SMART BIN FOR SMART CITIES

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Abstract: In the recent decades, urbanization has increased tremendously and thus there is a need of sustainable urban development plans. Now using new age technology and strategic approach, the concept of smart cities is coming up all around the world. At the same phase there is an increase in waste production. A smart city is incomplete without a smart waste management system. Waste management has been a crucial issue to be considered. In this paper, smart bin is built on an Arduino microcontroller based platform which is interfaced with GSM modem and ultrasonic sensor. Arduino will program in such a way that when the dustbin is being filled, the GSM & GPS module which will continuously alert the required authority until the garbage in the dustbin is squashed. Once the dustbin is squashed, people can reuse the dustbin.

Once these smart bins are implemented on a large scale, by replacing our traditional bins present today, waste can be managed efficiently as it avoids unnecessary lumping of wastes on roadside. Foul smell from these wastes that remain untreated for a long time, due to negligence of authorities and carelessness of public may lead to long term problems like huge number of diseases, as large number of insects and mosquitoes breed on the waste accumulated in this garbage.

Keywords: Arduino Microcontroller, GPS, GSM Modem, Sensors, Waste Management Etc.

Introduction: As the world is in a stage of up gradation, there is one stinking problem we have to deal with. Garbage! In our daily life, we see the pictures of garbage bins being overfull and all the garbage spills out. This leads to the number of diseases as large number of insects and mosquitoes breed on it. A big challenge in the urban cities is solid Waste management, not only in India but for most of the countries in the world. Hence, such a system has to be build which can eradicate this problem or at least reduce it to the minimum level. This paper gives us one of the most efficient ways to keep our environment clean and green. The upcoming large numbers of smart cities, large numbers of responsibilities are also required to be fulfilled. The prime need of a smart life style begins with cleanliness and cleanliness begins with dustbin. A society will get its waste dispatched properly only if the dustbins are placed well and collected well. The main problem in the current waste management system in most of the Indian cities is the unhealthy status of dustbins. In this paper we have tried to upgrade the trivial but vital component of the urban waste management system, i.e. dustbin.

Now with the rise of technology it is high time that we should use technology for waste management systems. In this paper we have used technology in order to create optimal changes in the conventional methodology of waste collection with the large amount of data that is being produced by the smart bin networks. This system can prove to be a revolution for the whole urban waste management system of upcoming smart cities.

System Block Diagram:
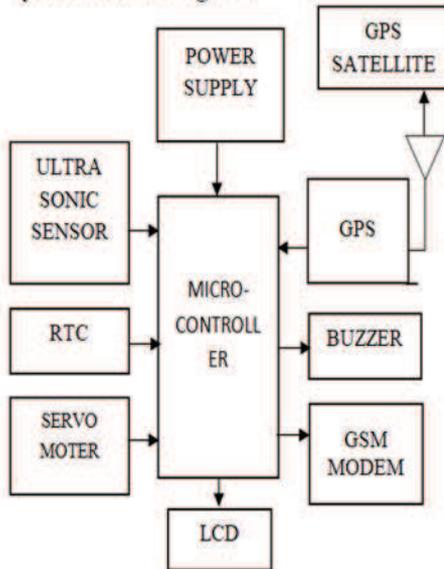

System Flow Chart:
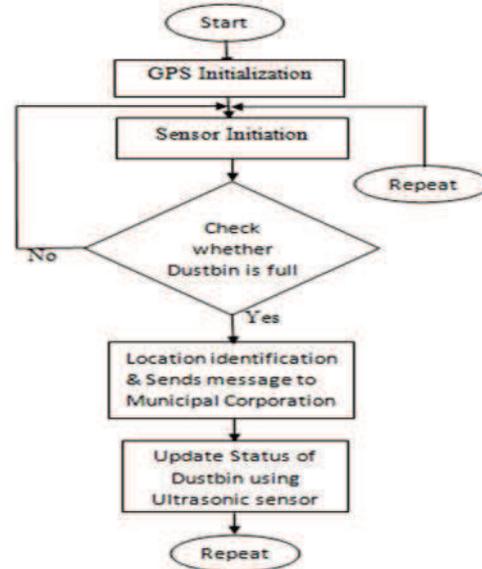
System Requirements:

1. Ultrasonic Sensor: The HC-SR04 ultrasonic sensor uses SONAR to determine the distance of an object . It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package from 2 cm to 400 cm or 1" to 13 feet. The operation is not affected by sunlight or black material, although acoustically, soft materials like cloth can be difficult to detect. It comes complete with ultrasonic transmitter and receiver module. In this System, Ultrasonic sensor is placed at the top of the dustbin which will measure the stature of the dustbin. The threshold stature is set for ultrasonic sensor. It is used to know whether the dustbin is filled or not by calculating the Height of Garbage which is present in the bin. If the dustbin is half filled, the remaining height from the threshold height will be calculated and displayed on LCD screen. If the Dustbin is being filled, the message is to be sent to Higher Authorities. So that Municipal Corporation will come and clean the bin.
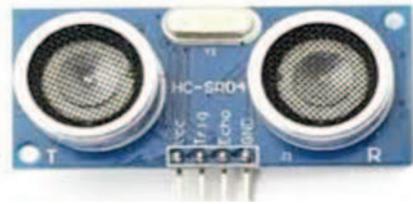
Technical Specifications:
- Power Supply – +5V DC
- Working Current – 15mA
- Measuring Angle – 30 degree
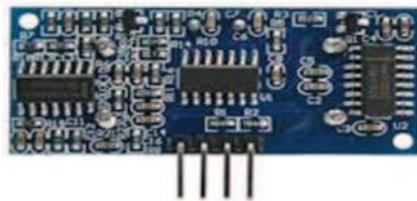
Fig: Ultrasonic sensor

2.Servo Motor: A Servo Motor is a small device that has an output shaft. This shaft can be positioned to specific angular positions by sending the servo a coded signal. As long as the coded signal exists on the input line, the servo will maintain the angular position of the shaft. If the coded signal changes, the angular position of the shaft changes. In practice, servos are used in radio-controlled airplanes to position control surfaces like the elevators and rudders. They are also used in radio-controlled cars, puppets, and of course, robots.

