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SmartBin

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Abstract— The generation of waste has grown tremendously with fast population growth and urbanization. Waste management is therefore a key problem that needs to be addressed. Because of the shortage of garbage barrels or bins and people's indolent behaviour, waste products are thrown away here and there, polluting our environment. We are therefore proposing the Smart Dustbin consisting of an android implementation. The aim of this project is to develop a dustbin that can move from location to location to collect waste products from individuals when accessed through the app. Its characteristics include a local map with buttons, line following method for its movement and available sensors to detect the level of trash.

Keywords— smart bin, autonomous, waste management system, sensors, controller, app, local map

I. INTRODUCTION

Due to rapid population growth, disorganization of city governments, a lack of public awareness and limited funding for programs, garbage management is becoming a global problem. Now-a-days, we can also see garbage spilled out of the garbage bins in the locality and also it becomes extremely difficult for the local garbage authority to locate the garbage bins that are overflowing. Also there is a major concern regarding the segregation of different waste. India faces the issues of disposal of 1.9 million ton of waste it produces everyday. Every single day garbage is produced from industries, work places and houses to dispose off. Waste disposal has increased tremendously due to the lack of dustbins and indolent behaviour of the people. As we know there are different types of waste like dry waste, wet waste, non-biodegradable, etc and the process of segregating these waste into different dustbins is a tedious work.

Hence we put forward the Smartbin which is a singular solution to the specific and peculiar problems in waste management. It consists of an android application that is user friendly. The app consists of a representation of the local map. Draggable buttons are present through which the user can interact with the smartbin. The system uses image processing technique to avoid obstacles in its path. For the movement of bin, line following method is used. The available sensors are used to detect the level of trash. When the trash reaches its threshold level, the smartbin dumps it in the dumping zone.

II. BACKGROUND AND RELATED WORKS

2.1 Smart Garbage Systems (SGS):

Smart bin is built on a microcontroller-based platform Arduino Mega 2560 board which is interfaced with Ultrasonic sensor and Rain drop Sensor. Ultrasonic sensor is placed at the top of the dustbin which will measure the height of the dustbin. The threshold height is set as 20cm. Arduino will be programmed in such a way that when the dustbin is being filled, notification will pop up in Blynk app. Once the garbage reaches the threshold level, ultrasonic sensor will alert the required authority until the garbage in the dustbin is squashed. Once the dustbin is squashed, people can reuse the dustbin.

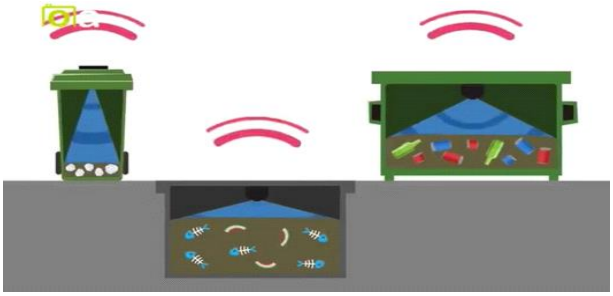

Fig 2.1:

Advantages:

- Saves time and money.
- Decreases traffic flow.
- Decreases air pollution.

Disadvantages:

- Sensor nodes used in dustbins have limited memory size.

2.2 Smart Wi-Fi Dustbin System:

The proposed system describes that the level of garbage in the dustbins is detected with the help of Sensor systems, and communicated to the authorized control room through GSM system. Micro controller is used to interface the sensor system with GSM system. A GUI is also developed to monitor the desired information related to the garbage for different selected locations. This will help to manage the garbage collection efficiently. The application of our model of Smart Bin in managing the waste collection system of an entire city. The network of sensors enabled smart bins connected through the cellular network generates a large amount of data, which is further analysed and visualized at real time to gain insights about the status of waste around the city.

2.3 Recycle Bins

A recycle bin is a container used to hold recyclables before they are taken to recycling centres. Separate containers are often provided for paper, tin or aluminium cans, and glass or plastic bottles, or may be commingled. Bins are sometimes in different colors so that user may differentiate between the types of materials to be placed in them.

Disadvantages:

- Products from recycled waste may not be durable.
- Recycling sites are always unhygienic, unsafe and unsightly.
- Recycling might not be inexpensive.

III. PROBLEM IDENTIFICATION

3.1 Problem Statement

As of now, not all dustbins are filled at the same rate and the dump vehicles waste time setting each and every dustbin. This leads to more fuel usage, labour and cost. To implement a smartbin built on a microcontroller based platform Arduino Nano Board, which consists of Ultrasonic sensor, IR sensor, etc which can give the status of the waste present in the dustbin and also automate the movement of the dustbin from one place to another. To automate the movement from source to destination.

To build an app that connects user and the dustbin. To develop a smartbin with sensors which identify the level of trash in the bin. To develop a dustbin which is user friendly and durable. To develop real time waste management system to check the fill level of dustbins whether the dustbins are full or not. The level of waste in the dustbins is detected with the help of infrared sensor. To develop a Force sensor used to measure the weight of the dustbin. When the measured value of sensors exceeds a certain threshold value then red LED becomes ON.

