

Solar Powered Smart Dustbin for Efficient Garbage Management System

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Abstract— As cleanliness is very important with the increase in population monitoring and disposal of the waste becomes an essential need. In our project smart dustbins with various sensors like Ultrasonic sensor for level detection, gas sensor for smell and smoke detection, Conductivity sensor is to detect the liquid content and the MEMS sensor to detect the position of the dustbin. When the signal from the Ultrasonic sensor exceeds the threshold value, the dustbin in the remote area itself acts as a robot and goes to the garbage dumping area/a place where the garbage collecting van is ready to collect the garbage through a pre-learned path. IR sensor is placed at the bottom to detect the obstacles in the path. Once the dustbin is emptied it returns back to its original position. The output of these sensors are given to the Arduino Microcontroller for which supply is given through battery which is charged by solar energy. The dustbin status is updated regularly.

Keywords— Ultrasonic sensor; Gas sensor; Conductivity sensor; Mems sensor; IR sensor; Arduino microcontroller; solar; monitoring and disposal .

I. INTRODUCTION

As population increases, waste management is very essential by the municipalities to keep the city clean and hygienic. With the improvement in technologies ,the municipalities have to adapt various methods to manage the solid waste and transform the city into “Smart City”. As waste generation rate is exponentially rising with the increase in population may lead to various diseases. So waste management plays a significant role.

The term normally relates to all kinds of waste, whether generated during the extraction of raw materials, the processing of raw materials into intermediate and final products. Waste management reduces various effects of waste on health, the environment etc.. Waste management practices differs from country to country , regions to region and sectors to sectors.

In this project efficient garbage management is done using IOT. In the proposed system , the level of the garbage in the dustbins is detected with the help of Ultrasonic Sensor systems and communicate to the authorized control room through IOT. In this project, an Arduino microcontroller is used to interface the sensor system with IOT platform to monitor the desired information related to the garbage for different selected locations. The power to the controller is through battery and it is charged through a solar panel.

II. EXISTING SYSTEM

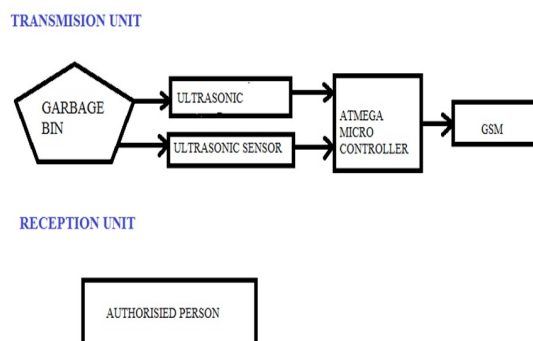


Fig 1: Block diagram of the existing system

In this existing system, the Ultrasonic sensors detect the garbage level. This sensor node sends the information to the server node using Bluetooth. The obstacle in front of the robot is detected by the ultrasonic sensor. LCD module is used to display the current position and action to be taken by the robot.

A. *Ultrasonic Sensor:*

It is used to detect the level of the garbage and the obstacles in front of the dustbin. ATMEGA

B. *Microcontroller:*

It receives the signal from the ultrasonic sensors and sends the information to the control room through GSM modem.

III. PROPOSED SYSTEM

When the dustbins are located in the remote area it is difficult for the garbage collecting vehicle to reach that place and collect the waste. To overcome this situation the dustbin is continuously monitored and once it is filled it gives a message to the supervisor and then moves to a place where it is easy for the garbage collecting vehicle to reach and collect the garbage. Once the garbage is emptied it moves back to the original position.

If this system is implemented it would play a significant role in maintaining clean and a healthy society. The various advantages of the proposed system include the garbage will be collected on time-to-time basis, reduce human intervention, reduce human time and effort, there would not be any bad smell around the bin, real time notification to collect the garbage, saving on fuel consumption, thus reducing the threat to the environment, resulting in healthy and waste ridden environment.

