

Real Time Solid Waste Monitoring Through Solar Smart Bin

Deviprasad Reddy H¹

¹M. Tech in Energy Systems & Management,
JSS Science & Technology University,
Mysuru-570006

Dr. M. S. Shashikala²

² Professor, Dept. Of EEE,
JSS Science & Technology University,
Mysuru-570006

Abstract – The main motive of this module is to lower the rate of problems incurred during waste disposal thereby increasing the efficiency of the bin and also reducing the carbon emission. The bin is totally supervised by Internet of things through solar assistance which mainly indulges in reducing the space required in waste disposal and pollution caused for the purpose. Now with the upcoming large number of smart cities which need proper waste collection and disposal system to keep environment and surroundings clean and hygiene. The best possible solution is solar smart bin which can overcome current hurdles of improving waste management system.

Key Words: Solar Assistance, Sensors, Raspberry pi3, Real time interface, Smart waste management

1. INTRODUCTION

As per now there is gradual increase in proportion of people living in urban areas, everyone prefers migration to cities from rural areas in order to self prosper, search of employment and to live with best possible life style. As the rate of urbanization is growing rapidly never like before all over the world as well as in India, The concept of smart cities comes in to picture. A big challenge in big cities is waste management as we see garbage bins being overfull and spills out which leads to number of diseases as large number of mosquitoes and insects breed on it. Hence such a system has to build which can eradicate this problem or at least reduce it to minimum level.

The use of pervasive computing technology such as Radio Frequency Identification (RFID), and sensor networks offer a new way to optimize the waste management systems[2].

Health deterioration, accidents, flood occurrences, and environmental pressures are just a few of the negative effects. In many developing countries, solid waste disposal sites are found on the outskirts of urban areas. These areas become children's sources of contamination due to the incubation and proliferation of flies, mosquitoes, and rodents. They, in turn, are disease transmitters that affect population's health, which has its organic defenses in a formative and creative state. The said situation produces gastrointestinal, dermatological, respiratory, genetic, and several other kind of infectious diseases[3]. A society will get its waste dispatched properly only if the dustbins are placed well and collected well. The main problem of dustbins nowadays is its unhealthy status, This model is designed to overcome such problems through smart assistance using various Internet of things which includes sensors and control units using solar energy as driving power source which is renewable and abundant in nature.

This proposed solar smart bin keeps tracking continuously status of bins and can be monitored by concerned department and this system also increases the efficiency of bins hence waste collection from bins can be made less frequently thereby reducing carbon emissions from vehicle which use to check and collect the waste on regular basics without knowing the exact status of the bins. Life. efficiency must be balanced with equity. New technologies have a tendency to polarise and divide at many levels and we need to explore how new forms of regulation at the level of urban and transport planning, and economic and community development can be improved using future and emerging technologies. The smart city of course offers the prospect of ending the digital divide but it will also open up different divides and our challenge is to anticipate and plan for these[4].

This model helps in controllable life cycle of waste with better public image in waste management and provides cleaner community to live with low labor and fuel cost with real time monitoring and communication assistance.

The movement of waste across the whole city can be tracked and thus can be monitored by a single system efficiently and concretely. This system can prove to be a revolution for the whole urban waste management system of upcoming smart cities[1].

2. PROPOSED DESIGN

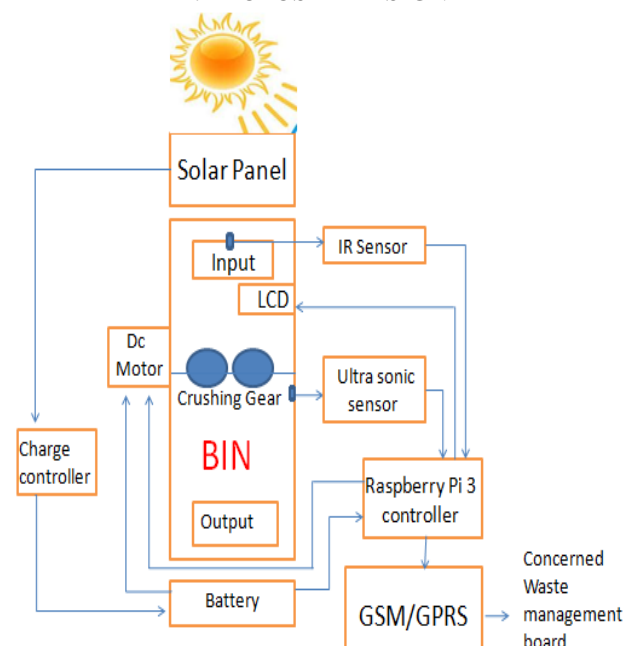


Fig -1: Block diagram of Solar smart bin

The above figure represents the block diagram of proposed design of real time solid waste monitoring solar smart bin, It consists mainly three important sections they are

