AutoBin

Portable Automated Trash Bin

- **Abstract:**

  The objective of this project is to provide a smart solution for collection of waste where the user has to engage in as little mobility as possible. This project was designed for people who are physically handicapped or for environments that require less mobility. The primary interfacing components used in this project are Arduino Uno R3 x2, Arduino Bluetooth Module HC-05 and Motor Shield L293D. The Arduino Bluetooth Module HC-05 uses the bluetooth SPP protocol along with UART protocol. The bluetooth protocol is used to wirelessly transmit serial data between the HC-05 and the paired bluetooth device. Meanwhile, the UART protocol is used to communicate with the arduino.

- **Problem Statement:**

  Improper disposal of waste and lack of convenient waste collection methods result in increased human effort and unhygienic conditions. Traditional methods involve a person to manually dispose of waste which can be inconvenient for the elderly or physically handicapped people. This project provides a solution by automating the waste collection process. The robot is called upon via a remote control, when it reaches the user, it opens the bin upon sensing an object in front of the bin. After collecting the waste, upon command, it goes back to its original position. When the waste basket is full, it notifies the user to empty the basket using a led light.

- **Significance:**
  - An efficient and hygienic waste management system.
  - Helps to keep the workspace clean without leaving the area.
  - Prevents contamination by timely and contactless disposal of waste.
  - Allows workers to remain in their workspace in crucial operation or when mobility is not feasible

- ## Components:
    - **Microcontroller:** Arduino UNO R3s (containing an ATmega328 microcontroller, I/O pins, a power supply interface, and a COM port).
    - **Sensors:**
        - HC-SR04 Plus Ultrasonic Sensor.
        - IR Sensor Module.
    - **Actuators:**
        - Servo Motor Micro SG90 (180 degree).
        - BO Geared Motors (motors with wheel attached).
    - **Body/Chassis:** foam board, plastic trash can, and 4WD wooden chassis.
    - **Additional Components:** Motor Shield L293D, Arduino Bluetooth Module HC-05, LED light, Li-ion Batteries, mini breadboard, battery holder, rocker switch, jumper cables, and thread.

- ## Image of AutoBin:

- ## Features of AutoBin:

  - **Feature 1:** Contactless, automated trash can.
    - **Overview:** A trashcan will be opened automatically as soon as something is held in front of its eyes (sensor).
    - **Working Procedure:** The ultrasonic sensor detects objects within 20 cm by sending and receiving sound waves, with the distance calculated using pulse duration. The control logic processes this input and decides whether the servo motor should open or close the trash can lid. The servo motor operates at 0° to open and 90° to close, following the programmed instructions. The workflow seamlessly integrates these components to create a responsive, contactless trashcan system.

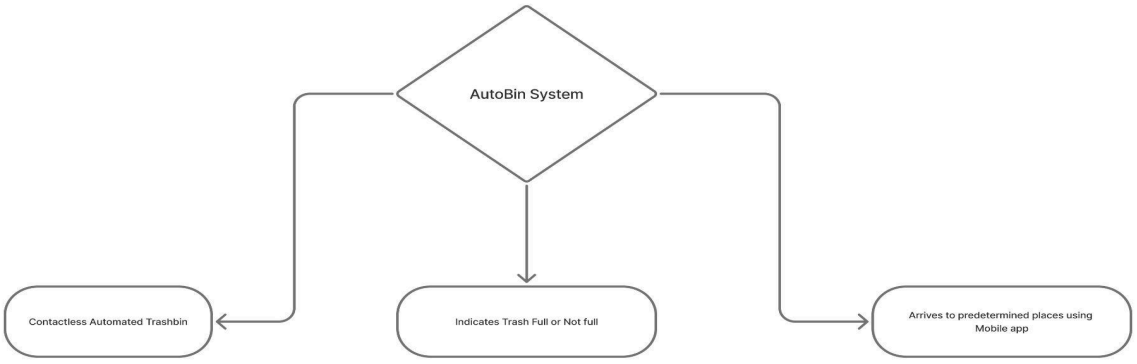
  - **Feature 2:** Trash unloading indicator.
    - **Overview:** A LED will turn on when the trash can is full, indicating that it needs to be emptied.
    - **Working Procedure:** The IR sensor module detects when the trash can is full by sensing the presence of trash at the top. The control logic processes the sensor's signal and activates the LED to indicate the full state. The LED serves as the actuator, turning on to notify users visually. This workflow integrates the IR sensor and LED to provide a simple yet effective trash level monitoring system.

  - **Feature 3:** Direct arrival to a predetermined workstation using a mobile app.
    - **Overview:** A software application containing buttons for specific (numbered) locations can be pressed from a mobile device, and AutoBin will move there following a predetermined path.
    - **Working Procedure:** The Bluetooth module receives commands from the application, which are processed by the control logic to determine the movement direction and duration. The BO motors act as actuators, executing forward, backward, left, or right movements based on the command. The control logic ensures smooth navigation to the predetermined workstation and docking when required. The workflow integrates user input, motor control, and feedback to achieve accurate positioning.

Business Proposal

- **Target Audience:** Operation theatres, hospitals, research and development institutions, precision manufacturing, and for physically challenged individuals.
- **Market Analysis and Competitors :** While there are similar projects done by students, there are currently no products similar to AutoBin available to consumers.
- **Revenue Model:** Our main revenue source would be through product sales available for both institutions (large number of units) and for direct consumers for personal use (single or few units).

Flowchart



● Future Work:

For future developments, camera based navigation with waste classifier can be installed to detect and properly identify between users and obstacles and include a hardware to collect the found waste automatically.

● Potential Applications:

In professional environments such as laboratories, hospitals or workstations, this robot can ensure that waste is disposed of in a timely manner without the operator/worker having to leave their designated space. Also can be used in Elderly & Disabled Care Facilities and Smart Cities with Urban Infrastructure .