IV. THE PROPOSED SYSTEM ARCHITECTURE

This architecture shows overall description of our system. The first part of our system the user simply put the some garbage in to the dustbin. The hardware which is the electronic device is already connected I to the dustbin, after user put the some garbage the sensor identify it and display the unique id for user. User read the number then opens the address of our web application in to the browser. The second part of our system is the web application; user put the unique id in to the textbox and submits. Then system checks the id and compare with database value, if it matches system gives password of Wi-Fi network device to user or if it not matches it send failed message for user. After matches the password user can free to use internet facility

Fig 4.1:

Advantages:

- For security purpose the only provide to user, who have the unique ID which matches the system database values.
- User get the number from the system which is already stored in the system.
- Maintain the previous password by user and also block the unauthorized user.

Disadvantages:

- Need of Good sensor for regular sense dust.

V. IMPLEMENTATION

5.1 Module Description

5.1.1.Hardware

The hardware of this project is a robotic waste management system that moves from location to location using line following method. It consists of several components like:

IR Sensor: IR Sensor module has great adaptive capability of the ambient light, having a pair of infrared transmitter and the receiver tube. The infrared emitting tube is to emit a certain frequency, encounters an obstacle detection direction and infrared reflects back to the receiver tube receiving. It emits a green light when it detects an object. In our project, IR sensors are used to detect object and it is connected to a buzzer which produces beep sound until the object moves.

DC Motor: A DC motor is any of a class of rotary electrical motors that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor. These motors have a 3 mm threaded drill hole in the middle of the shaft thus making it simple to connect it to the wheels and helps in rotation. Its speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings.

Servo Motor: A servo motor is an electrical device which can push or rotate an object with great precision. It is a linear actuator or rotary actuator that allows for precise control of linear or angular position, acceleration, and velocity. It consists of a motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors. If we want to rotate an object at some specific angles or distance, then you use servo motor. It is just made up of simple motor which run through servo mechanism.

L293D IC: A motor driver is an integrated circuit chip which is usually used to control motors in autonomous robots. Motor driver act as an interface between Arduino and the motors . The most commonly used motor driver IC's are from the L293 series such as L293D, L293NE, etc. These ICs are designed to control 2 DC motors simultaneously. L293D consist of two H-bridge. H-bridge is the simplest circuit for controlling a low current rated motor. We will be referring the motor driver IC as L293D only. L293D has 16 pins.

Arduino Nano: The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328P. It offers the same connectivity and specs of the Arduino Uno board in a smaller form factor. The Arduino Nano is programmed using the Arduino Software (IDE), Arduino HYPERLINK "https://en.wikipedia.org/wiki/Arduino" cc's Integrated Development Environment common to all Arduino boards and running both online and offline. The Arduino Nano can be powered via the Mini-B USB connection, 6-20V unregulated external power supply (pin 30), or 5V regulated external power supply (pin 27). The power source is automatically selected to the highest voltage source.

Bluetooth HC- 05 Module: HC- 05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. The HC-05 Bluetooth Module can be used in a Master or Slave configuration, making it a great solution for wireless communication. This serial port bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Bluecore 04- External single chip Bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature).

Ultrasonic Sensor: An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e. the sound that humans can hear). Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target). In order to calculate the distance between the sensor and the object, the sensor measures the time it takes between the emission of the sound by the transmitter to its contact with the receiver. The formula for this calculation is **D = ½ T x C** (where D is the distance, T is the time, and C is the speed of sound ~ 343 meters/second).

LM2596: The LM2596 series of regulators are monolithic integrated circuits that provide all the active functions for a step-down (buck) switching regulator, capable of driving a 3-A load with excellent line and load regulation. This feature greatly simplifies the design of switch-mode power supplies.

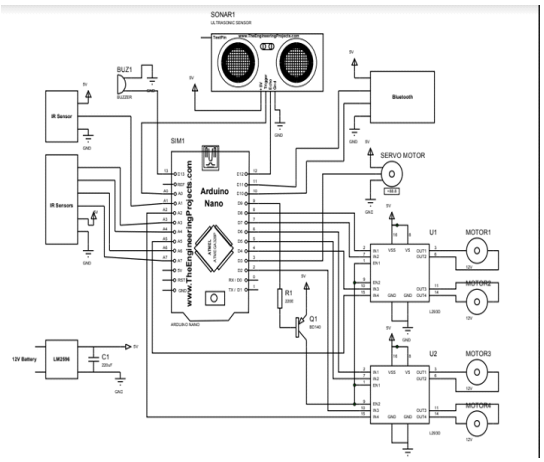

Fig 5.1

5.1.2 Software (Controller)

At first the main data will be checked continuously and check whether the data received is correct and is required, that is, the data is compared to other points and if the data is ok, then it will go to that point. The First point will be listening, that is, whether the data is receiving or not and also whether it is a junk value or not. If there is some point to go, then it will look for the control paths and after the path is understood, the motor is given the control, that is, to which direction the motor should go(predefined).Using the ultrasonic sensor the objects are identified. Then there will be a stop function in between for stopping or pausing the robot for 10sec.The bin is checked continuously for checking whether the bin is filled and if this is filled then the control will go to the dumbing point and dumb the waste. When one person closes the app, then the connection will be lost or disconnected and then the next person accessing the app will get connected.

