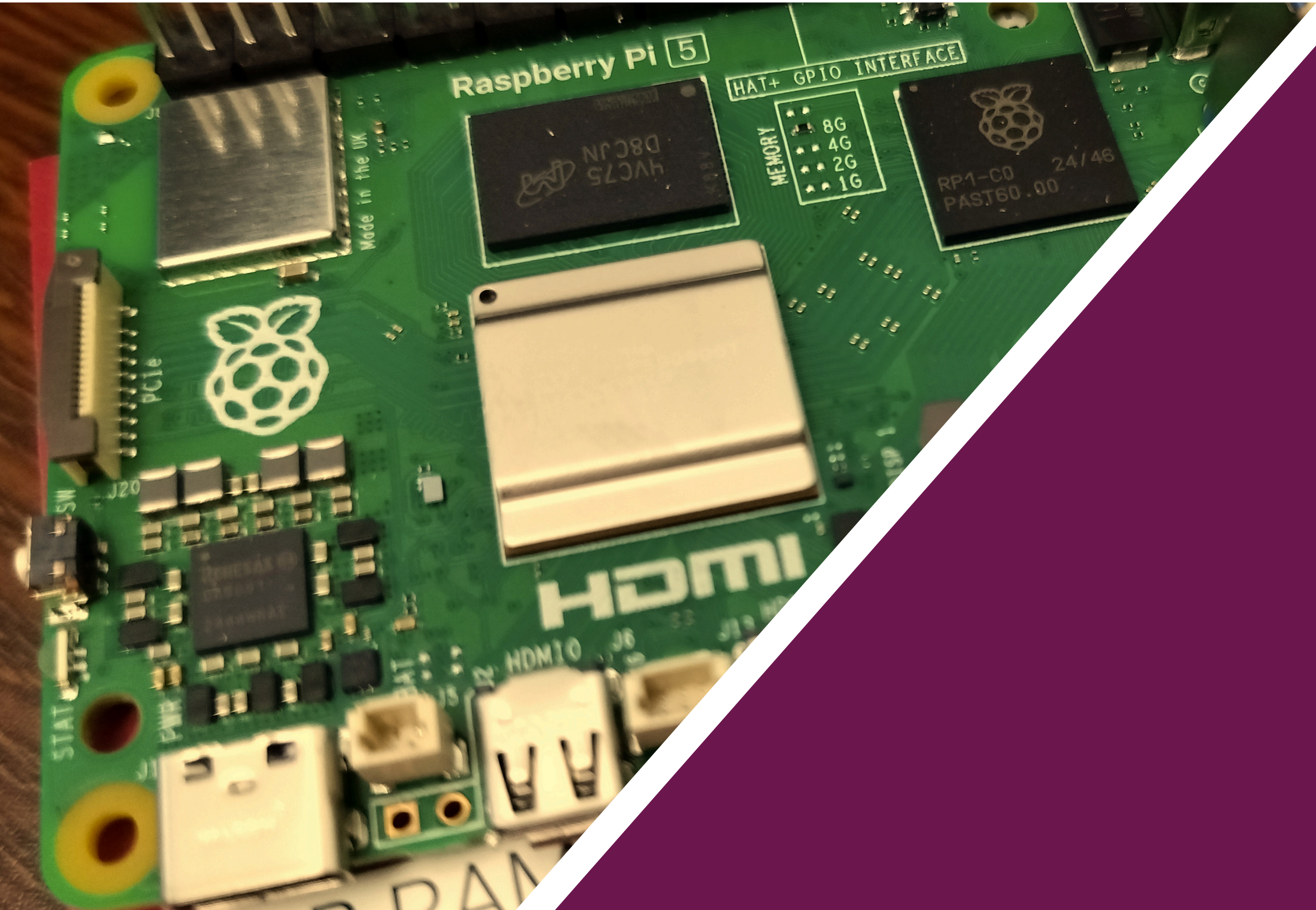




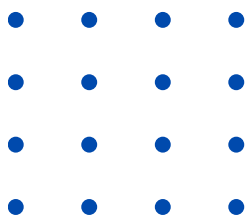
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EESEE 2025

