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IOT Based Garbage Monitoring Using GSM

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ABSTRACT

Everywhere people are investigating on different aspects in several fields for making smart cities to enhance civilization and human comfort. This paper presents some basic ideas on smart dustbin which can be helpful to reduce human effort to make waste management more efficient.The garbage dustbins is filled these information can be send to the concerned authority person to clean the dustbin. For real time information we use GSM.

Keywords: Smart Dustbin, GSM, Arduino Module, Waste Management.

INTRODUCTION

TheInternetof Things (IoTs) can be described as connecting everyday objects like smart-phones, and where the devices are intelligently linked together enabling new forms of communication between things and people, One of the main concerns with our environment has been solid waste management which impacts the health and environment of our society. The detection, monitoring and management of wastes is one of the primary problems of the present era.

This paper presents some revolutionary remedies in this context. People are more interested to use such technologies which can reduce their time.Automation is the most demandable feature now a day. For this purpose smart dustbins are the much suitable approach. It will be helpful to develop green and smart city. For this we have to develop a fully automatic dustbin which will first be able to detect the current status and connected to local area network and servers by sending the data to computer system about its current status. This is our IoT Garbage Monitoring system, an innovative way that will help to keep the cities clean and healthy.

EXPERIMENTAL DETAILS

Smart dustbin

We have developed a dustbin which is call it smart dustbin. The smart dustbin is a carefully designed solution that solves the social issue of waste disposal, the smart dustbin identifies the kind of material being thrown inside it and segregatesit into bio or non biodegradable.GSM AND ARDUINO MODULE is used for creating the smart dustbin. This is done by the process flow of sensing, data transfer and messaging which make the dustbin able to sense to be open automatically as we come near to this and we get the display message on mobile phone that the dustbin is full. [1-4]

At the same time it is connected to the servers and GSM MODULE system which send the information about the status of dustbin that either it is full or empty.This whole process is controlled by the ARDUINO platform.

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Fig 1: Smart dustbin

Description of key components

- Arduino
- GSM module
- Ultrasonic Sensor
- Jumper wire
- Breadboard

Arduino

Arduino is an open-source platform used for building electronics projects. Arduino is a software company, project, and user community that designs and manufactures computer open-source hardware, open-source software. It consists of a circuit board, which can be programmed (referred to as a microcontroller) and ready-made software called IDE (Integrated Development Environment), which is used an upload the computer code to the physical board. The board feature serial communication interface, including Universal Serial Bus(USB) on models, which are also used for loading from personal computer. Additionally, theArduino IDE uses a simplified version of C++, making it easier to learn to program. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.Itincludes a code editor with features such assyntax highlighting, bracematching, and automatic indentation, and provides simple one-clickmechanism to compile and load programs to an Arduino board. A programwritten with the IDE for Arduino is called a "sketch". The Arduino IDE supports the languages C and C++ using special rulesto organize code. [5-8]

Fig 2: Arduino kit

GSM module

GSM (Global System for Mobile Communications, originally *Group Special Mobile*), is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe the protocols for second-generation (2G) digital cellular networks used by mobile phones. The **SIM900** is a complete Quad-band **GSM**/GPRS solution in a SMT **module** which can be embedded in the customer applications. GSM kit i.e. sim 900A module, is quad band modem suitable for voice ,message and data transfer used here so that messages could be sent to cell phones. GSM/GPRS modem assembled together with power supply circuit and communication interfaces (like RS-232, USB, etc.) for computer. GSM/GPRS MODEM is a class of wireless MODEM devices that are designed for communication of a computer with the GSM and GPRS network. It requires a SIM (Subscriber Identity Module) card just like mobile phones to activate communication with the network. A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves. GSM networks operate in a number of different carrier frequency ranges (separated into GSM frequency ranges for 2G and UMTS frequency bands for 3G), with most 2G GSM networks operating in the 900 MHz or 1800 MHz bands.