A. *Block Diagram:*

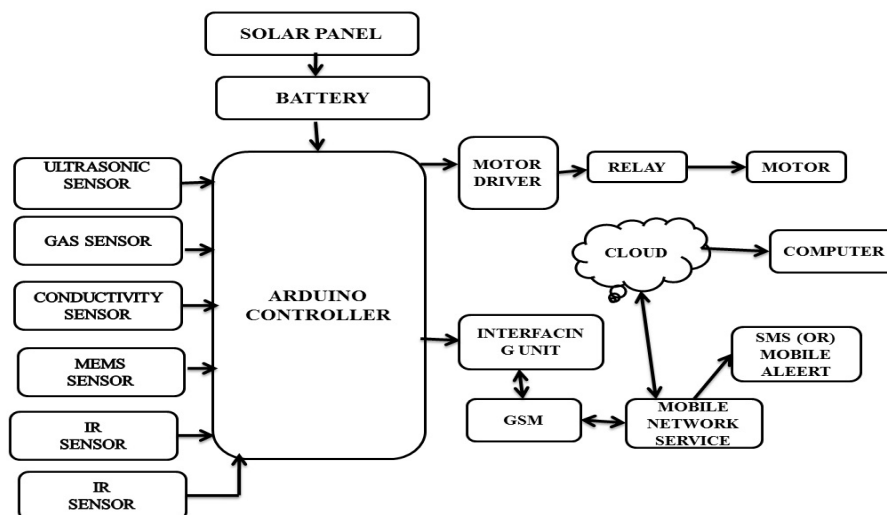


Fig 2. Block diagram of the proposed system

B. *Methodology*

Solar panel is used as a source of power supply. It is stored in battery and is given to all the units. An Ultrasonic sensor is placed in the rim of the dustbin which is used to detect the level of the garbage level. If the garbage level reaches the threshold, the dustbin moves to its destination from where the threshold, the dustbin moves to its destination from where the van empties the content. Once the contents are emptied it returns back to the original position.

An conductivity sensor and a smoke sensor is placed in the dustbin which is used to detect the liquid content and the amount of harmful gases. Once these sensors exceeds the threshold value a message is send to the supervisor . If cleaning is essential the supervisor gives a command to the dustbin to move and come to the desired position where the garbage collecting van will be ready to clean the content in the bin . Once it is cleaned it moves back to the original position.

The MEMS sensor is also placed in the dustbin which sends a message to the supervisor when the value exceeds the threshold value. In this project it is used to detect whether the dustbin is erect or fell down. In this case the supervisor should send his employees to correct it.

The IR sensors are used to detect the obstacle in the front and back of the smart dustbin. Controller receive the sensor data and to send the messages to the control room through GSM modem. LCD is used to display short messages.