10TH ELECTRICAL ELECTRONICS SYSTEMS
ENGINEERING EXHIBITION 2025
VOLUME 1



FACULTY OF ELECTRICAL ENGINEERING
UNIVERSITI TEKNOLOGI MARA
JOHOR BRANCH
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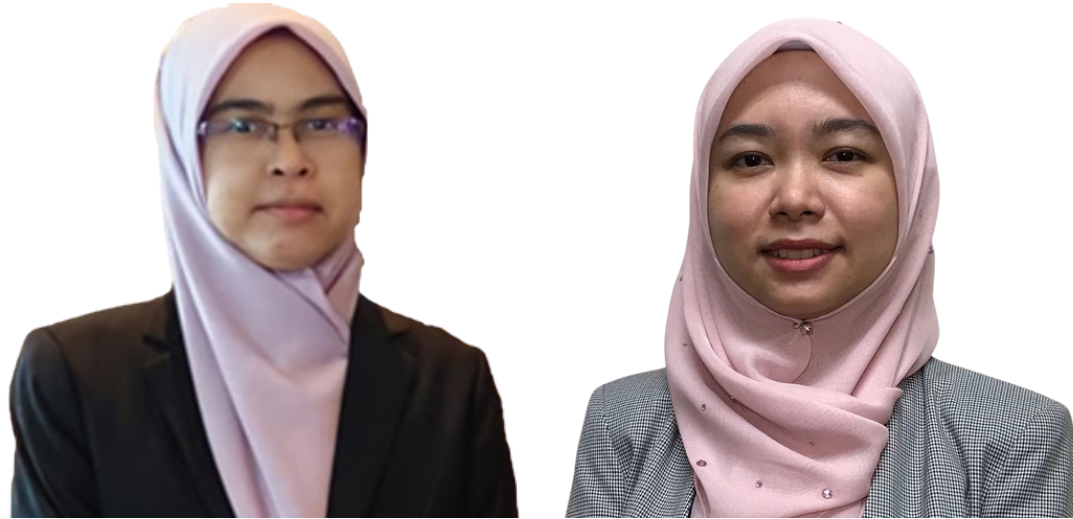
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FOREWORD BY THE PROGRAM CHAIR



Greetings from the Electrical, Electronics, and Systems Engineering Exhibition 2025 (EESEE 2025).

As the Program Chairs, it is our great pleasure to present this compilation of extended abstracts, showcasing the remarkable projects developed by our final-semester students from the Diploma in Electrical Engineering (Power) and Diploma in Electrical Engineering (Electronics) programs at Universiti Teknologi MARA, Cawangan Johor, Pasir Gudang Campus.

This exhibition marks a significant milestone in our students' academic journey, representing the culmination of years of dedication, perseverance, and learning. It also serves as an essential step toward the successful completion of their diploma studies. The projects featured this year are centered on the theme *Engineering Excellence: Bridging Technology and Life*, reflecting current trends and innovations in the engineering field.

This extended abstract book highlights not only the students' technical expertise but also their creativity, problem-solving skills, and ability to engage meaningfully with peers and industry professionals. Within these pages, you will find a diverse range of projects that embody a unique blend of knowledge, innovation, and practical application.

We warmly invite you to explore this collection, which celebrates the achievements of our aspiring engineers. Welcome once again to the Electrical, Electronics, and Systems Engineering Exhibition 2025. May the insights shared here inspire and pave the way for the next generation of innovative engineers.

