ENGAGE

Project Name: The Automated Bin

Big Idea: Clean Environments through Autonomous Robotics.

Essential Question: How can we use technology to reduce littering and improve recycling rates in social gatherings?

Kongoni , Kongoni Comprehensive School,

Kakamega, Kenya

MEMBERS

RICHARD W

PRINCE M

MALIA A

VALLERY

What is the Issue??

The project addresses the critical issue of unmanaged waste and ineffective recycling at large-scale social gatherings like sports events, weddings, and conferences. In these environments, stationary bins are often ignored or become overfilled, leading to littering. Furthermore, people often throw all types of waste into a single bin, causing cross-contamination that makes recycling impossible.

What Impact does this have?

This waste ends up in drainage systems, causing blockages and water pollution.

Why did our team select this topic or challenge?

Our team observed that even with a "Green" mindset, the "convenience gap" prevents people from disposing of trash correctly. We were inspired by seeing how much plastic and organic waste is left behind after community events. We saw that even when people want to recycle, they often put the wrong items in the wrong bins because of a lack of clear sorting systems at events.We wanted to move away from "Passive Waste Management" (waiting for people to find a bin) to "Proactive Waste Management" (the bin finds the people).

How is it a real-world problem or concern?

Litter is an environmental hazard. Small pieces of plastic and metal often blow into drainage systems, eventually polluting local water bodies—a direct link to **SDG 6 (Clean Water)**. Additionally, the lack of sorting at the source means that thousands of tons of recyclable materials end up in landfills, contributing to soil degradation and **greenhouse gas emissions (SDG 12**).

INVESTIGATION

What did our team learn and discover during the investigations?

The Convenience Gap:We discovered that people are significantly more likely to use a bin if it is mobile and approaches them during a moment of disposal. Also, people are 70% more likely to dispose of trash correctly if a bin is within 5 meters of them.

The Mobile Solution: We decided a robot that "comes to the person" solves the convenience problem.

Technical Investigation

→ We researched the "Three-Stream" waste system. We learned that separating Metals, Plastics, and Organics immediately is 5x more effective for recycling than trying to sort a mixed bag of trash later.

→ Through testing the LEGO SPIKE Prime Obstacles Sensor, we learned about, we had to program the robot to stop for some seconds firmly when a person stands directly in its path.

→ We investigated "Interval Navigation"—moving for a certain metres, stopping, then moving again to ensure full coverage of the available event space..

ACTION

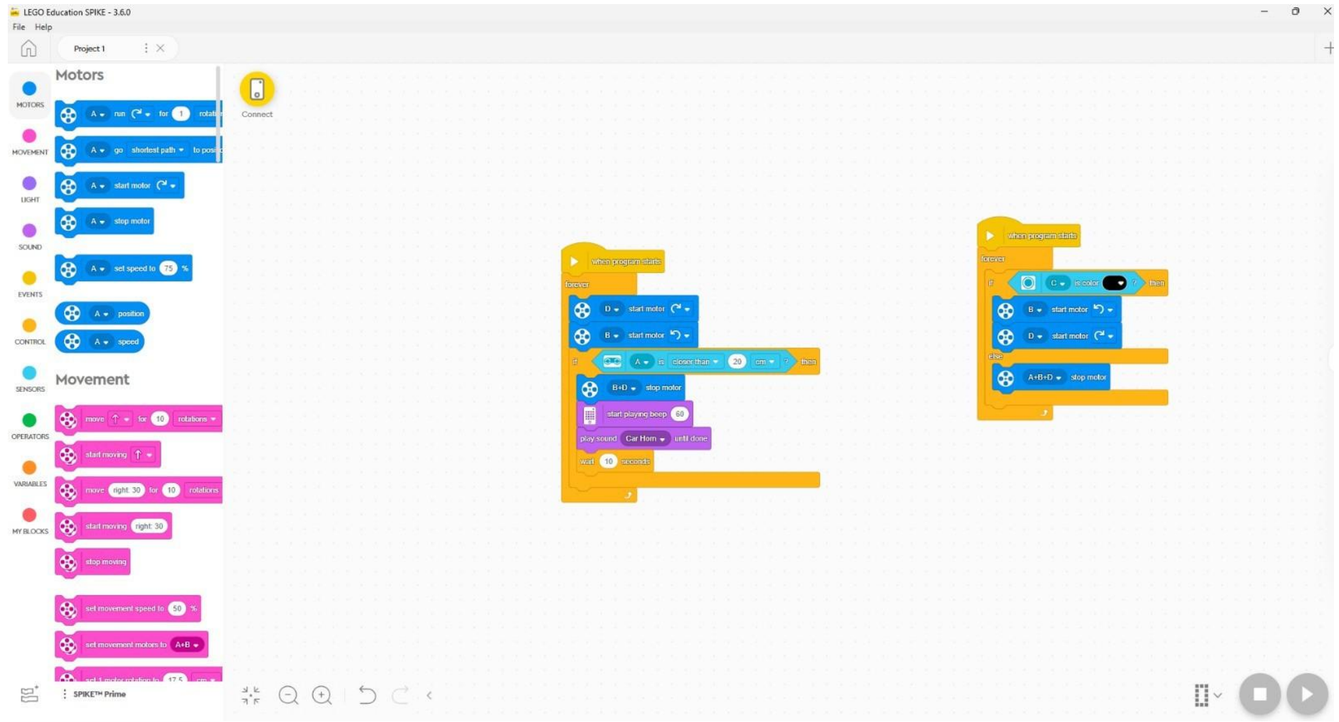
What it is: This is a mobile, interactive waste bin that proactively approaches people at events.

