

Solar Photovoltaic Powered Smart Garbage Monitoring System Using GSM/GPS

Poornima G R
Associate professor
Department of E&CE
Sri Venkateshwara College of Engineering,
Bengaluru, Karnataka, India
poornima_g_r@yahoo.com
Bindu Shree N
UG Students, Department of E&CE
Sri Venkateshwara College of Engineering
Bengaluru, Karnataka, India
bindushree.014@gmail.com

Aishwarya S
UG Students, Department of E&CE
Sri Venkateshwara College of Engineering
Bengaluru, Karnataka, India
aishuk317@gmail.com
Nayana K M
UG Students, Department of E&CE
Sri Venkateshwara College of Engineering
Bengaluru, Karnataka, India
nayanakm03@gmail.com

Abstract— The expansion in the population has resulted in enormous reduction in the quality of cleanliness concerning waste administration. In numerous spots, the dustbins are spilled over everywhere throughout the places and they are not cleaned at the appropriate time. Because of which the results are extreme. It incorporates flood of waste which brings about land contamination, the spread of sicknesses, likewise, it makes unhygienic conditions for individuals and makes the place odd. To avoid all such situations and keep up open tidiness and wellbeing, the proposed work has been planned for a 'Smart Garbage Monitoring' which shows that the dustbin is filled to a specific level by the trash and cleaning or disposing them involves quick concern. Distinctive LED's are allotted to demonstrate the levels of the dustbin. At the point when the garbage has completely filled the compaction module actuates and compresses the waste which is powered by solar. The GSM module sends the message to concerned authorities to clean the bin and with the help of GPS the exact location of the bin will be known. Proposed venture incorporates a compaction module, Arduino AT mega 2560, GSM Module and a Solar Panel.

Keywords— Solar panel, Arduino Atmega 2560, DC Motor, ultrasonic sensor, fire detecting sensor, GSM/GPS module, compaction module.

I. INTRODUCTION

Disregarding the way that the world is exceedingly created, we have another issue which is to be highly concentrated on i.e., waste management [1]. The dustbins being fully filled or littered everywhere is the daily scenario seen. This results in numerous irresistible ailments as immense variety of bugs, flies and mosquitoes sit on the garbage. A noteworthy issue in the village and city is garbage organization. Subsequently, a smart garbage monitoring system is a system which can remove this disadvantageous situation or atleast it can reduce the the arising issue to the lower level[2]. Littering of garbage in and around the city is one of the major problems faced today. As per the recent garbage collecting systems, a person and a truck is being assigned to collect the garbage in a particular area and in particular time.

This process is being done twice a week. In this process, a person assigned for the area has to collect garbage from each house and fill it in the truck. Problems aroused in this process are people who missed the disposal of garbage tend to dispose them in an empty space. This might cause harmful/contagious diseases. Also, the truck driver and the person who collects the garbage might face few health issues. This entire process requires more time, fuel expenditure and labor. Our Prime Minister of India, Sri Narendra Modi has exhibited the idea of executing in excess of 100 smart urban groups in India. "Swachh Bharat Abhiyan" is a national campaign started to spread the awareness and to keep up the tidiness in the lanes and streets urban communities, towns and town panchayats. Despite this activity by government, we watch the dustbins which are kept at open spots are underutilized or they are littered on the roads as well. This results in the harm of biological communities and threat to human life which prompts unhygienic condition. The essential reason behind this disadvantageous circumstance is the strategy of waste social affair which is most wild, complex, moreover uses much human power, time and cost which doesn't match with the current advancements [3]. This model is designed with a powerful compaction module which increases its internal capability to fill in more garbage than a normal one. As solar panels are used in this model, use of electricity can be avoided. It can be set up in each area such that it is monitored by the concerned authorities which gives a clear information about the bins and the garbage is collected as and only when required. The final model can be implemented for maintaining a neat and healthy environment making the city a clean looking and might also attract tourists.

To discontinue the tradition of the collection of Garbage, to reduce the man power, fuel and time consumption, smart work instead of hard work and to use renewable energy "Solar Photovoltaic Powered Smart Garbage Monitoring System using GSM/GPS" is proposed.

