IOT BASED SMART GARBAGE AND WASTE COLLECTION BINS

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ABSTRACT*: The modern era waste management has become one such issue. Many times, in our city we see that the garbage bins placed at a public places are overloaded due to the increase in the population and wastage from hotels, industries. It creates unhygienic conditions for people as well as ugliness to that place leaving bad smell and cause much disease to the public. To avoid all such situations, I am going to proposed system called iot based smart garbage and waste collection bins. The waste collection dustbin is provided with low cost embedded device and it will sense the level of dustbin, and then it is sent information to the municipality officer. Then it will send the information to the truck driver to collect the waste. The Ultrasonic sensor is used to sense the level of dust in dustbin and this is directly connected with microcontroller. This device is connected to the internet then micro controller update the garbage level and dustbin status to the central server then concern authority can access those data on mobile phone or computer using web browser. The main aim of this project is to reduce human resources and efforts along with the enhancement of a smart city vision and absence of efficient waste management has caused serious environmental problems and cost issues. Therefore, in this paper, an iot-based smart garbage system is proposed to manage the waste in cites.*
Keywords: *Internet of Things, Smart cities, Waste management.*

1. INTRODUCTION

Things (Embedded devices) that are connected to Internet and sometimes these devices can be controlled from the internet is commonly called as Internet of Things. In our system, the Smart dust bins are connected to the internet to get the real time information of the smart dustbins. In the recent years, there was a rapid growth in population which leads to more waste disposal. So a proper waste management system is necessary to avoid spreading some deadly diseases. And also in 2050, the vast amount of earth population (i.e., 70%) will move to urban areas, thus, forming vast cities [1]. Such cities require a smart sustainable infrastructure to manage citizen's needs and offer fundamental and more advanced services [2]. The adoption of Future Internet technologies enhanced by the use of the Internet Protocol (IP) on numerous wireless sensors enables the Internet of Things (iot) paradigm. Numerous sensors have the opportunity to be part of Wireless Sensor Networks (wsns). When wsns are applied in a city, they are responsible for collecting and processing ambient information and, thus, to upgrade legacy city infrastructure to the so-called Smart Cities (scs). A definition of the concept of SC is provided in [3]: "A Smart City is a city well performing in a forward-looking way in the following fundamental components (i.e., Smart Economy, Smart Mobility, Smart Environment, Smart People, Smart Living, and Smart Governance), built on the 'smart' combination of endowments and activities of self-decisive, independent and aware citizens". This definition incorporates the fundamental component of a smart environment which is mainly adopted for systems dealing with environmental pollution. The concept of smart environments depicts the ambient intelligence

found in a SC through the adoption of smart devices and wireless networks. This way, intelligent applications could be delivered on top of such infrastructures. We are capable of reforming activities in a SC in every aspect of daily life [4]. In this paper, we focus on a specific application domain, smart garbage and waste collection. The efficient collection and management of waste has a significant impact on the quality of life of citizens. The reason is that waste disposal has a clear connection with negative impacts in the environment and thus on citizens' health.

Today's iot technology mostly help to implement this project in cities. This technology can be simply explained as a connection between human's computers-things. All the equipment's we use in our day to day life can be controlled and monitored using the iot. A majority of process is done with the help of sensors in iot. Sensors are deployed everywhere and these sensors convert raw physical data into digital signals and transmits them to its control center.

By this way we can monitor environment changes remotely from any part of the world via internet. This systems architecture would be based on context of operations and Processes in real-time scenarios. Smart collection bin works in the similar manner with sensor namely IR sensor that indicates its different levels. The IR sensors will show us the various levels of garbage in the dustbins and also the weight sensor gets activated to send its output ahead when its threshold level is crossed. These details are further given of the microcontroller and the controller gives the details to the transmitter module (Wi-Fi module). At the receiver section a mobile handset is needed to be connected to the Wi-Fi router so that the detail of the garbage bin is displayed onto the HTML page in web browser of our mobile handset.

Whenever the garbage is full information can be send to the concerned authority to clean the bin. Here we use a low maintenance recent communication development like GSM. GSM is used in the project as a communication back bone for the whole system for various reasons like low cost, easy to implement and less signal deterioration. Hence these networks can work even with very low power. Suppose this project is being implemented in a city and the different garbage bins placed at different locations within a city send messages indicating the garbage levels and location in the respective bins to a local corporation office and at the same time to the head office as well.

2. MOTIVATION AND BACKGROUND

In present some countries are implemented this system in the city area however they are using a different technologies and methodologies then from this one. Existing garbage collection system actually based on RFID

technology but an IoT-based SGS is proposed. The proposed SGS fits into the category of IOT applied to external and public environments and was therefore designed to include the necessary components for such applications.

