Abstract:

This project introduces the design and development of a Smart dustbin. Waste disposal strategy is crucial to the environment. This project is implemented on Arduino and Particle Photon. It integrates two Ultrasonic Sensors. one sensor is used to monitor the bin level while the other sensor is used to open and close of the lid when an object is brought near to the bin. When the bin is full a buzzer rings to notify the user. In this project signal communication between Arduino and smartphone is achieved in two ways one is using a smartphone buzzer can be stopped by interfacing the Bluetooth module. The other mode of communication is using photon particle a notification is sent to the mobile.

Introduction:

This project contains four modules. The first module is done using a servomotor and ultrasonic sensor when an object is detected at the lid of the bin it will open automatically. In the second module using the Ultrasonic sensor, the level of the bin is detected, Once the bin is full a buzzer will ring. In the third module, the user can stop the buzzer using the smartphone via a Bluetooth module. Finally, in the last module, a Photon Particle is used using this particle a notification is sent to the user's smartphone about the bin level and about the garbage pickup days. In detail design is explained in design description.

Motivation:

Garbage releases toxic gases which cause air pollution. Garbage disposal is very important to society, it not only causes air pollution but also contaminates water and leads to several health issues, so garbage management is vital for the general wellbeing of the public. Technology improved drastically that nowadays in every aspect technology is applied. The traditional method of garbage disposal is no more a part of society as it requires a lot of human power. Automated machinery has come to lift bins and dispose of the garbage. The concept of smart bin came into existence however smart the system is people forget to dispose of their dustbins properly in the home. They constantly need provocations or alarms when the bin is filled and get acknowledged with the garbage pick off days so that they can keep their bins outside. All the remainders are notified and can be controlled using smartphones as today's everything is smartphone mechanized.

Background:

In [1] this is IoT based smart dustbin using the ESP8266 module. The main functionality of this project is to track the amount of waste inside the bin and the dump vehicle can plan the route accordingly and decide which part of the cities dump to clean first. Using this device, the dump vehicle can plan the route in an optimized manner. The components used in this project are Arduino Nano, ESP8266, HC-SR04 Ultrasonic Sensor, 9v Battery,3.3v Regulator. The ultrasonic sensor is used to measure the bin waste level, to interact with the internet ESP8266 is used. The only disadvantage of this project is it is cost effective, installing this device in each public bin is a tedious task.

In [2] this project, a Smart bin is made using the Ultrasonic sensor and servomotor. This smart bin can open and close the lid of the dustbin when an object is brought near to the lid. The shaft of the servomotor is connected to the thread and this thread is connected to the lid so that when the motor rotates the lid will open.

DESIGN DESCRIPTION

Overview: The design and description of smart Bin are described in the following sessions. There is a total of four modules are explained in detailed. Each module is important to the next higher layer modules. Illustrate the different components involved in the project, their functionalities and why that component and also challenges faced while integrating all modules.

Components Required:

* Arduino UNO
* Ultrasonic ping sensor
* Dustbin
* Servo meter
* Buzzer
* LED
* Smart phone
* Bluetooth Module
* Particle Photon
* LCD Screen
* Smartphone

Software installations Required:

* Arduino IDE
* Particle IDE
* Bluetooth terminal Application in smartphone
* IFTT Application

Module 1:

Components used in this module are

* Ultrasonic Sensor
* Servomotor
* Lid of the bin

Description: When an object is brought near to the lid of the dustbin, the sensor detects the object and sends signals to Arduino, according to the code written in the microcontroller. It sends the signal to the servo motor and motor rotates its knob given an angular. The servomotor is attached to the lid of the bin when the servo motor receives the signal from Arduino it rotates its shaft as well as the lid of the bin and allows the user to place the waste into the bin and closes automatically. The user's hand will not contact with the dustbin for throwing the waste into the bin.