a) Internet of things

This bin consists of IR SENSOR which is shown in figure 1 which is used to detect the waste thrown in to it to actuate the dc motor fabricated gear to crush the waste, IR sensor basically consist an IR LED and a photodiode, the pair is generally called IR pair or photo coupler. IR sensors work on the principle in which IR LED emits IR radiation and photodiode sense that IR radiation.

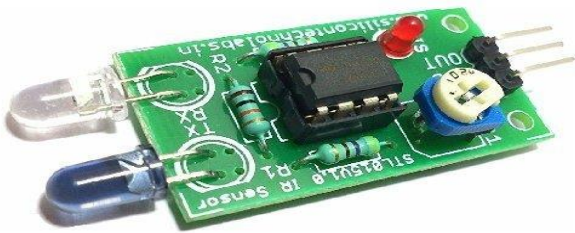


Fig -2: IR Sensor

ULTRASONIC SENSOR which is shown in figure 3 used to measure non distance measurement of status of bin whether the bin status is full or empty, HC-SR04 ultrasonic distance sensor is popular and low cost solution for non contact distance measurement function. it is able to measure distances from 2cm to 400 cm with an accuracy of about



3mm. This module includes ultrasonic transmitter, ultrasonic receiver and its control circuit.

Fig -3: Ultrasonic sensor

RASPBERRY PI3 model is a 64 bit quad core processor used to control the sensors, LCD display, GSM/GPRS module and Dc motor fabricated gear mechanism which has on board Wi-Fi, Bluetooth and USB boot capabilities. Other options includes Ethernet(Poe), USB boot and network boot which is shown in figure 4.



Fig -4: Raspberry pi3

LCD (LIQUID CRYSTAL DISPLAY) draws its definition from its name itself. Its combination of two states of matter, the solid and liquid. LCD uses a liquid crystal to produce a visible image, Here in this model it used to display the status of the bin whether its full or empty which is shown in figure 5.



Fig -5: LCD Module

GSM/GPS MODULE is used for real time monitoring the waste by tagging the bin with unique ID number and each bin is tracked individually and waste disposal is done by monitoring each bin by the module which is shown in figure 6

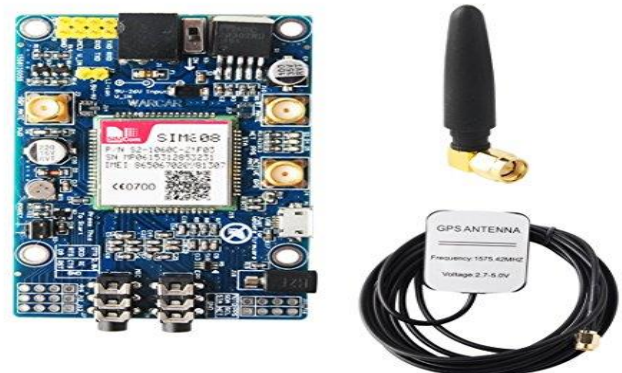


Fig -6: GSM/GPS Module

b) Dc Motor fabricated Gear system

The Gear assembly is set up on two metallic cylinders whose working can called as similar to that of axle. 60 RPM 12V side shaft compact DC motor is suitable to run this gear assembly as shown in the figure 7 to crush the waste that is thrown inside to certain extent by increase the efficiency of the bin.



Fig -7: Dc motor with Gears assembly

c) Power Source

12w Polycrystalline solar panel is used to trap the energy from the sun and can be covered to energy and later stored in a battery and later it is harnessed to internet of things and dc motor.