- **Reliability.**
  In IoT applied to external and public environments, communication is important for service provisioning. In particular, since this type of IoT has a wide service Domain, reliable communication is necessary for devices to communicate with each other. Therefore, the SGBs utilized in the proposed system communicate with each other based on a wireless mesh network, securing communication reliability.

- **Mobility.**
  IoT devices in an external environment may need to move on occasion. For a high level of mobility, the proposed system operates with a battery instead of the fixed Power source that an existing RFID card system utilizes. With a battery-based power supply, the mobility of the proposed system is secured.

- **Service continuity.**
  In IoT with a wide service domain, data exchanges and services should be conducted seamlessly at any time and any location. Thus, SGBs, which communicate and exchange information based on a wireless mesh network, enable users to discharge their waste anywhere a bin is available

- **User convenience.**
  User convenience has been enhanced with the advent of IoT. For user convenience, the proposed SGS reduces the process delay time of the existing RFID-based garbage collection systems, which enables users to discharge their waste without a lengthy wait.

- **Energy efficiency.**
  IoT applied to external and public environments relies on an always-on infrastructure and requires mobility, causing a large amount of energy consumption. To solve this problem, the SGBs operate using energy-efficient techniques, increasing their battery lifetimes.

3. IMPLEMENTATION

In this project the normal dustbin is made as a smart dustbin. The Wi-Fi module is attached to the dustbin to connect the dustbin located at different places. Internet is used to transfer the information about the dustbin level to the municipality officer through web browser. The dustbin is divided into three levels based on their height. Then connect the IR Sensor to the dustbin. It consists of resistor one is used for sensing, other is used for processing and transfer of the level to the RF module for transmitting.

The IR Sensor is used to detect the level of waste in the dustbin. After detecting the level of dustbin, the LED present in the IR Sensor will glow. This indicates that the dustbin is full. In this way the dustbin can be monitored and implemented as smart dustbin.

3.1. Workflow

The project module is divided into two parts Transmitter section and receiver section. Here in the transmitter section 8051 microcontroller is used, RF Transmitter and sensors these are attached to the dustbin and the sensors are used to detect the level in the dustbin whether the dustbin is full or empty. The sensor senses the content of the dustbin and sends the signals or the data to the microcontroller. The microcontroller reads the data from the sensor and send to the web browser as well as the truck driver will receive the notification message from the filled dustbin.

Workflow Diagram

The general workflow as follows:

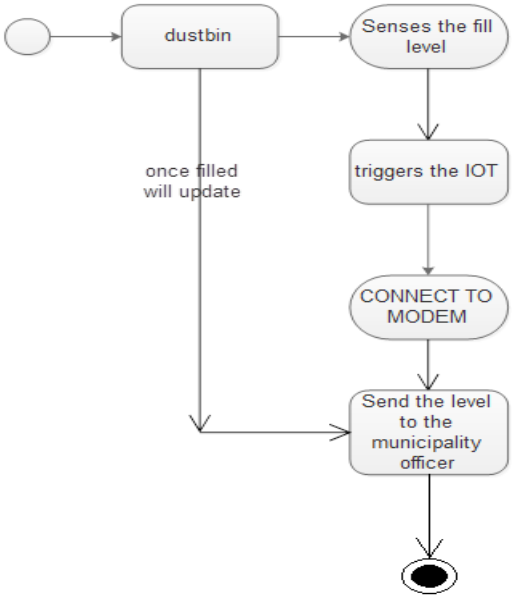

Fig.1 work flow of smart garbage collection bin

Architecture

The general architecture as follows:

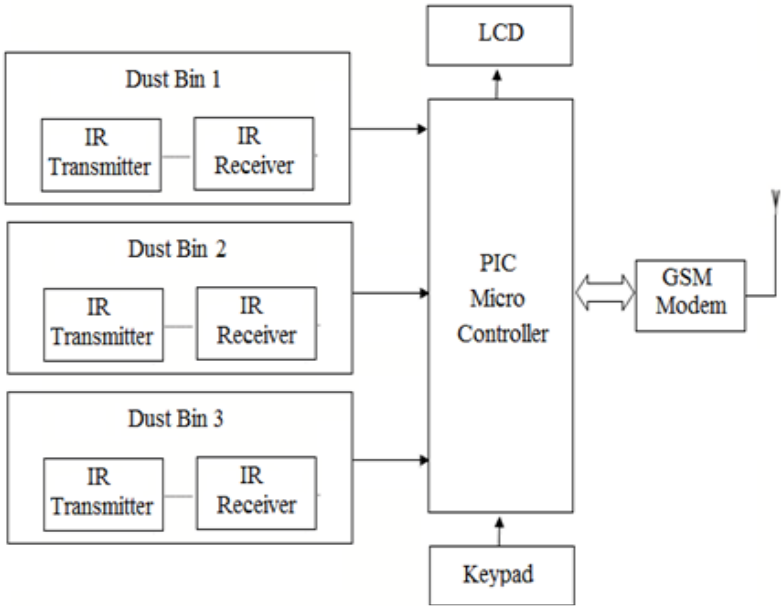

Fig. 2 architecture of smart garbage collection bin

3.2 Hardware requirements

There are some hardware needed to implement the proposed system. It is very vital to choose the best and recommended tools to implement a system in a proper manner. Hardware requirements for the proposed system are given below.