C. Circuit Diagram

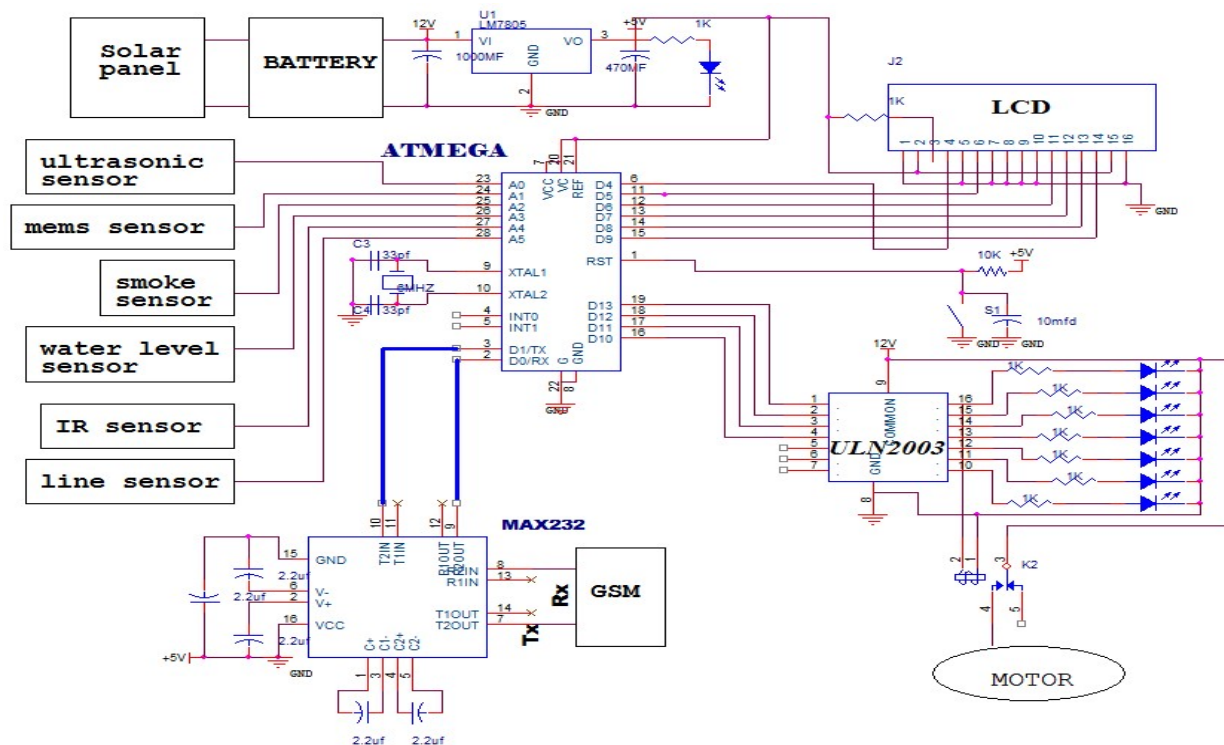


Fig 3. Circuit diagram of the proposed system

Power supply gives supply to all components. Solar panel is used as source, it is stored in battery, and is connected to regulator. LM 7805 regulator is used to maintain voltage as constant. Then signal will be given to next capacitor, which is used to filter unwanted DC component. Load will be LED and resistor. LED voltage is 1.75V. if voltage is above level beyond the limit, and then it will be dropped on resistor. In this project we used Atmega328 controller. Reset switch is connected to pin no 1. It is used to reset the program. Ultrasonic sensor is connected to controller port A0 (pin no 23), MEMS sensor is connected to controller port A1 (pin no 24). Smoke sensor is connected to controller port A2 (pin no 25). Level sensor is connected to controller port A3 (pin no 26). IR sensor is connected to controller port A4 (pin no 27). Line sensor is connected to controller port A5 (pin no 28). Controller receive the sensor signal, and to display the information in LCD. LCD is connected to controller port D4 to D9. If any parameter is above the threshold level, the controller send the message to control room through GSM. It is connected to

MAX232 port no 7 & 8. MAX232 is connected to controller port 2 & 3. It is used for serial communication between controller and GSM. Controller to move the garbage through driver unit. Driver we use ULN2003. It is connected to controller port D10 to D13. It is used to drive the relay. Relay is act as a switch. Relay is connected to driver output port 16. Motor is connected to relay N/O port. The connections are made as per the circuit diagram to design the prototype model.

When the readings of the Ultrasonic sensor exceeds the threshold value the Atmega 328 microcontroller turn on the DC motor and it begins to move forward to the destination where the garbage collecting van is ready to collect the garbage. During this movement when an obstacle is detected by the IR sensor the microcontroller sends a message to the supervisor through the GSM modem. When the readings from the other sensors exceeds the threshold value the Atmega 328 sends the message to the supervisor through the GSM modem. The values from the sensors are also updated regularly in the website using IOT.

IV. HARDWARE DETAILS

The prototype was developed by using the hardware and software tools. In this model two solar panels each of 6V is used to power the entire model through two 6V batteries. The entire process is controlled by ATMEGA 328 microcontroller . The Ultrasonic sensor is used to detect the level of the garbage in the dustbin. Once it is filled/exceeds the threshold value the DC motor of 12V , 30 rpm is turned on with the help of relay and it begins to move forward. Once the dustbin is emptied and the value goes down it moves back to the original position.



Fig 4. Prototype model

During the movement of the dustbin from one place to another if an obstacle is detected the IR sensor senses it and send the message to the supervisor. If the obstacle is cleared it continues in its path. The conductivity and smoke sensor is used to detect the liquid level and the smoke/harmful gases level in the dustbin. Once the value exceeds the threshold value a message is sent to the supervisor. If the dustbin has to be emptied when the values of the conductivity or smoke sensor is high where the value of the ultrasonic sensor lie below the threshold it can be operated manually using IOT. The values of the various sensors are updated regularly in the website.



Fig 5. Webpage to monitor and control

V. CONCLUSION

“Cleanliness is next to Godliness” is a good saying and is believed all over the countries. According to these saying the city should be clean and hygiene for a healthy growth. This Smart Dustbin helps in maintaining the city clean. It also helps in monitoring the garbage level and intimate the supervisor when it is full. This avoids the overflow of the garbage. This can be used in industries, hospitals, remote places where the garbage collecting van could not reach etc.

This system 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 contractor. 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 ultimate helps to keep cleanness in the society. Therefore, the smart garbage management system makes the garbage collection more efficient.

By practically implementing this project we can make the city clean and hygiene with the increase in the population. With the improvement in technologies ,the municipalities have to adapt this method to manage the solid waste and transform the city into “Smart City”.

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