Smart city waste management System using IoT

P.Subhasundari[1], Keshhor S N [2],R logesh [2], G Subash [2]

Assisstent Proffessor [1],UG student [2]

Department of Electronics and Communication Engineering

Muthayammal Engineering College

Rasipuram, India

Abstract— Our country is facing vast challenges in the environment due to waste generation some of them were: inadequate waste collection, transport, treatment, and disposal. One of the important challenges is from its inception till its disposal. Our country can't cope with the current systems by an increasing urban population with the volumes of waste, and this result on the public and environmental health pollution. Unhygienic conditions are created due to the flooding of the dustbins each day. This paper is for the commenting of the challenges, barriers, and opportunities for the betterment of collection, and segregation in the field of waste management. When it senses the nearby trash the dustbin that function automatically, and it is built through a prototype. Dustbins are placed all over the city, and delivered with low cost embedded method to help in tracking of the garbage bins. The Blynk app indicates through SMS as soon as dustbin has reached its maximum level, to the unwanted management department. An immediate action would be taken by the alarmed authorities once the position of the bin is sent via the Internet. The proposed system is developed by using ultrasonic sensors, node mcu, servo motor, Blynk app

Keywords-Waste management; servo meter; Ardinuo; ultrasonic sensor;smart bin.

I.INTRODUCTION

Wired and wireless networks are used for connecting the surrounding without the user intervention is called Internet of Things (IoT). Information is exchanged between the objects. The level of water is measured using ultrasonic sensor inside a tank. It consists of transmitter and receiver. High frequency waves are emitted from the transmitter and it is received by the receiver. The ultrasonic sensor is controlled by the 32-bit microcontroller [1]. Garbage collection system that is automatic having information collection system based on the processing of images taken and GSM module [2]. The garbage bins indicate the garbage level is monitored by the module via a web page to the user. The webpage highlights the collected garbage in a particular color and gives a graphical view of the bin [3]. System that identifies when a litter bin is completely full. In this system, data is collected and transmitted via a wireless mesh network. Moreover, to reduce the amount of power maximize the time efficiency of the operations, the system employs duty cycle technique [4]. IoT plays a vast role in making the city greener, safer, and more efficient. Identification and collection of wastes in a garbage bin. Garbage containers transmit signals to the appropriate authority indicating that it is over 80% or 90% full and requires to be emptied. Once the garbage bin is full, a signal or notification is then sent via a mobile communication network to a web-based presentation used by the unwanted controlling authorities and the garbage collecting vehicle [5]. The details of the dustbins and their location details are stored in the intelligent bin management. [6]. Scalable system for unwanted bins that can sense and send exact waste level of the bins while overwhelming fewer resources and having cost effective components [7]. Smart garbage bin integrated with alarms that operate in the same way as other systems. The system has the capability to inform the appropriate authorities when the garbage bin is about to or completely full [8]. A cloud-based in nature. In this system, the waste bins are furnished with sensors which sense and alerting of the waste level status which is sent and stored in the cloud [9]. Smart waste bin for the prompt collection of waste. The system operates by alerting the appropriate authorities of the status of the bin for immediate collection and disposal [10]. A system having the capability to provide information about waste bins when they are full or the garbage level is reached [11]. How people are interacting with the waste management process are measured using IoT devices, RFID tags [12]. Garbage overflow is the main issues these days. Quick widening in people is stimulated to more waste transfer in the present years. One of the primary problems is detection, monitoring, and management of wastes. Garbage bins fixed at exposed dwellings in the city scopes are flooding are the cases these days we come about are snappy addition of waste well ordered. Inhabitants living near the bins may suffer to some dangerous infection reminders to unhealthy and dangerous condition to the general populace which may make stench around the surroundings. Manual monitoring the wastes in waste bins is the traditional way and it is a burdensome process and more human effort is utilized, time and cost which can easily be avoided with our present technologies. An innovative way that will help to preserve the municipalities clean and healthy is the IoT based waste management using smart dustbin. IoT concept is used for the implementation. The cities are arranged with the different dustbins. The consumer will not be capable to access the bins when the bins are full.

The concerned authorities access the status of the bin from their place with the help of the Internet and exploit will be taken immediately to substitute overflowing bins.