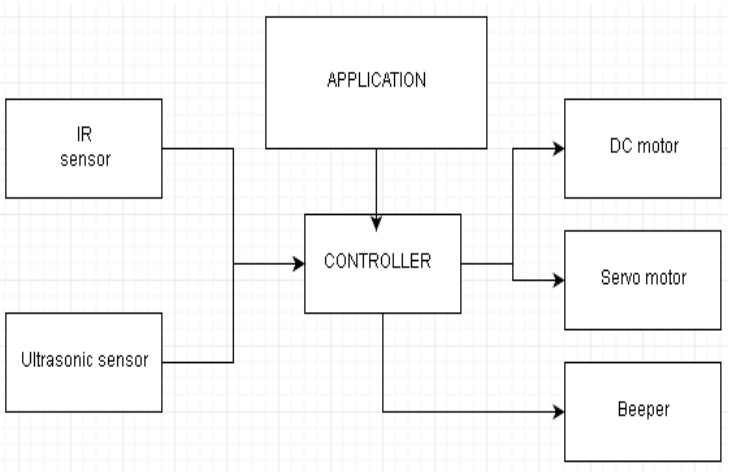

Fig 5.2

When the controller receives a function from the application (such as GO TO B), it first checks whether the current position is B, if not it starts moving until the junction is reached.

Same happens with every function call (to every junction).An IR sensor is attached at the top of the dustbin, which detects the maximum level of the dustbin. This detection is understood when the sensor reads continuously for 5 seconds and the dustbin further goes to the dumping zone to dump the waste. For dumping process, when the junction is reached, the servo motor gets enabled and dumps the waste by turning to angle 136 degree.36 degree - preset initial position.136 degree - turning position of the bin to dump waste.

5.1.3 Line follower

Our Smartbin will be a line follower.

Concept of working of line follower is related to light. We use here the behavior of light at black and white surface. When light fall on a white surface it is almost full reflected and in case of black surface light is completely absorbed. This behavior of light is used in building a line follower robot.

5.1.4 Software (Application)

The app is built on android studio platform and it supports every version of android kitkat and its above versions.

The app sends data through bluetooth adaptor. It uses socket protocol encrypted with UTF-8 encoding. Data is received by the bluetooth adaptor by socket protocol. Commands are send in the form of string (encoded) to the bluetooth HC-05 module inputs are taken from the user by means of buttons. App has a feature to display the status of the dustbin. Another feature of the dustbin is a STOP button to stop the movement of the dustbin. The user has to manually pair his device. The app shows whether the device is connected with the smartbin.

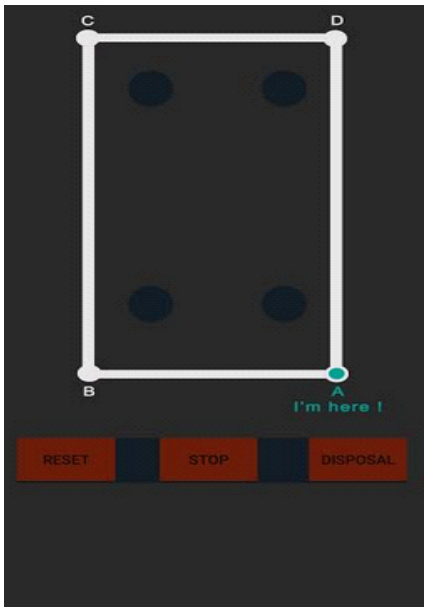

Fig 5.3

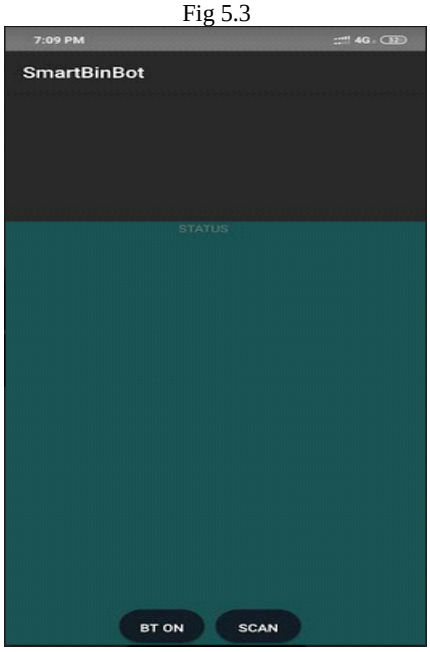

Fig 5.4

VI. CONCLUSIONS

This system assures the cleaning of dustbins soon when the garbage level reaches its maximum .If the dustbin is not cleaned in specific time, then the record is sent to the sweeper or higher authority who can take appropriate action against the concerned contractor. This reduces the total number of trips of garbage collection vehicle and hence reduces the overall expenditure associated with the garbage collection. This project implements real time waste management system by using sensors to set the level of garbage in the dustbin and to automize the movement of smartbin from its source to the destination user with the help of deep learning.

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