Fig -8:Solar Panel and Battery

Charge controller is used in this model to limit the rate at which electric current is added to or drawn from electric batteries, It can prevent overcharging and protect against over voltage which can reduce the battery performance or life span.



Fig -9: Charge Controller

3. METHODOLOGY

This model starts working from the point at which the waste is thrown in to it continuously assisting until it is made empty from concerned department. when the waste is thrown in to bin, IR sensor senses the garbage coming inside the bin which is placed near inlet and it actuates the dc motor fabricated gear mechanism through raspberry pi3 controller which crushes the garbage to certain extent by decreasing its size to 3 times smaller than its actual size by literally increasing the efficiency of the bin, when the garbage fills to certain level then the ultrasonic sensor come in to action which continuously measure the level of dustbin, The Bin is divided in to two levels one is empty and other is full, Every time garbage level crosses the limit ultrasonic sensor detects that the bin is full and bin status is displayed as Full on LCD screen and message is sent to concerned waste department with the location that bin is full and to empty it. Each bin is tagged with different GSM/GPS module equipped with unique numbers so that concerned department can empty the bins which are full by not checking every bin which saves lot of fuel and prevents carbon emission which aims in reducing air pollution by taking technology parallel with green environment. This bin is completely eco friendly as it uses renewable energy which is available freely in nature, Every component present in the bin is driven through solar energy trapped through solar modules stored in photovoltaic battery making

it unique than other smart bins and this bin can also placed near electric poles and additional energy can be fed to lighting purpose using dc to ac convertor.

4. REAL TIME INTERFACE

This Smart bin helps concerned waste department to track the bin status either empty or full using GSM/GPS module and can dispose waste for the selected bins which are full rather than monitoring all bins every time which saves fuel even time and labor thereby reducing pollution and keeping surroundings clean and hygiene by preventing many diseases. The GSM/GPS module sends text message of every bins status with location whether it's full or empty from unique Id's so that every bin can be differentiated and efficient route path to collect and dispose waste properly which makes smart management system.

5. ADVANTAGES

- a)it will stop overflowing of dustbins along roadside and localities which keeps environment hygiene and disease free.
- b)Eco friendly as its driving force is renewable energy and doest leave any carbon footprints on environment
- c)Reduces the workforce, time by saving taxpayers money.
- d)Better public image in waste management.
- e)Real time monitoring and communication assistance.

6. FURTHER DEVELOPMENT

In Addition to the designed model to make further efficient, Empty bin with ultrasonic sensor can be placed beside it to collect only recyclable wastes such as plastic bottles, tins etc.. without crushing it so that degradable problem can be solved for further extent by separating recycling waste without crushing with as usual garbage so that it adds up advantages to disposal problem in oceans and forests by preventing harmful effects to wildlife, aquatic and natural biodiversity. Additionally solar panel can also be placed and power is generated and can be fed to grid or street pole lights

7. CONCLUSIONS

Millions of gallons of public waste can be successfully managed by this smart platform with real time and communication assistance which also increases efficiency of dustbins by contributing pollution free and hygienic environment. This system changes mainly the way you look at waste management system and it will be never like before with smart solar assistance. To catch up the speed of urbanization smart cities need this kind of smart model for smart management system. Our system is tested and it can be implemented and it will encourage others to contribute more this kind of projects towards the development and growth of society which makes people life easier and happier in future.

REFERENCES

- [1] Smart Bin Implementation for Smart Cities Narayan Sharma, Nirman Singha, Tanmoy Dutta
- [2] Michael Alexander, John Walkenbach, "Microsoft Excel Dashboards & Reports", Wiley; Second edition, 28 June 2013. (Book style)

- [3] Yann Glouche, Paul Couderc. A Smart Waste Management with Self- Describing objects. Leister, Wolfgang and Jeung, Hoyoung and Koskelainen, Petri. The Second International Conference on Smart Systems, Devices and Technologies (SMART'13), Jun 2013, Rome, Italy. 2013. (Conference proceedings)
- [4] Foday Pinka Sankoh, Xiangbin Yan, Quangyen Tran on “Environmental and Health Impact of Solid Waste Disposal in Developing Cities: A CaseStudy of Granville Brook Dumpsite, Freetown, Sierra Leone,” on Journal of Environmental Protection, 2013, 4, 665-670. (Journal or magazine citation)