Component description:

Ultrasonic sensor: The model number used in this project is HC-SR04. It can measure the distance from 2cm to 400cm. It contains a transmitter, receiver and a control circuit. The transmitter transmits ultrasonic sound when these rays encounter object rays reflect and reaches the receiver. The distance is calculated by the time taken for the sound to travel forward and backward from the sensor to object times the speed of the sound. It contains four pins namely Trig pin, Echo pin, Vcc, Ground. The main reason behind choosing this component is it can calculate the distance of the object and perform certain actions. In this project the trig pin of the Ultrasonic sensor is connected to the digital pin 5 and echo pin is connected to the digital pin 6.

Servo motor: Servomotor works on the principle of pulse width modulation. It works in a closed loop mechanism and contains three parts Controlled device, Output sensor, the Feedback system. Encoder controls the position feedback. It can rotate up to 180 degrees. Precise control of the shaft can be achieved. Servomotor contains three wires one is positive second is the negative third to the digital pin. In this project, the servomotor is attached to the digital pin 11. When Arduino sends the signal to the servomotor the shaft of the motor moves according to the angular position given. So, with the above features, the only servomotor can rotate the lid of the bin.

Module 2:

Components used in this module are

* Ultrasonic Sensor
* buzzer
* LCD

Description: The sensor continuously monitors the waste level of the bin and displays the amount of waste the bin is full and displays the same on the LCD screen. When the bin is full a message is displayed on the LCD screen and a buzzer rings to indicate the bin owner that it’s time to empty the bin. A buzzer is rung when the bin is full this is due to some lazy human beings require constant provocation to empty the bin.

Two modes of communication:

* Module 3 explains the communication between the Arduino and smartphone using Bluetooth module
* Module 4 explains the communication between the Arduino and smartphone using photon particle.

Module 3:

Components used in this module are

* Bluetooth Module
* Smartphone
* Buzzer

The main functionality in this module is to turn off the led and buzzer using a smartphone. Instead of implementing the traditional button method to off the buzzer a smartphone via Bluetooth module. The components used in this module are Buzzer, Smartphone, Bluetooth module and Bluetooth terminal app.

Bluetooth Module: The Bluetooth module uses radio waves for communication. In this project, the Hc05 module is used. This can range up to ten meters. It contains a total of six pins the first state pin which shows the status by blinking the led if Bluetooth is connected to the device. Second and third pins are RX and TX pins they help in interfacing the communication. Vcc, Ground, and key are the other pins. It also contains the button it allows the user to choose the modes between command and application.

Bluetooth Terminal:

Bluetooth terminal is an application that can connect to the Bluetooth module via smartphone Bluetooth and can send signals to the Bluetooth module. As it establishes serial communication, so it can exchange the data bidirectionally. The buzzer and led both can be controlled using this app by sending input signals from this app to the Bluetooth module. Finally, the Bluetooth module sends signals to the Arduino.

Module 4:

Components used in this module are

* Photon
* Buzzer
* Ultrasonic sensor
* IFTT App

This module functions similar to module 3 that is the ultrasonic sensor monitors the waste level of the bin when the bin is full a buzzer is rung and led flashes. Both buzzer and LED can be controlled using a smartphone. The only difference is all the actives are performed using particle photon instead of using Arduino. A notification is also sent to the IFTT app and buzzer is also controlled using this app.

Particle photon:

Particle photon is a microcontroller with a built-in Wi-Fi chip. Same as Arduino it also contains 3.3 volts power, Digital pins, and analog pins. The photon has a web IDE where the code is verified and flashed into the microcontroller of the photon. Before using the photon particle, the device should be claimed, only if the device is claimed it shows the status of the particle in the IDE and one can flash the code into it. The photon can be controlled using the IFTT app in the smartphone from anywhere in the world. The only criteria are the photon particle should be in the same network used while claiming the device.

Difference between the two modes of communication mentioned above

In the first mode, the communication between the Arduino and smartphone is achieved using an interface called Bluetooth module. In the second mode, there is no interface device for communication between the particle photon and smartphone. In the first mode, the communication is only within a particular range whereas in the second mode of communication one can control the particle photon from anywhere in the world till the photon is in the registered network. In both cases, two-way communication is possible in the first case the communication through Bluetooth is a bit difficult compared to the second case. Of both cases, the second one is the best communication mode compared to the first if the usage of the particle is acquainted.