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SMART DUSTBIN MANAGEMENT SYSTEM

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ABSTRACT

we are living in a world that is in a state of constant up-gradation, but there is one ubiquitous problem that we haven‘t been able to deal with, the problem that is impeding our advancement to a hygienic, clean and healthy society, is garbage. Mostly in our daily life we encounter dustbins that are excessively full and garbage spilling out of them. This kind of situation is neither good for our environment nor for our advancement. This problem leads to huge number of diseases as large number of insects and mosquitoes breed on the waste accumulated in this garbage. Hence, we developed a project to control the overfilling of the dustbin by making the dustbin smart enough to notify itself for its cleaning. In this project the smart dustbin management system is built on the microcontroller based system having ultrasonic sensors on each of the four dustbins that will show the current status of garbage on the LCD screen as well as on the mobile.

Keywords: ATMEGA328P, Ultrasonic Sensor, ESP8266, IR Sensor, PIR sensor.

I. INTRODUCTION

The quantity of waste generated and their potential impacts depend on multifarious factors, including the level of industrial development, the way in which wastes are managed, the existing state of the local environment and the capacity of the receiving media.Nowadays, cities withdeveloping economies experience exhausted waste collection services, inadequatelymanaged and uncontrolled dumpsites and the problems are worsening [1]. The key issue of an inadequate waste management is that the garbage bin at public places gets overflowed well in advance before the commencement of the next cleaning process. Hence, we need such a system that can deracinate or at least minimize this problem to some extent. With the advancement in technology it is high time that we use technology for waste management systems. The Smart Dustbin is a singular solution to the specific and peculiar problems in waste management.

In this proposed system there are four dustbins and are denoted by four location East, West, North and South, these dustbins are equipped with low cost devices. This design signifies the technique through which the status of the garbage in each dustbin can be checked by the admin as well as by the employee assigned to each dustbin at regular intervals which will help in preventing the undesirable overflow of dustbins. The Wi-Fi module ESP8266 will act as an interface between the hardware and the software whereas the ultrasonic sensors will sense the height of the garbage inside the dustbins. In addition to this the East dustbin will be have the feature of opening it’s led with an informative message when it detects any motion and to lure people it will give an incentive by polishing shoe with help of PIR sensor, APR module and IR sensor respectively.

II. LITERATURE SURVEY

Since smart cities are becoming center of attraction for the advancement of developing countries and without the removal or solution to the garbage problem these cities will be not that attractive. Therefore, large number of projects and research is going on in the area of smart dustbins for smart cities and to implement such projects typically use microcontroller based real time bin monitoring system, RFID technology, GPS, GSM, RF module etc.

Yusof et al. [2], presented an Arduino Uno micro controller based smart garbage monitoring system to ascertain the level of waste in the garbage bin in real-time and before there is overflow in garbage bin the system sense out and alert through SMS municipality for the bin to be emptied an garbage to be collected immediately.

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Ultrasonic sensor is used to estimate the level of waste while the GSM module is used for sending SMS and Arduino UNO is used to control the system operation.

Issac and Akshai [3], proposed a system called SVASTHA (a Sanskrit word, meaning ―be healthy and hygienic), to effectively control the municipal solid waste. This system is based on RFID and GPS in which data is gathered using the RFID reader via Bluetooth and this data is stored on the central server.

The main objective of GREENBIN [4] is the segregation of waste at source so that useful electricity can be produced from theindividual components of waste. Sensors like capacitive based moisture sensor, inductive based metal sensor, methanesensor and odour sensor are used to achieve this goal.

III. METHODOLOGY

The automation of the smart dustbin is achieved through the use of a power supply, Microcontroller (ATmega328P), APR module, PIR sensor, servo motor, and ultrasonic sensor all programmed using Arduino IDE. In addition, DC motor and IR sensor are used for the incentive that is shoe polisher. A block diagram of the control circuit is shown in Figure 1.

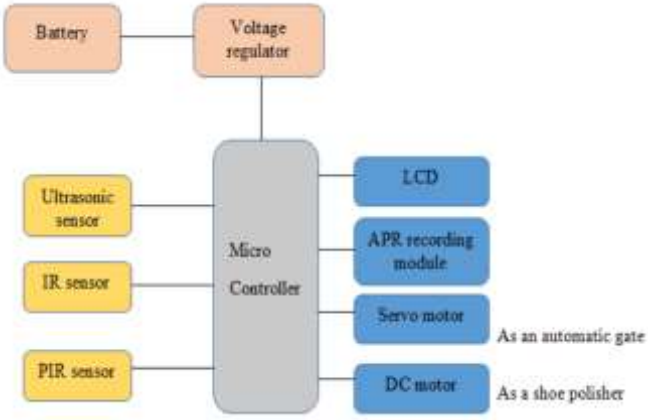

Figure 1. Block diagram

3.1 Hardware

3.1.1 ATmega328P

ATmega328P is a microcontroller that is manufactured by Atmel. It is a high-performance Atmel picoPower 8-bit AVR RISC-based microcontroller that combines 32KB ISP non-volatile storagewith read-while-write capabilities, 1024B EEPROM, 2KB SRAM, twenty three general purpose I/O lines, thirty two general purpose operating registers, three versatile timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, a 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. This device operates between 1.8-5.5 volts.