Fig 3: GSM Module

Ultrasonic sensor

Ultrasonic sensors work by emitting sound waves at a frequency too high for humans to hear. They then wait for the sound to be reflected back, calculatingdistance based on the time required. This is similar to how radar measures the time it takes a radio wave to return after hitting an object. Senix Tough Sonic Ultrasonic Sensors measure the distance of target objects or materials through the air using "non-contact" technology. They measure distance without damage and are easy to use and reliable. The HC-SR04 Ultrasonic (US) sensor is a 4 pin module, whose pin names are Vcc, Trigger,

Echo and Ground respectively. This sensor is a very popular sensor used in many applicationswhere measuring distance or sensing objects are required. The module has two eyes like projectsin the front which forms the Ultrasonic transmitter and Receiver.

The sensor works with thesimple high school formula that

(Distance = Speed × Time)

The sonic waves emitted by the transducer are reflected by an object and received back in the transducer. After having emitted the sound waves, the ultrasonic sensor will switch to receive mode. The time elapsed between emitting and receiving is proportional to the distance of the object from the sensor.

Fig 4: Ultrasonic sensor

Ultrasonic sensors generate high-frequency sound waves andevaluate the echo which is received back by the sensor, measuring the timeinterval between sending the signal and receiving the echo to determine thedistance to an object.

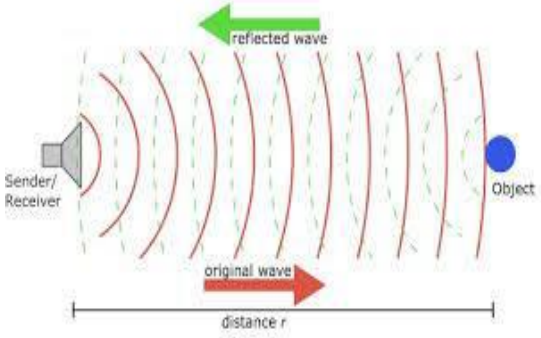

Fig 4:Principle of sensor

Jumper wire

A jump wire (also known as jumper wire, or jumper) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard.

Ready to- use jump wires come in different qualities, some even with tiny plugs attached to the wire ends. The jumper wire should usually be 22 AWG (0.33 mm2) solid copper, tin-plated wire - assuming no tiny plugs are to be attached to the wire ends. The wire endsshould be stripped 3⁄16 to 5⁄16 in (4.8 to 7.9 mm). Differently colored wires and color-coding discipline are oftenadhered to for consistency. However, the number of available colors istypically far fewer than the number of signal types or paths. Typically, a fewwire colors are reserved for the supply voltages and ground. (e.g., red, blue,black), some are reserved for main signals, and the rest are simply usedwhere convenient.

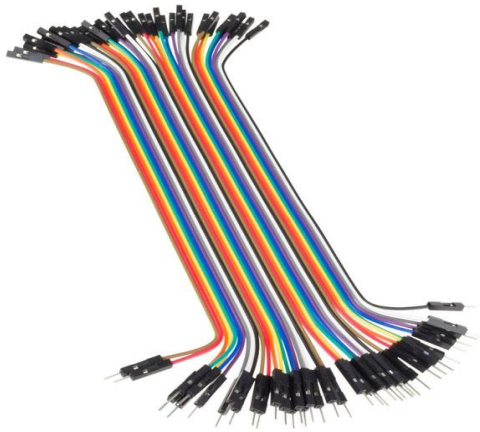

Fig 5:Jumper wire

Breadboard

A breadboard is a construction base for prototyping of electronics. Originally it was literally a bread board, a polished piece of wood used for slicing bread. In the 1970s the solder less breadboard (AKA plug board, terminal array board) became available and nowadays the term “breadboard" is commonly used to refer to these. "Breadboard" is also a synonym for "prototype”. Because the solder less breadboard does not require soldering, it is reusable. This makes it easy to use for creating temporary prototypes and experimenting with circuit design. For this reason, solder less breadboards are also extremely popular with students and in technological education. Older breadboard types did not have this property. Strip board (Vero board) and similar prototyping printed circuit boards, which are used to build semi permanent soldered prototypes or one-offs, cannot easily be reused. A variety of electronic systems may be prototyped by using breadboards, from small analogue and digital circuits to Complete central Processing Units (CPUs).