Key Feature: "Proactive Navigation" (moving through the crowd) vs "Passive Collection" (waiting in a corner).

Coding the Logic

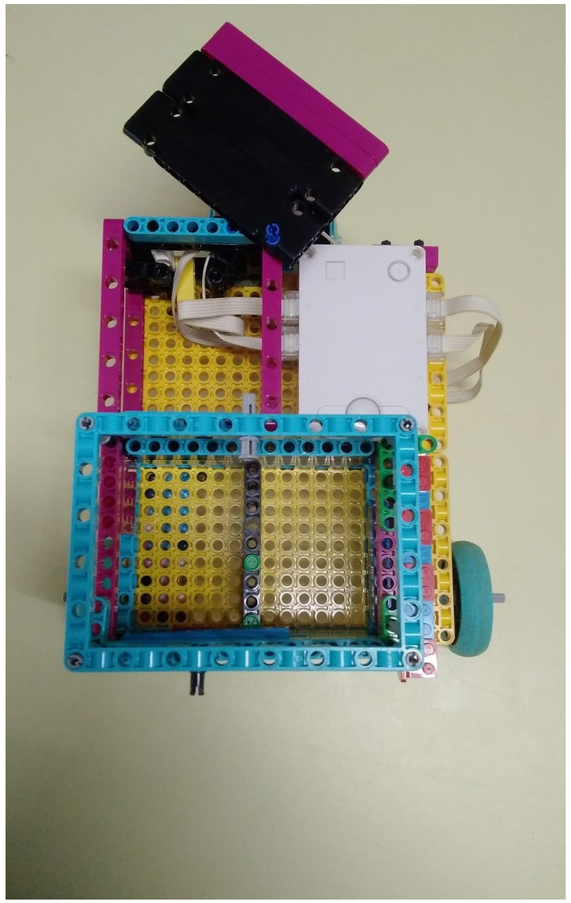
The Algorithm:

1. Move forward at 50% power.
2. If Ultrasonic Sensor senses an obstacles e.g. < 1 m, STOP.
3. Wait 5 minutes (User deposits waste).
4. Play "Thank You" sound/ Beep.
5. Resume movement.



Creating the automated dustbin prototype

The aerial view showing the compartments



The "Main Bin" System

Automation: When the Automated dustbin is full, it is programmed to return to a "Main Bin" station.

Outcome: This prevents spillage and ensures the small mobile robot doesn't get overwhelmed by large crowds.

Testing the Automated dustbin.

The Experiment: We tested the robot in a controlled environment. A table where we put obstacles and upon sensing, The robot stops until there’s no obstacle on its’ path.

User Feedback: We collected feedback from people on how they found the automated bin project, They particularly found the "Stop-and-Serve" logic friendly and easy to use in social contexts.

How does this use technology creatively to address the challenge?

We are leveraging Robotics and IoT (Internet of Things) concepts to solve a manual labor problem. By using sensors to automate the collection process, we reduce the need for constant human supervision. The use of a "Main Bin" deposit system—where the robot empties itself—is a creative way to use limited robot storage to handle unlimited event waste.

IMPACT

What is the potential impact of our project?

Environmental: A 40-60% increase in properly sorted recyclables at events. It also contributes directly supports **SDG 6 (Clean Water and Sanitation)** the robot prevents litter from blowing into our oceans and polluting our water. By sorting waste into Metals, Plastics, and Organics, it ensures that materials are recycled properly instead of ending up in a landfill.

Social: Raising awareness among event-goers about the importance of waste categories and proper management.

Economic: Reducing the cost of post-event cleanup for organizers and municipalities.

Global Goals: This project provides a scalable model for SDG 11 (Sustainable Cities and Communities) by showing how "Smart Technology" can create cleaner, more efficient urban spaces.

Future Vision (Scaling)

The project could be improved adding solar panels for longer operation hours and a weight sensor to alert the "Main Bin" when it's time for a pick-up.

Additionally, We hope to automate the robot for autopicking waste in the environment as currently it relies on people throwing waste into it

Global Application:

Public Parks-> It can move along the walking paths in a park to collect waste from benches where people are sited or eating.

Busy Areas: In crowded airports, it can navigate around people to find the busiest areas that need the most cleaning.

Hospitals and Airports-> Because the robot opens its lid automatically (using the distance sensor), people don't have to touch a dirty trash can lid. This keeps everyone’s hands clean and stops germs from spreading.

Conclusion

"Sustainability is not just a choice; it's an automated future."

Special Thanks: To our facilitators at the Kongoni Comprehensive School, Kongoni Community Library and EduTab Africa, and the Ciena Solutions Challenge.