3.1.2 Ultrasonic Sensor

An Ultrasonic sensor is a device that measures the distance of an object with the help of sound waves. It measures distance through sending out a sound wave at a particular frequency and listening for that wave to bounce back. It is possible to measure the distance between the sensor and that object by recording the elapsed time between the sound wave being generated and the sound wave bouncing back. In other words, the sensor head emits an ultrasonic wave and receives the wave that is reflected back from the target.
The distance can be calculated with the following formula:
Distance = 1/2 × T × C
Where T is the time between the emission and reception, and C is the speed.

3.1.3 ESP8266 Wi-Fi Module

The ESP8266 WIFI Module is a self-contained SOC with integrated TCP/IP protocol stack that can offer any microcontroller access to your Wi-Fi network. It is capable of either hosting an application or offloading all Wi-

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Fi networking functions from another application processor. Each ESP8266 module are pre-programmed with an AT command set firmware, which simply means, thatit can be simply hooked to the Arduino device and can get as much WIFI-ability as a Wi-Fi Shield offers. The ESP8266 module is highly cost-effective board with a large, and ever growing, community. It supports APSD for VoIP applications and Bluetooth co-existence interfaces, it contains a self-calibrated RF that allows it to work under all operation conditions and no external RF parts are required.

3.1.4 LCD (Liquid Crystal Display)

LCD screen is an electronic display module and have a wide range of applications. A 16x2 LCD display is a basic module which is commonly used in various devices and circuits. These modules are preferred over the seven segments and other multi segment LEDs. A 16x2 LCD means that it can display 16 characters per line and there are 2 such lines. Each character is displayed in 5x7 pixel matrix in this LCD.

3.1.5 PIR Sensor

PIR sensors allow us to sense motion. They detects whether a human has moved in or out of the sensor‘s range. Commonly they are found in appliances and gadgets that are used at home or for businesses. They are often referred to as "Passive Infrared", "Pyroelectric", or "IR motion" sensors. PIR sensors are really easy to connect to a microcontroller. It acts as a digital output so all we need to do is to listen for the pin to flip high (detected) or low (not detected). Power the PIR with 5V and connect ground to ground. Then connect the output to a digital pin.

3.1.6 IR Sensor

An infrared (IR) sensor is an electronic device that emits so as to sense some aspects of the environment. An IR sensor can detect the heat of an object as well as the motion. Whenever the IR sensor senses an object close enough to it, the light from the LED bounces back from the object and into the light sensor. Usuallyall the objects radiate some form of thermal radiations in the infrared spectrum. These are invisible type of radiations to our eyes that can be sensed by an infrared sensor. An IR LED (Light Emitting Diode)is simply an emitterand an IR photodiode is simply a detector which is sensitive to IR light of the same wavelength that is emitted by the IR LED.

3.1.7 APR Module

APR module a single chip Voice recorder and a Playback device for 20 to 30 seconds maximum voice recording and play back. It is considered as an ideal IC for automatic answering machine, door phones etc. This IC has a data storage capacity and no software and microcontroller is required. It provides a high quality voice recording and play back up to 30 seconds.

3.2 Software

3.2.1 Ionic Framework

Ionic is a complete open-source SDK for hybrid mobile app development. Its original version was released in 2013 and was built on top of AngularJS and Apache Cordova. The more recent releases, known as Ionic 3 or simply "Ionic", are built on Angular. It provides all the required tools and services for developing hybrid mobile apps using Web technologies like CSS, HTML5, and Sass. Apps can be easily built with these Web technologies and then can be distributed through a native app stores and can be installed on devices by leveraging Cordova.

Ionic provides all the functionality which is found in native mobile development SDKs. Users can simply build their apps, customize them for either Android or iOS, and deploy through Cordova. Ionic also includes mobile components, typography, interactive paradigms, and an extensible base theme.

IV. RESULTS

The experimental set up of the Smart Waste Management system in which the first dustbin contains the PIR sensor for detecting the motion so that the gate opens, APR module for voice message and IR sensor for shoe polishing is shown in Figure 2. If the dustbins are empty the value on LCD and on app will be 100%.

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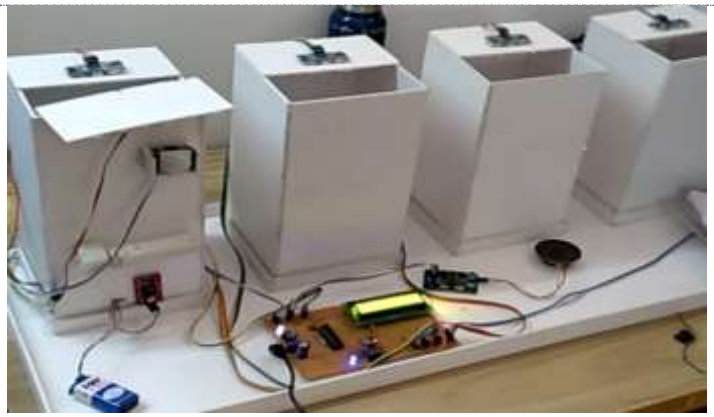

Figure 2.Smart Dustbin Management System

When there is some waste in any of the dustbin shown in figure 3 the value on the LCD changes with respect to that dustbin and when this system is connected to the network via Wi-Fi module the it sends the data to the app which shows the same value that can be checked by the admin or by an individual employee assigned to that particular dustbin shown in figure 4 and figure 5.

