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IOT Based Waste Monitoring System for Smart Cities

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Abstract: - *The method of connecting the objects or things through wireless connectivity, Internet called Internet of Things. Now a days a variety of tasks are based on IOT. Cities in the world are becoming smarter by implementing the things around using IOT. This is a new trend in technology. Smart cities include obstacle tracking, object sensing, traffic control, tracking of our activities, examining the baby, monitoring home lights and so on. One of the objectives of smart cities is keeping the environment clean and neat. This aim is not fulfilled without the garbage bin management system.*

Hence the project "IOT Based waste monitoring system for Smart Cities" has been developed. Waste monitoring is one of the major applications of IOT. Here sensors are connected to all the bins at different areas. It senses the level of garbage in bin. When it reaches threshold a message is sent via GSM to the concerned person to clean it as soon as possible with a link where the waste bin is located and if the concerned person was not able to clear the bin, and if there is any moving object then the status of the bin can be evaluated by the corporation in the cloud i.e we will be using Thingspeak.and ESP8266 wifi module .So that they can appoint another person to clear the bin.

Keywords: - **IoT, Waste management, Arduino uno, GSM, ESP8266, Ultrasonic sensor, PIR sensor.**

1. INTRODUCTION

A smart solid waste bin operates to ensure the efficient measurement of its status while consuming minimum energy. At present, most of the cities around the world require challenging solutions for waste management, as there is rapid growth in residential areas and the economy. Solid waste management is a costly urban service that consumes around 30% of Municipal Corporation's annual budget in many developing nations. After various surveys and studies done by numerous organizations it has been seen that factors affecting effective waste management are due to improper management and lack of cutting edge technology infrastructure. Municipal authorities have inadequate resources for waste management institutions to effectively collect the waste generated. It becomes an excessive wastage of resources when bins are collected that are filled up partially. By optimizing the quantity and deployment of smarter technology for waste collection and monitoring activities can be carried out very efficiently to reduce operational cost. In today's connected devices era, Internet of things (IoT) technology is revolutionizing society in different domains like healthcare, industrial automation, automobile and smart cities. In this paper, we have proposed IoT internet of things based smart waste monitoring system which allows waste management authorities to continuously monitor status of dust bins placed at different locations and as per the status takes appropriate actions to collect it immediately and efficiently. This is not a unique thought, for the usage of keen trash container; the thought has existed for a long time. Motivation for this work comes from "Integrated Sensing Systems and Algorithms for Solid Waste Bin State Management Automation" [1] have already presented sensing system and algorithm for solid waste bin to automate the solid waste management process. Several sensing methods have been integrated and have combined their verdicts that offer the detection of bin condition and its parameter measurement. Though results and developed algorithms are efficient for automatic bin status monitoring work lacks remote monitoring of bin. So, in this paper we have proposed system which can be deployed in general purpose dust bins placed at public places and which allows us to monitor its status remotely over internet for efficient waste management.

2. SYSTEM OVERVIEW

The proposed system offers remote monitoring of the real time bin status data from two sensing systems: waste filled level sensing, motion sensing. Explicit of the individual systems are described below. The sensing of waste filling level inside a bin is based on the measurement of the time of flight i.e. the time taken by an ultrasonic pulse to transmit

and receive its reflected echo between the sensor and the sensed material level. The motion estimation in the waste bin is based on the principle of an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are most often used in PIR-based motion detectors.

3. PROPOSED METHODOLOGY

Things (inserted gadgets) that are associated with the Internet and occasionally these gadgets can be checked from the internet are regularly called as IoT i.e. Internet of Things. In this framework dustbins are arranged at different locations. [4]The Smart clean dustbins are related with the internet to get the ongoing status. Ultrasonic sensor is settled at the highest point of the dustbin to avoid inaccurate level measurement. PIR sensor is placed at the top of the dustbin and is additionally interfaced with controller to recognize over motion in the junk filled in the dustbin. Both sensors send the signals to the controller. The RF-transmitter encode the information originating from ultrasonic sensor and send to Arduino unit which acts as receiver, it sends the information to RF-collector which is associated with the Arduino. Arduino collects information received by the collector and transfer on Internet to ThingSpeak account through the ESP 8266.