Warm regards,

Dr. Fatimah Khairiah binti Abd Hamid

Dr. Atiqah Hamizah binti Mohd Nordin

Program Chairs

Electrical, Electronics, and Systems Engineering Exhibition 2025 (EESEE 2025)



Solar Powered Recycle Product Procurement Vending Machine

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ABSTRACT

In Malaysia, recycling faces significant challenges due to inefficient infrastructure and limited accessibility. The "Solar Powered Recycle Product Procurement Vending Machine" addresses this issue by introducing an automated and energy-efficient recycling system. This machine uses Arduino-based sensors, including an inductive proximity sensor, a color sensor, and an ultrasonic sensor to identify, measure, and sort recyclable materials (metal, plastic, and paper). Integrated with an LCD for real-time display and an OLED to generate QR codes for rewards, the system provides both convenience and user incentives. A solar panel and rechargeable battery supply sustainable energy, enhancing the system's environmental benefits. Wokwi and TinkerCAD simulations validate the machine's effectiveness in identifying and sorting material values dynamically. This project offers a scalable solution for recycling infrastructure, fostering sustainability, and incentivized participation in the community.

KEYWORDS: Recycling infrastructure, Reverse Vending Machine, Arduino-based sensors, OLED display, Servo motor, Solar energy.

PRODUCT DESCRIPTION

The Solar Powered Recycle Product Procurement Vending Machine has the capability to aid recycling infrastructure with its automated sorting and rewarding capabilities. Utilizing Arduino MEGA as the microcontroller, it detects recyclable materials through sensors (inductive proximity, color, and ultrasonic). Users insert recyclable items, and the machine identifies their type, sorts it, calculates the price value, and displays the information of the process on an LCD Display. Rewards are provided as a QR code on an OLED display, which will take users to a website. The rewards then can later be redeemed there. The system's operation is powered by a solar panel and rechargeable battery, ensuring eco-friendly and sustainable functionality. Servo motors organize sorted materials efficiently. Simulated and tested using Wokwi, this vending machine presents a user-friendly, energy-saving solution that encourages recycling participation.

PICTURES/ SCHEMATIC DIAGRAMS/ FLOW CHARTS / GRAPHS VISUALS

1. Block Diagram of the Solar Powered Recycle Product Procurement Vending Machine:

Figure 1 shows a solar cell that generates energy and stores it in a rechargeable battery to power the entire system. The Arduino MEGA microcontroller manages inputs and outputs as the central processing unit. Input devices include an inductive proximity sensor for detecting metallic objects, a color sensor to identify the color of recyclable items (for plastic objects), and an ultrasonic sensor to detect item placement. The microcontroller processes these inputs to control the outputs. Output consists of an OLED display and LCD for user interface and information display, and a servo motor to facilitate operations of items dispensing. The system is designed to operate sustainably using renewable energy sources.

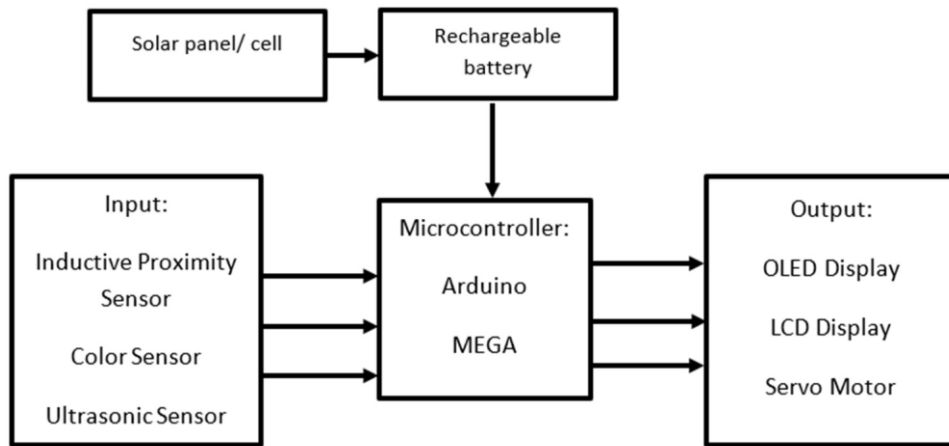


Figure 1. Block diagram of the overall system

2. Flow Chart of the Solar Powered Recycle Product Procurement Vending Machine:

The flowchart in Figure 2 outlines the operation of the designed system. It begins by detecting an inserted item type either metal, plastic, or paper. The system uses sensors as described in the block diagram (Figure 1) to identify the item type and activates the servo motor to sort it into the appropriate sections/boxes. After successfully sorting, the system displays a "Thank You" message on the LCD and generates QR code on the OLED display for user appreciation. If no item is detected, the LCD shows "No item inserted".