Figure 3. Garbage in South (U4) Dustbin

Figure 4. Value of Dustbins on LCD

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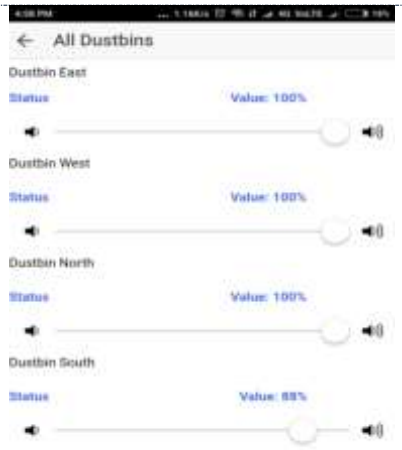

Figure 5. Value of Dustbins on App

The admin can register employees and can assign each dustbin to an individual employee and the employee gets notification from the dustbin about cleaning the dustbin when he/she login there account as shown in figure 6 – 9.

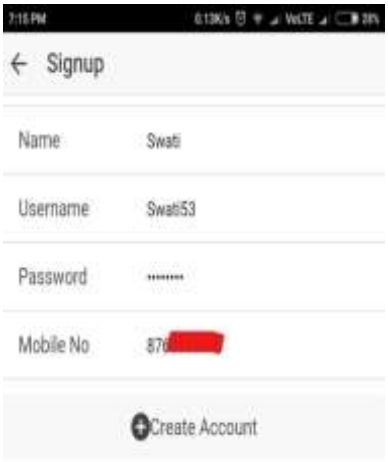

Figure 6. Admin Creating Account

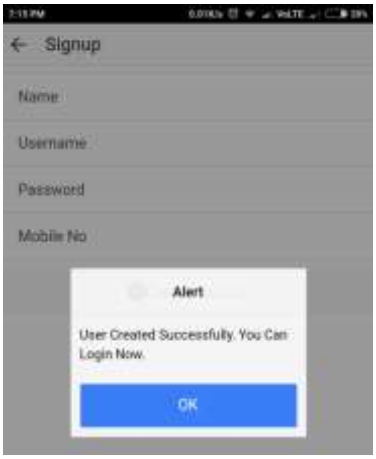

Figure 7. Confirmation that account is created

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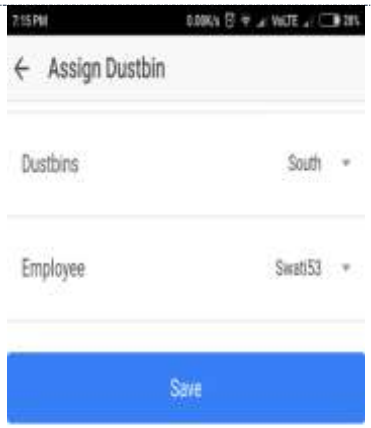

Figure 8. Admin Assigning the Dustbin

Figure 9. Employee Login page

If the assigned employee has not cleared the dustbin it will get a notification informing about cleaning the dustbin as shown in figure 10.

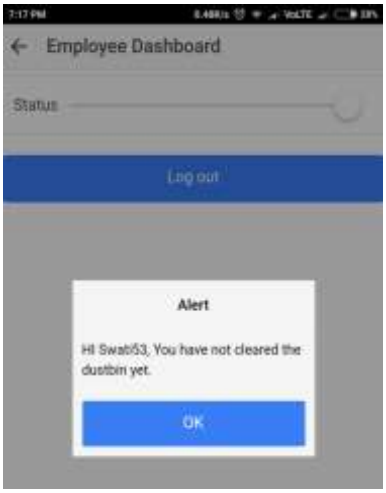

Figure 10. Message to Clean the Dustbin

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V. CONCLUSION

In this project the implementation of smart dustbin management system using IoT as a hardware and ionic framework as our software insures 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 higher authority in our case the admin who can take appropriate action against the concerned employee.

This system also shows the use of PIR sensor, IR sensor and APR module. When some motion is detected by the PIR sensor it opens the gate of West dustbin using the servo motor and when the PIR detects the motion APR module gives the information fed into it of minimum 30 sec. For our lucrative part that is shoe polish we have used IR sensor and to rotate the brush we have used the DC motor.

The smart garbage management system makes the garbage collection more efficient the use of solar panels in such systems may reduce the energy consumption. These dust bin model can be applied to any of the smart cities around the world. A waste collecting and monitoring team which is deployed for collection of garbage from the city can be guided in a well manner for collection.

VI. FUTURE SCOPE

In our project we are only using an app that will notify the assigned employee regarding the value of the dustbin. But in future the dustbins not only notify about their values but also share the locations so that it becomes easy to find those dustbins and empty them.

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