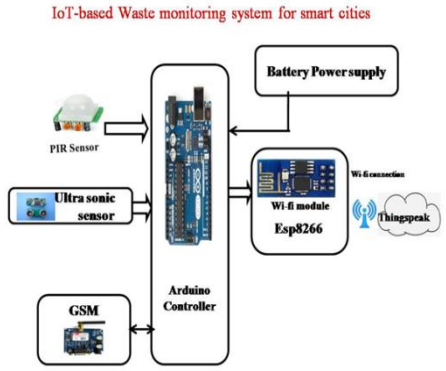

Figure 1 :Block Diagram for Proposed System

[3]Ultrasonic sensor is used to check the level status of dust bin so to determine if it is full or empty, while PIR senses the motion in the garbage present in the dustbin and to determine if the threshold limit is reached or not. Algorithm has developed which checks filled level continuously and if dustbin is filled to its maximum limit then the encoded signal will be transferred by RF transmitter. RF receiver receives the data which is then transferred to the arduino modem connected with the ESP8266. Active status of dustbin is shown on ThingSpeak account using connections through ESP8266.[2] Monitoring the ThingSpeak account will help the garbage collection department to track for the exact location and amount of the garbage. The garbage vehicles can then unload the garbage from a particular location. The function of GSM module is to send a message to the garbage collection department

4. EXPERIMENTAL SETUP AND IMPLIMENTATION

Using a set of carefully chosen sensors, we have implemented solid waste monitoring system which is described previous sections. For the lab experiment, we have not considered the detailed manufacturing problems. Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit. Using input trigger for at least 10us high level signal, the module automatically sends eight 40 kHz and detect whether there is a pulse signal back. If the signal back, through high level, time of high output duration is the time from sending ultrasonic to returning. On the other side PIR sensor is installed at top of dustbin.

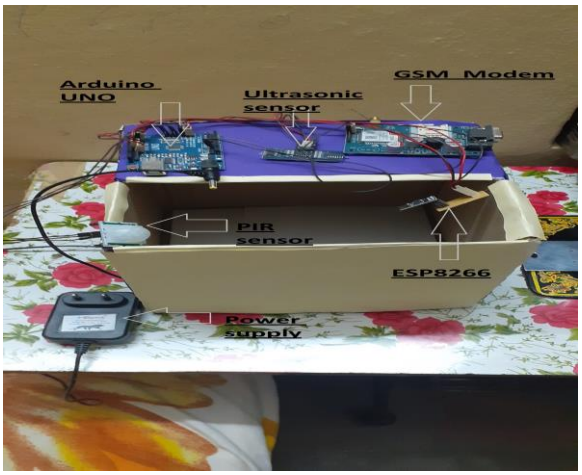

Figure 2: Experimental setup

We have also developed ThingSpeak account which is a open source and allows us remote monitoring of the real time bin status as shown in Figure[3].ThinSpeak provides information regarding status of level of waste and any motion detection in the bin. Real time status i.e. full or empty is shown on the ThingSpeak account and if it is full SMS is sent via GSM module to coordinator.

