximity Sensor are shown in table 1.

Table 1. The results of the literature review

Title of Research	Result of the Review
Design of a Smart Trash Can System Using the HC-RSF04 Sensor Based on Arduino UNO R3 (Anus Wuryanto, 2019)	This journal discusses research that builds a smart trash can system using the HC-RSF04 sensor as a sensor that reads the distance from the trash can lid to the object (trash). If the trash can is full, the buzzer will sound as a warning sign. If the trash is read by the HC-RSF04 sensor, the servo motor will move and open the lid of the trash can. Reasons for being a research observation:

	The waste reading system used in this journal is a reference for researchers in conducting research.
Automated Waste Segregation System using IoT (Rifath Jahan, 2020)	This journal discusses research that builds a smart trash system that can sort metal and non-metal waste. After sorting the waste, the system will monitor the capacity of the waste bin and it will be displayed on the website. If the trash can is full, the system will send a notification to the user via the IoT system. <u>Reasons for being a research review:</u> The waste sorting system uses inductive and capacitive proximity sensors, these sensors are being considered by researchers for use in research.
Zero-Smart Recycle Bin : IoT-Object Detection Based Smart Trash Bin System (Aziz, 2023)	This research discusses the design of an automatic waste sorting system that can sort metal and non-metal waste. The sensors used are sensors using inductive and capacitive proximity sensors, the microprocessor used is a Raspberry Pi3 integrated with visual detection of objects using YOLOv5. In this research there is also a notification if the trash can is full, the system will send a notification to the user via the IoT system <u>Reasons for being a research review:</u> The microprocessor system used is a Raspberry Pi3. This system is being considered by researchers for use in research.

Research Method

This study has two stages, first mechanical belt conveyor design and automation design. The research method used is an applied research method with experimental techniques [12]. The first stage is to create a mechanical design for the conveyor, and carry out trials on several materials for the conveyor base. In general, the research stages are depicted in Figure 1.

Fig 1. Flowchart for the systems

This section will describe the design of the physical system to be built. In general, Arduino is chosen as the microcontroller of the system. The ultrasonic sensor functions as a trash detector in the system, and the proximity sensor is a sensor that functions to sort metal objects or non-metal objects. In general, the physical design of the system is depicted in Figure 2.

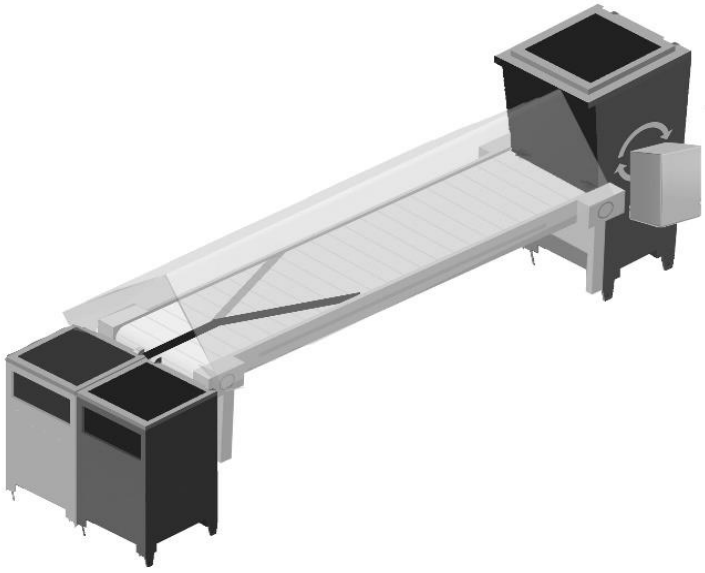

Fig 2. Mechanical design of the waste sorting system being made

Result and Discussion

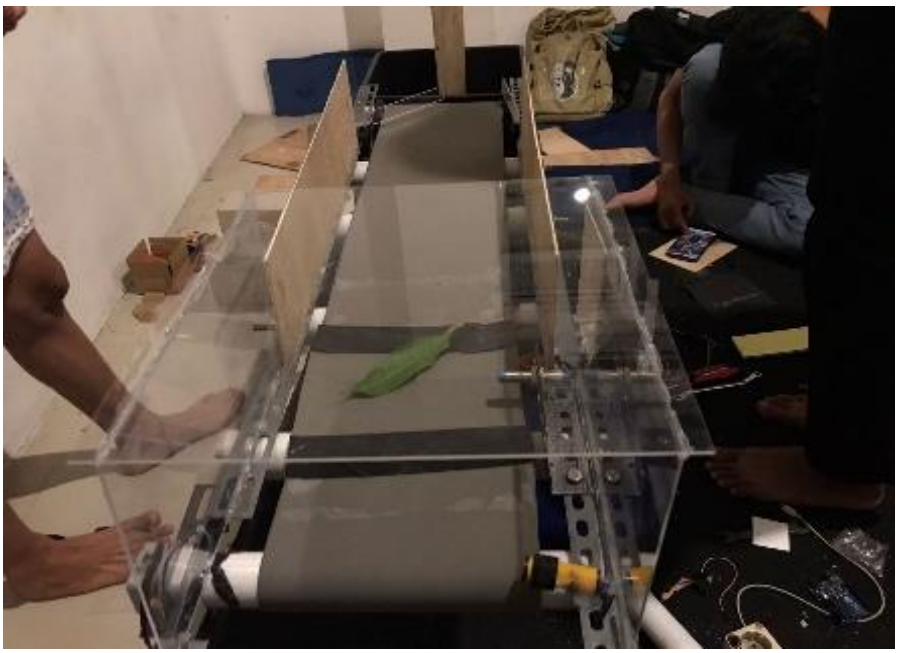

Fig 3. The mechanical system of the waste sorting tool that is made

Figure 3 shows the waste sorting system that has been created. With a conveyor length of 1 meter, and a stepper motor is used to move the conveyor system. The base used on the conveyor is a mattress.