A modern solder less breadboard consists of a perforated block of plastic with numerous tin plated phosphor bronze or nickel silver alloy spring clips under the perforations. The clips are often called *tie points* or *contact points*. The number of tie points is often given in the specification of the breadboard. The spacing between the clips (lead pitch) is typically 0.1 in(2.54 mm). Integrated Circuits (ICs) in Dual in-line Packages (DIPs) can be inserted to straddle the centreline of the block. Interconnecting wires and the leads of discrete components (such as capacitors, resistors, and inductors) can be inserted into the remaining free holes to complete the circuit. Where ICs are not used, discrete components and connecting wires may use any of the holes.

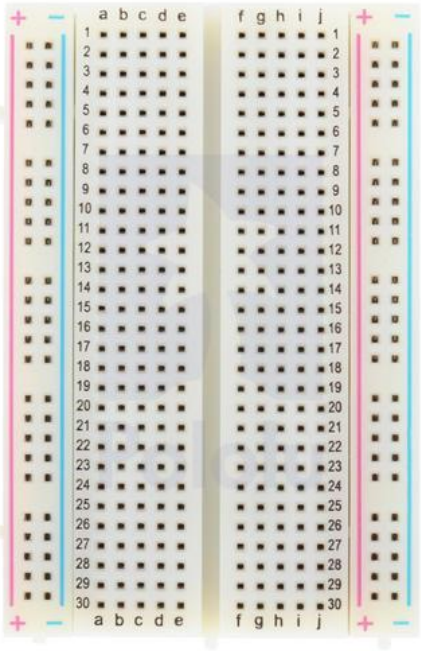

Fig 6:Breadboard

SMART BIN FOR SMART CITY

Fig. 7. Smart bin for smart city

Municipal Corporation is administrating the city and serving the citizens by using new technologies. Municipal Corporation has taken an initiative by implementing the new idea of automation and monitoring of waste management operations. As waste management operations all over the world attempt to become more cleaner and greener. Municipal Corporation is using the new technologies like GSM, Ultra High Frequency Radio Frequency Identification, IOT Sensors along with mobile phone.

The main purpose of Municipal Corporation for adopting these technologies is for processing the waste in addition to the system for waste collection and

decentralization of its processing by setting up small capacity plants across the city.

OBJECTIVE

Smart City mission is a new initiative taken by Pune Municipal Corporation. The objective is to promote cities that give a decent quality of life to its citizen, a clean and sustainable environment. These technologies can provide visibility on solid waste management, route planning for garbagecollection, resource optimization, efficient asset management, efficient maintenance, visibility of waste bins etc. Automated waste collection system provides long term solution and can take care the conventional methods like door-to-door, crub-side, community bins collections and transportation via sloping channel system.

Fig. 8. Garbage collection

SCOPE OF WORK

Sensor Based Waste Collection Bins is used to identify status of waste bins if it is empty or filled so as to customize the waste collection schedule accordingly and also save the cost. Real time waste management system by using smart dustbins to check the fill level of dustbins whether the dustbins are full or not, through this system the information of all smart dustbins can be accessed from anywhere and anytime by the concern person. It will inform the status of each and every dustbin in real time so that concerned authority can send the garbage collection vehicle only when the dustbin is full. By implementing this system resource optimization, cost reduction, effective usage of smart dustbins can be done.