Servos are extremely useful in robotics. The motors are small, have built-in control Circuitry, and are extremely powerful for their size. A standard servo such as the Futaba S-148 has   42 oz/inches of torque, which is strong for its size. It also draws power Proportional to the mechanical load. A lightly loaded servo, therefore, does not consume much energy. In this system, we are using servo motor to open & close the dustbin automatically to manage efficiently. If the shaft is at the correct angle, then the motor shuts off. If the circuit finds that the angle is not correct, it will turn the motor until it is at a desired angle. The output shaft of the servo is capable of traveling somewhere around 180 degrees. Usually, it is somewhere in the 210-degree range. A normal servo is used to control an angular motion of o to 180 degrees.

Fig: Servo Motor

3. GSM: GSM Modem can accept any GSM network operator SIM card and act just like a mobile phone with its own unique phone number. Advantage of using this modem will be that you can use its RS232 port to communicate and develop embedded applications.

Applications like SMS Control, data transfer, remote control and logging can be developed easily using GSM. The modem can either be connected to PC serial port directly or to any

microcontroller through MAX232. It can be used to send and receive SMS or make/receive voice calls. It can also be used in GPRS mode to connect to internet and do many applications for data logging and control. In this system, GSM will send the message to higher authorities when the dustbin is filled with garbage. So that they can come and clean the bin and people can reuse it. In GPRS mode you can also connect to any remote FTP server and upload files for data logging. This GSM modem is a highly flexible plug and play quad band SIM900A GSM modem for direct and easy integration to RS232 applications. Supports features like Voice, SMS, Data/Fax, GPRS and integrated TCP/IP stack.

Fig: GSM Modem

4. GPS: The Global Positioning System (GPS) could be a space-based navigation system that gives location and time info altogether atmospheric condition, anyplace on or close to the planet wherever there's an unimpeded line of sight to four or a lot of GPS satellites. The GPS system provides crucial capabilities to military, civil, and industrial users round the world. The United States government created the GPS, maintains it, and makes it freely accessible to anyone with a GPS receiver.GPS is used in this project to see the location of filled Dustbin in that particular city. Along with the message, location is also sent to higher authorities. It is easy to identify the Dustbin location if we use GPS.
Features:
- A radical high sensitive and good antenna GPS module.
- Embedded with GPS (Global Positioning System) antenna
- Enables high performance navigation in most tight applications and solid fix even in harsh GPS visibility environments.

5. RTC: Real Time Clock (RTC) as the name recommends are clock modules. The DS1307 real time clock IC is an 8-pin device using an I2C interface. The DS1307 is lower-power clock/calendar with 56bytes of battery backup. It provides seconds, minutes, hours, day, date, month and year qualified data and automatically adjust. In this system, RTC is used to send the time of the garbage filled in the dustbin along with message and location. When Dustbin is filled, along with the message, location, time is also going to send to the municipal corporation.

Prototype: The Working prototype is shown. The dustbin is able to open the lid with the help of servo motor and ultrasonic sensor whenever it detects motion. The ultrasonic sensor is giving the details about the waste present in the dustbin. The status of the waste is transferred to the municipal authority whenever it is necessary.

Applications: The Smart Dustbin thought is an improvement of normal dustbin by elevating it to be smart using sensors and logics. The idea of Smart Dustbin is for
1. Industries,
2. Public places/Bus stands,
3. Buildings/Residence/ Hospitals,
4. Schools and colleges.
5. Better performance in wireless network
6. Simple system & reliable Real-Time object monitoring.
7. Aims at creating a clean as well as green environment, as it will reduce the pollution in the air.
8. Reduces manpower, cost and time.

Future Scope: There is a great scope for the modifications of the Smart Dustbin in future. The system can be improved by adding new functionalities. Many times garbage dustbin is overflow and many animals like dog or cow enters inside or near the dustbin. This paper can avoid such situations. Apart from this, differentiation can be made between dry trash bin and wet trash bin collecting biodegradable and non-biodegradable waste. To enhance it further, an automated system can be developed which is able to pick up waste in and around the bin, segregate them and put them in respective bins.

Conclusion: Cities are expanding like never before to accommodate the rapid growth and in this process the concept of smart cities came into action. The parameters like cleanliness and hygiene are the topic of concern in these smart cities and concrete measures should be taken for that. Also, the growth should go hand in hand with the green environment and our work is a small but efficient step towards cleanliness. It ultimately helps to keep cleanliness in the society. Therefore, the Automatic Garbage fill Alerting system makes the garbage collection more efficient. So as to keep the area clean & healthy, thus avoiding many diseases and also avoids the people to throw the garbage outside the dustbins.

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