Human resources and efforts are to be reduced beside with the development of a clever city dream is the main objective of this work. An important issue that required immediate attention is the junk dripping above from dustbins on to the streets was often noticed by the people. The important reason to inspire in this work is the proverb "Cleanliness is next to god and the clean city is next to heaven". Pollution reduced by using smart dustbins. Garbage dustbin overflowed many times and countless animals like dog or rat enter into or near the dustbin. So, a bad scenario created over here. These situations are avoided through this work done here. Cleaning vehicle directly receives the alert message rather than to the contractor's office. Government of India, shell 4,041 statutory cities and towns, to uncontaminated the streets, roads and frames of the country is the scheme called as Swachh Bharat Abhiyan in English: Clean India Mission and abbreviated as SBA or SBM. In this system, the Smart dustbins are attached to the internet to get the real-time data of the smart dustbins.

II.METHODOLOGY

A. System Overview

The devices called as IoT can be checked from the web are the injected gadgets that are connected with the internet i.e. Internet of Things. Dustbins at dissimilar localities which function automatically when it senses nearby trash are explained in this work. To avoid inaccurate level measurement two ultrasonic sensors are established at the highest point of the dustbin are interfaced with Node mcu (ESP8266). The Node mcu receives the signals from both sensors. To crisscross the flat status of dust bin ultrasonic sensor is used so as to regulate if the threshold limit is reached or not. To check the filled level continuously an algorithm has developed and if dustbin is occupied to its supreme limit then there is a dustbin is occupied to its supreme limit then there is a warning.

B. Ultrasonic Sensor

The proposed system is designed using Node mcu, Ultrasonic Sensors, Servo motor, Blynk app and will be implemented through the Arduino Integrated Development Environment (IDE) tool as shown in Fig. 1 and Fig. 2.
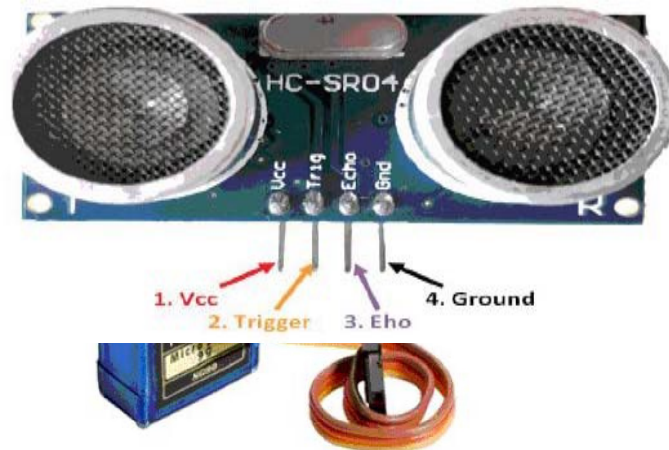

Fig. 2 Servo Motor.

Trash can fill with garbage or not is detected using the ultrasonic sensor. At the topmost of the bin ultrasonic sensor is filled and is used for calculating the space of garbage from the highest of the bin. According to the size of the trash the threshold value is set. The bin is full of garbage if the distance is less than the threshold value. If any object is detected like a hand by using the ultrasonic sensor for example Arduino IDE calculates its distance. The ultrasonic sensor consists of two drums for transmitting ultrasonic pulse anywhere further drums are for getting ultrasonic signal. The echo pin of the module is set high once ultrasonic detect obstacle. Depending upon the location of the obstacle, the coming up period of the reflected pulse is fully set. The distance is calculated by using the formula when the echo signal is obtained,

$$\text{Distance (in cm)} = (\text{duration}/2) / 29.1$$

 Nodemcu (ESP8266) is the microcontroller used. NodeMCU is an exposed source IoT platform as shown in figure.3. Wi-Fi SoC from Espressif Systems is the firmware which runs on the ESP8266, and hardware which is based on the ESP-12 module.