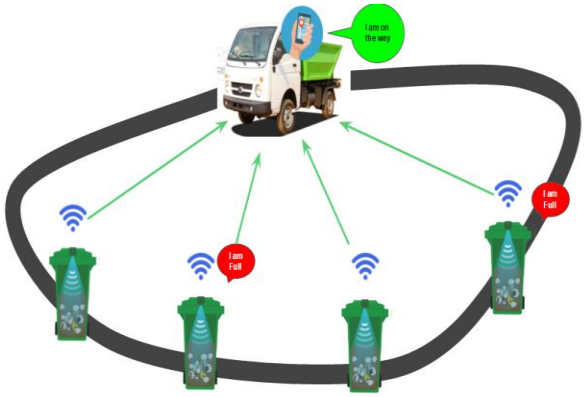

Fig. 9. Garbage collection

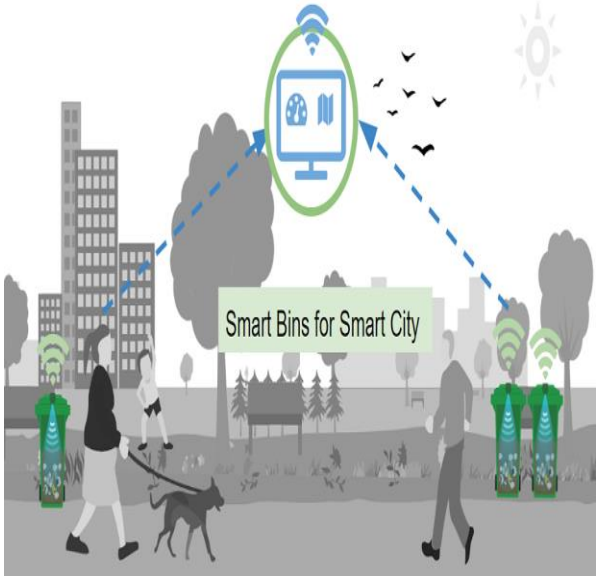

Fig 10. Garbage Information

EXPERIMENTED RESULTS

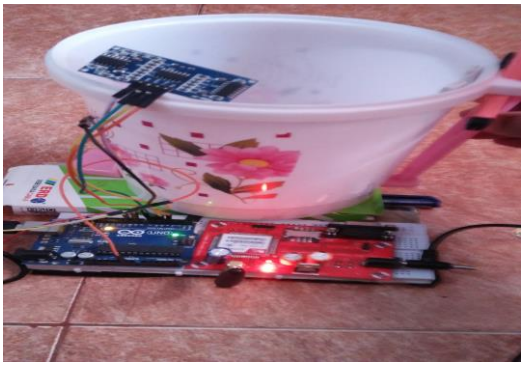

Fig 11. A prototype model of smart dustbin

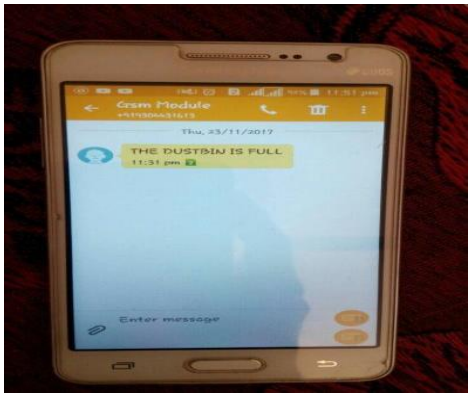

Fig 12. Message displayed on cell phone

CONCLUSION

This project work is the implementation of Automatic Garbage Fill using Ultrasonic sensor, Arduino Uno. By using this method the collection of waste in the city becomes more easier. It helps in reducing air pollution. This system assures the cleaning of dustbins soon when the garbage level reaches its maximum and this project can add an edge to the cities aiming to get smart and people-friendly.Days are not so far we have to take oxygen kit and go outside because no fresh air is left. So we have come with such an eco friendly hi tech prototype to save earth and existence of human in it. This data can be further used to plan garbage collection trips more efficiently, ultimately reducing overflowing bins and helping have better public sanitation. This reduces the total number of trips of garbage collection vehicle and hence reduces the overall expenditure associated with the garbage collection.

FUTURE ENHANCEMENTS

This project should satisfy some features. Features to be tested as follows:

- The ultrasonic sensor should give proper output. To check whether the output is accurate or not, the output of the sensor will be checked against a meter tape.
- The arduino board should show the distance in the serial monitor. So should theNodeMCU.
- The GSM module should send messages after the specified delay. If the text messages arereaching the phone, that means the GSM module is working. It should make a small ringing sound, when it sends messages

Many timesgarbage dustbin is overflow and many animals like dog or cow enters inside or near thedustbin. Also some birds are also trying to take out garbage from dustbin. This project canavoid such situations. And the message can be sent directly to the cleaning vehicle insteadof the contractor's office.

Fig. 13. Future enhancements

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