The next stage is to test the system created, testing consists of two stages. The first stage is testing the ultrasonic sensor to detect the presence of waste on the conveyor. The second stage is testing the proximity sensor in detecting metal waste and non-metal waste. Table 1 shows the results of ultrasonic sensor testing, namely that several objects can be detected at a distance of 15 cm and the conveyor stops for 0.5 seconds. From these measurements it can be stated that the system is able to work according to the expected design.

Table 1. Test results on ultrasonic sensors

No.	Waste Type	Distance object	Status object	Status Conveyor
1.	Plastic	15 cm	object detected	Stop
2.	Beverage cans	15 cm	object detected	Stop
3.	Paper	15 cm	object detected	Stop
4.	Leaf	15 cm	object detected	Stop
5.	Aluminum spoon	15 cm	object detected	Stop

Table 2 shows the test results on the proximity sensor to detect metal or non-metal types of waste. The object is read by the proximity sensor when the object is 2 cm from the sensor. After the object is detected by the proximity sensor, the servo motor will move according to the detected object. When the object is metal waste, the servo motor moves 30 degrees to the right, if the waste is non-metal then the servo motor moves 30 degrees to the left.

Table 2. Test results on proximity sensors

No.	Waste Type	Sensor Proximity	Distance object	Servo motor	Status on LCD
1.	Plastic	0	2 cm	Moving	Non- Metal
2.	Beverage cans	1	2 cm	Moving	Metal
3.	Paper	0	2 cm	Moving	Non- Metal
4.	Leaf	0	2 cm	Moving	Non- Metal
5	Aluminum spoon	1	2 cm	Moving	Metal

Conclusion

The design for Smart Trash Based on the Inductive Proximity Sensor with Arduino Uno as a microcontroller was successfully created. The test results on the ultrasonic sensor were that several objects could be detected at a distance of 15 cm and the conveyor stopped for 0.5 seconds. The test results on the proximity sensor are that the object is read by the proximity sensor when the object is 2 cm from the sensor, and if the object is metal waste then the servo motor moves 30 degrees to the right, otherwise, remaining metal then the servo motor moves 30 degrees to the left.

Funding acknowledgment

The author would like to thank the Swadaya Gunung Jati University- Lembaga Penelitian for providing the opportunity to conduct this research and provide support to researchers

References

Anus Wuryanto, N. H. (2019). Perancangan Sistem Tempat Sampah Pintar Dengan Sensor HC-RSF04. Paradigma – Jurnal Informatika dan Komputer, 55-60.

Aziz, M. A. (2023). Zero-Smart Recycle Bin : IoT-Object Detection Based Smart Trash Bin System. Multidisciplinary Applied Research and Innovation, 48-53.

Emmanuel Atta Williams, J. B. (2016). Design and Implementation of a Microcontroller-Based Automatic Waste Management Sorting Unit for a Recycling Plant. American Journal of Engineering Research (AJER), 248--252.

Fatima Betul Demir, U. U. (2023). A Sustainable Life: A Study on the Recycling Attitudes of Secondary School Students. Discourse and Communication for Sustainable Education, 137-151.

Mohammad Kamrul Hasan, M. A. (2022). Smart Waste Management and Classification System for Smart Cities using Deep Learning. International Conference on Business Analytics for Technology and Security (ICBATS). IEEE Xplore.

Nazwa AhadaAnis, F. Z. (2020). MENJAGA KELESTARIAN HUTAN DAN SIKAP CINTA LINGKUNGAN BAGI PESERTA DIDIK MI/SD. El-Banar: Jurnal Pendidikan dan Pengajaran, 35-46.

Oktami Puadi, H. (2022). Perancangan Alat Pemilah Sampah Otomatis . JTEIN: Jurnal Teknik Elektro Indonesia, 1-14.

Rifath Jahan, M. J. (2020). Automated Waste Segregation System using IoT . International Research Journal of Engineering and Technology (IRJET), 6111-6115.

Rionopagel Pardede, H. S. (2022). SOSIALISASI BUDAYA HIDUP BERSIH MENGGUNAKAN TEKNOLOGI PEMILAH SAMPAH OTOMATIS BERBASIS PANEL SURYA. JMM (Jurnal Masyarakat Mandiri), 2895-2902.

Rosiana, E., & Perdana, R. (2022). Rancang Bangun Sistem Robot Pemilah Sampah Anorganik dengan Inductive Proximity dan LDR Sebagai Sensor. Building of Informatics, Technology and Science (BITS) , 1001-1009.

Siti Baro'ah, S. M. (2020). PENANAMAN CILI (CINTA LINGKUNGAN) PADA SISWA MELALUI PROGRAM LINGKUNGAN SEKOLAH TANPA SAMPAH PLASTIK. JURNAL PANCAR (PENDIDIK ANAK CERDAS DAN PINTAR), 11-16.

Widodo, A. E. (2020). Otomatisasi Pemilah Sampah Berbasis Arduino Uno. IJSE – Indonesian Journal on Software Engineering, 12-18.