Microcontroller ARM (LPC2148): The LPC2148 microcontrollers are based on a 32/16-bit ARM7TDMI-S™ CPU. With real-time emulation and embedded trace Support that combines the microcontroller with 32 kB, 64 kB and 512 kB of embedded high-speed Flash memory.

Fig. 3 Microcontroller

UV Sensor: The Ultrasonic Sensor sends out a high-frequency sound pulse and then times how long it takes for the echo of the sound to reflect back. The sensor has 2 openings on its front. One opening transmits ultrasonic waves, (like a tiny speaker), the other receives them, (like a tiny microphone). The speed of sound is approximately 341 meters (1100 feet) per second in air. The ultrasonic sensor uses this information

along with the time difference between sending and receiving the sound pulse to determine the distance to an object. It uses the following mathematical equation:

Distance = Time x Speed of Sound divided by 2

Time = the time between when an ultrasonic wave is transmitted and when it is received you divide this number by 2 because the sound wave has to travel to the object and back.

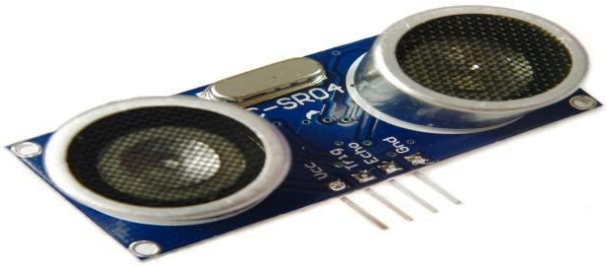

Fig. 4 UV sensor

GPRS Module: GPRS Module helps us to send the details of the dustbin at the Receiver side. This is an ultra-compact and reliable wireless module. The SIM900A is a complete Dual-band GSM/GPRS solution in a SMT module which can be embedded in the customer applications. Featuring an industry-standard interface, the SIM900A delivers GSM/GPRS 900/1800MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption. With a tiny configuration of 24mmx24mmx -3mm, SIM900A can fit in almost all the space requirements in user applications, especially for slim and compact demand of design.

Fig. 5 GPRS Module

4. RESULT

The proposed system was implemented and successfully demonstrated by a planned working model.

System Image:

Garbage level Indicator:

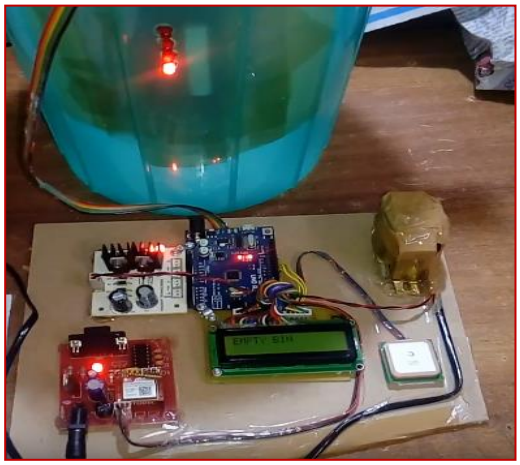

Fig. 6 Entire System Implementation

5. CONCLUSION

This implementation of Smart Garbage Collection System using IoT, 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 higher authority who can take appropriate action against the concerned official. This system also helps to monitor the fake reports and hence can reduce the corruption in the overall management system. This reduces the total number of trips of garbage collection vehicle and hence reduces the overall expenditure associated with the garbage collection. It is ultimately helps to keep cleanliness in the society. This is quite a significant project in its originality and Concept. We are using Internet of Things theory which gives this project its charisma and uniqueness about the concept. The project aims at cleanliness of the areas where trash bins are located and the very basic management that it contains with it. It aims at advanced management of the whole garbage collection system. We use ultrasonic sensors (details mentioned above) and its other hardware microcontrollers and processors such as Arduino for analyzing the garbage levels and sending information about it to administrators and then garbage trucks are being deployed by them. Another very important aspect of our project is the web portal that is designed in such a way that operators and citizens both will find it user friendly to monitor the garbage information of various places. Hence, all in all, an Iot Concept based software project with electronic devices used, is the one that will be a great service to the world and make it a better place to live in, to some extent.

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