Creating ThingSpeak Account

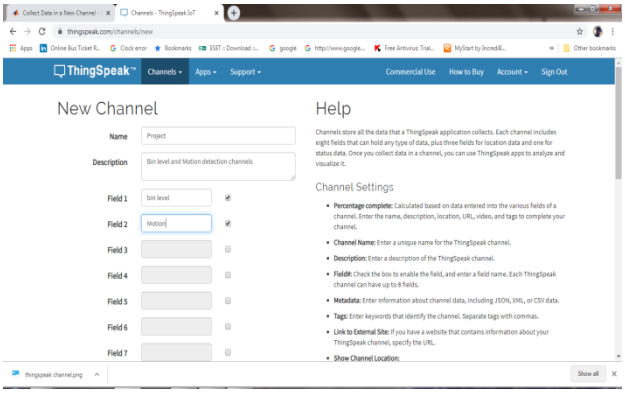

Figure 3: creation of ThingSpeak Account

5. RESULTS AND DISCUSSION

We have given a supply to the kit. The empirical outcomes shown in figure (6) represent the bin filling level values for both the sensors placed at top of the bin for level and Motion in waste inside the bin and respective status. Various possible combinations have been tested to assess performance of proposed prototype under different conditions. As shown in the figure when the waste is croses 50% level in the bin the graph raises and also when the motion detected the graph goes to the peak level. We have developed a program as for every 6 seconds the status of the bin should be changed. And the result is exposed in the ThingSpeak account through internet.

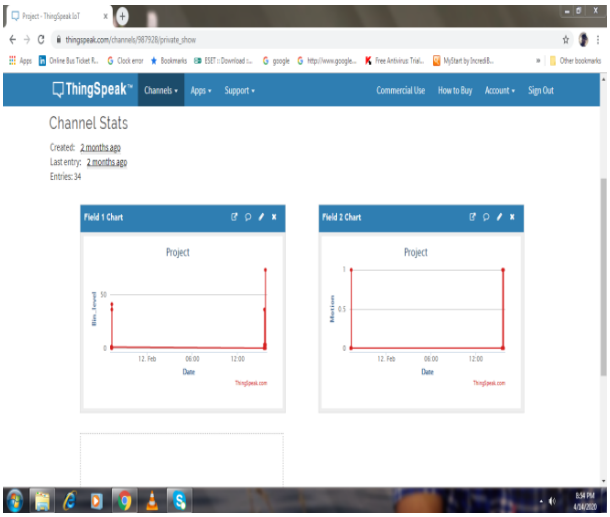

Figure 4: Status of bin in ThingSpeak

If the waste in the bin reaches the threshold level i.e nearly 90% the SMS is send to the respective person via GSM modem .The sent message is as shown in the figure [5]

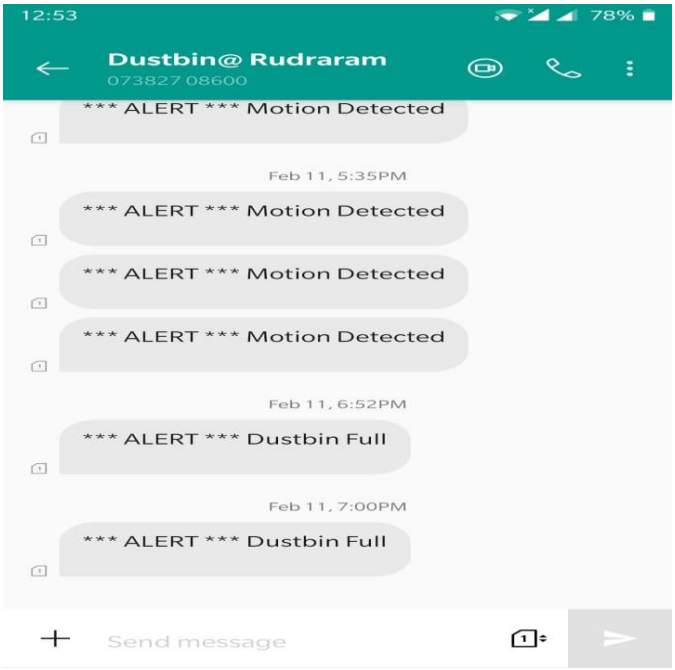

Figure 5: Message Result

6. CONCLUSION

This paper improves practicality of IoT based solid waste collection and monitoring system for smart cities. The integrated sensing system is designed using ultrasonic sensor and PIR sensor to offer a proficient and automatic dustbin status monitoring system. Still there is good scope for improvement in algorithm which synthesizes bin operative situation, its status, and time threshold and motion status perception. Optimizing power required for the system would also be a challenge. Number of tests run were performed for assessment of proposed system.

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