By default, "NodeMCU" raises to the firmware moderately than the expansion kits. Lua scripting language is used by the firmware. It is manufactured on the Express-if Non-OS SDK for ESP8266 and is constructed on the eLua project. Open source objects such as Lua-cjson, and spiffs are used by ESP8266.
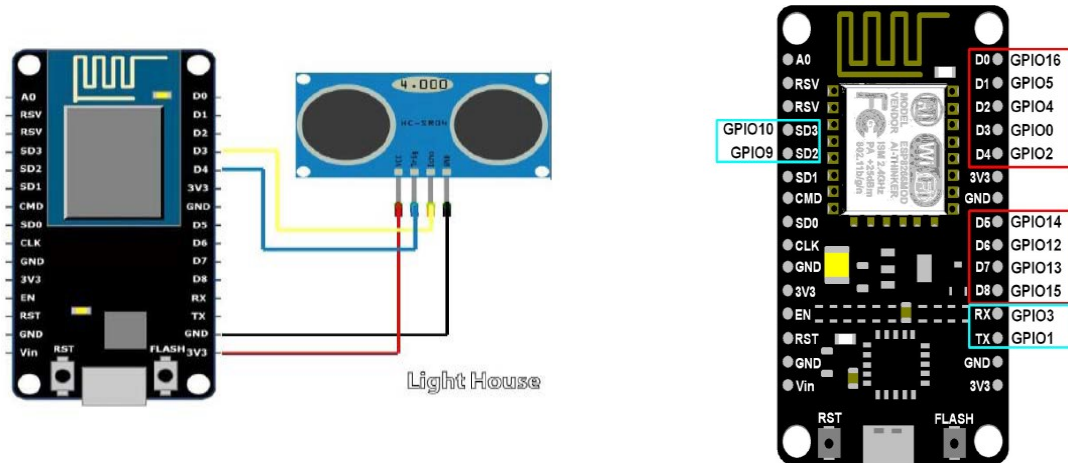

Fig. 3 NodeMCU.

The 32-bit ARM microprocessor is an IoT device ESP8266 module with support of WI-FI network and built-in flash memory. The data is stored in the microcontroller which is retrieved from the sensor. Microcontroller has a Micro USB slot that tin can be directly coupled to the computer or other USB host devices.

The ultrasonic sensor echo pin and activate pin is attached to pin digital pin D3 and D4 as shown in Fig. 4. The +Vcc pin is coupled to source and GND pin is coupled to ground pin of nodeMCU. Digital pin D2 of nodemcu is connected to the control pin (PWM) of the servo motor. The Arduino IDE activates the servo motor and it opens the lid of the bin with the support of the extended arm when IDE calculates its distance to be less than a certain predefined value. Arduino IDE is used to perform the objective. It is open source software and it becomes simpler to the code and uploading it into the board. There are several plants like Windows, MAC OS, Linux where it runs in as much simpler way. The concerned software is JAVA so before running 1D JAVA should get installed on the machine and it is applicable in any Arduino board as shown in Fig. 6. The cap of dustbin is shifted to zero-degree position initially by the servo motor as shown in Fig. 5. The signal received from the ultrasonic module is monitored through the controller. Threshold distance value set for open the cap of the dustbin. The controller induces the servo motor to open the cap for the limited line if the limit is reached the lid is automatically closed.
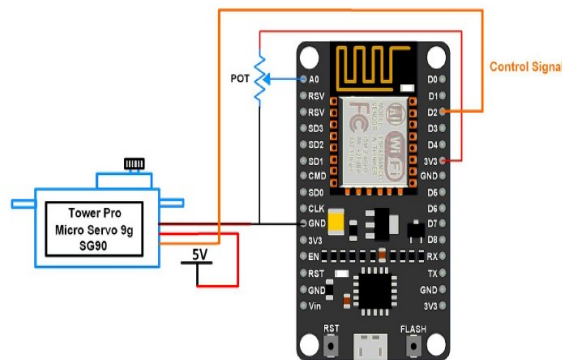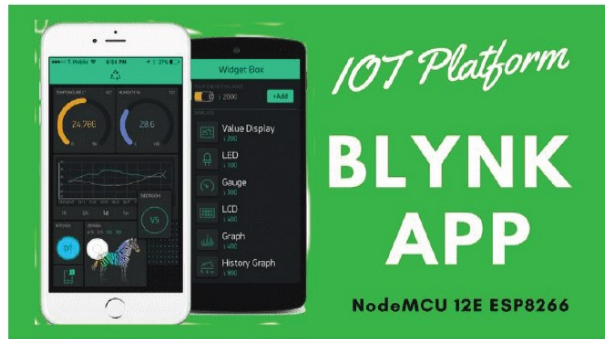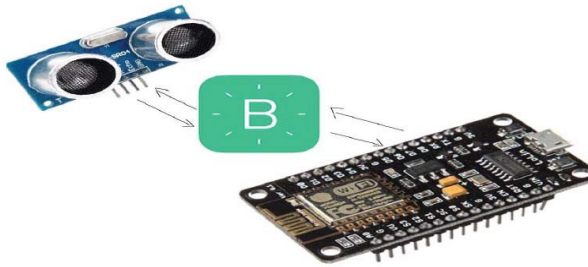
Fig. 6 Arduino IDE.