Figure 2. Flow Chart of the system operations

3. Schematic Diagram of the Solar Powered Recycle Product Procurement Vending Machine:

Figure 3 represents the schematic diagram of the solar powered recycle product vending machine built using Arduino MEGA, integrating components such as an ultrasonic sensor for object detection, servo motors for sorting, an LCD and OLED for displays, and push buttons for user input. Simulating the schematic is essential to validate the circuit design, identify potential issues, and ensure smooth functionality before physical implementation, saving time and resources.

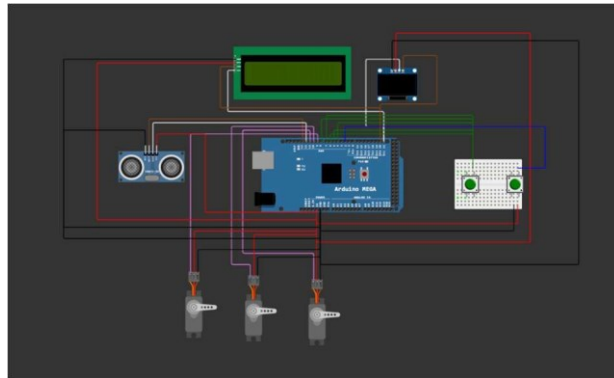


Figure 3. The Schematic Diagram

NOVELTY AND UNIQUENESS

The novelty and uniqueness of the Solar Powered Recycle Product Procurement Vending Machine in the multi-sensor approach to detect recycling materials and identify them. The project utilized servo motors to operate the sorting operation which makes the system neat. Visual aid using LCD Display makes the project user-friendly for users to acknowledge the processes such as identification, sorting and pricing. The main highlight of this project is the reward system as it uses OLED Display to display a QR Code which will take users to a well-organized website (<https://sites.google.com/view/nakrecycle>) where the reward can be redeemed. Additionally, the system integrates with solar power and rechargeable batteries for energy efficiency and sustainability. From a different perspective, the project is also cost-effective as it utilizes Arduino MEGA as the microcontroller and the components related are inexpensive and accessible in the ordinary market. Unlike conventional systems, this project introduces a versatile machine that promotes renewable energy use while incentivizing recycling behavior.

BENEFIT TO MANKIND

The Solar Powered Recycle Product Procurement Vending Machine offers transformative potential to bring environmental impact. It provides a new alternative to address the recycling issue in Malaysia as well as tackling environmental issues. It also increases the chance of user engagement by offering incentives to recycle with rewards, encouraging public participation. From here community awareness would also increase as it promotes recycling awareness and encourages sustainable behavior. Lastly, the project uses renewable energy (solar panels) to power operations, and benefits from the aspect of sustainability.

COMMERCIALIZATION POTENTIAL

The Solar Powered Recycle Product Procurement Vending Machine possesses significant commercialization potential. Key markets are urban and rural recycling centers to reduce logistical barriers, making the project more efficient. Opportunities also exist in public spaces such as commercial spaces like shopping malls and convenience stores to promote sustainability efforts. This project also can be implemented at public and educational institutions to teach recycling practices. Additionally, it can also be utilized in smart cities and IoT applications in the aspect of integrating real-time data for waste management. Lastly, both government and corporations can implement this as their sustainability projects or social responsibility (CSR) programs. Its adaptability and low operational costs make it an ideal solution for enhancing recycling infrastructure.

CONCLUSION

The Solar Powered Recycle Product Procurement Vending Machine addresses Malaysia's recycling challenges through innovation and sustainability. By combining automated sorting, real-time price calculations, and solar-powered operations, it provides a scalable, eco-friendly solution. Future recommendations include integrating IoT for remote monitoring, mobile app support for user rewards, and expanding to cloud-based data analysis. This project has the potential to transform recycling behaviors while contributing to a cleaner, sustainable environment.

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