Fig. 7 Blynk APP.

Fig.8

Blynk app is used for referring attentive messages to the disturbed authorities; thereby speedy act would be taken to vacant the bins. This is executed concluded the Arduino Integrated Development Environment (IDE) tool. For hardware testing control supply and correct range of measurements and a meter, the tape exists used. The garbage dump should have only solid waste. The Node MCU is connected first to the Wi-Fi hotspot and then to the Blynk app as shown in Fig. 8.

III.RESULTS AND DISCUSSION

- Detection of waste level inside the dustbin
- Wireless Transmission of the information
- Assessment of the data anytime and from anywhere
- The real-time data transmission and access
- Avoids the overflows of Dustbins

Fig. 9 and 10 shows the flow chart of the proposed algorithm and smart bin respectively.
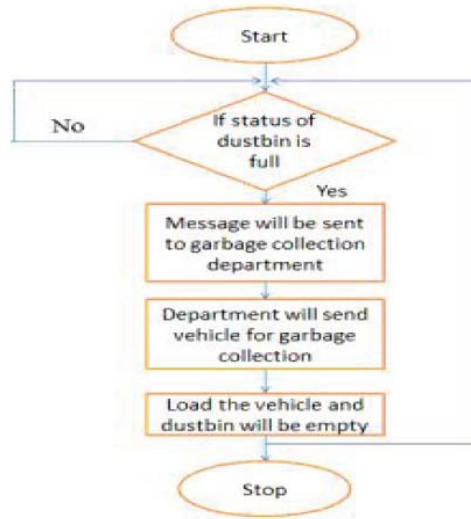
In many aspects keeping the city clean is achieved through IoT based waste management. For an unsanitary environmental condition in a city solution is provided by IoT based waste management. The assurance for the system to send SMS notification and status of dustbins is provided by this system when the garbage level reaches its maximum. The over-all number of journeys of garbage gathering vehicle is compact as much as probable and later condensed the overall spending related with the refuse collection. Rush-hour traffic in the cities are incidentally condensed due to this methodology. Cost decline, source optimization, real practice of smart dustbins can be prepared by fulfilling this system. Therefore the cleanliness is achieved through this in the society ultimately. Waste collection becomes more efficient through smart waste management system. Such arrangements are susceptible to the aggressive of mechanisms in the system in dissimilar ways which requisite to be worked on. These dustbin ideal can be applied to any of the smart cities around the world. A waste gathering and 24-hour care team which is positioned for collection of junk from the city can be lead in a moral style for gathering.

Fig.11 Working model of the proposed algorithm.

In cities, there are different dustbins located in the different areas and dustbins get overflown many times and the concerned people do not get information about this. Our system is designed to solve this issue and will provide complete details of the dustbin located in the different areas throughout the city. The working of the system in as shown in Fig. 11 and 12. The concerned authority can access the information from anywhere and anytime to get the details. Accordingly, they can take the decision on this immediately. The scope for the future work is this classification can be carry out with a time print in which real-time clock is shown to the fretful person at what time dust bin is full and at what time the waste is collected from the smart dustbins.

CONCLUSION

Smart Dustbin is a simple work we designed for the purpose of the clean city. This paper improves the cleanliness of the smart cities by the practicality of IoT based waste collection and management. Ultrasonic sensor offer a proficient and automatic dustbin status monitoring system by using an integrated sensing system. Assessment of the proposed system is performed by the number of test runs. Its status, time algorithm to improve bin operative situation is a very good scope for us through this paper. Power optimization required for the system is also a challenge. IoT communication paradigm has provided the capability for devices to communicate and share information in distance while utilizing less power. This project presents smart waste collection systems using IoT technologies. The objective was to identify the technologies used, their challenges, possible solutions, and other technical factors. Therefore, it is important that improvement and innovation be geared to the management of waste in our cities to ensure healthy environment devoid of diseases and infections.

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