II. LITERATURE REVIEW

The specialists in paper [4] proposed the technique for waste management which is as per the following. The

container was interfaced with a framework consisting of microcontroller which had IR wireless device with a focal system that demonstrated the present status of the junk in the canister. The results were seen on an advanced cell based web programming language with a html page by using Wi-Fi. To decrease the cost, they simply used weight build sensors and in light of the transferring of data they have simply used a Wi-Fi module to receive and send the data. Finally the sensor could simply perceive the amount of waste present in the container yet not the level of waste.

The authors of [5] have proposed a smart alerting system which gives an immediate alert signal to the municipal web server for instant garbage clearance. The proposed work consists of ultrasonic sensor which is interfaced on to the ARDUINO UNO board to check the levels of the garbage filled in the dustbin. As soon as the maximum level is filled in the dustbin an alert message is sent to the web server and as soon as the garbage is cleared from the dustbin, the driver has to confirm that the given task of clearing the garbage from the dustbin was successfully done using RFID tag.+

In [6], the authors have designed a structure in which a Camera will be set at every waste accumulation point close by load cell sensor at base of the junk can. The camera will take persistent depictions of the trash can. An edge level is set which contrast the output of camera and load sensor. The comparison is finished with help of microcontroller. After examining the picture, a thought regarding level of trash in the can and from the load cell sensor, weight of trash can be known. In like manner, information is made ready, that is the controller watches that the farthest point level is outperformed or not. This is worthwhile to use however monetarily not dependable.

Internet of Things-based "Smart Garbage System" (SGS) is worked out to diminish the measure of eatables by the creators in [7]. In this proposed system, the smart garbage bins which consists of battery that can exchange information with systems using remote working systems, a switch and server assemble and researching the information for the benefits. Plus, the proposed system fuses diverse Internet of Things which aptitudes having the considerations of the client accommodation and manufactures of the battery long backup time and its life with two sorts of vitality effective undertakings of the smart garbage bins: stay lone movement and also collaboration dependent action. The smart garbage bins was considered to be as a pilot project in Gangnam locale, Seoul, Republic of Korea, for a one long year time period. The examination of the test displayed that the disadvantageous situation was reduced up to 33% of the measure.

In [8], the respected authors have come up with "Wireless solid waste management system for smart cities". This is designed in such way that municipal corporations can monitor the status of the dustbins remotely using web server. When the garbage is filled to the maximum level of dustbin, the message is being sent to concerned authorities by sending an alert SMS through GSM module which is placed in the dustbin. By this

method authorities can instruct the waste collectors to direct their vehicle to exact location of the dustbin.

The creators of [9] have done the comparison between present dustbins and the population in their country. The examination initially explores the treatment of garbage in a couple of regions of Dhaka city making using of typical components of GIS. Shockingly, the course of the present garbage bins has had every one of the reserves of being dominantly in grouped plan. Next, a perfect number of extra garbage bins was figured. It is being scene that the amount of present dustbins is not sufficient in the examination zone. The heights of damage and pollution that is caused by the present dustbins was figured using specialist components of GIS. It was discovered that each dustbin made tainting nature. The results subsequently gained would help the flow condition of the waste organization of Research Article Volume 6 Issue No. 6 Worldwide Journal of Engineering Science and Computing, June 2016 7114 <http://ijesc.org/Dhaka> city and in a perfect world put the required number of dustbins to foresee elevates contamination to condition.

In [11], the writers have proposed a work called "IOT based smart waste clean management system" which detects the level of waste collected in the dustbin by using sensors placed in them. Once it detects its maximum level authorities are alerted using GSM/GPRS modules. The sensor systems and GSM/GPRS module is interfaced on to the microcontroller. An android application is developed to monitor and to get desired information related to the different levels of the waste in dustbins in different locations.

The main objective of proposed work is, To design a solar based garbage monitoring system to monitor the garbage level and indicate levels of bin through Led's, To manage the waste collection of garbage in order to reduce impact of overflowing bins and maintain cleanliness in the surroundings, To provide an efficient and reliable solar powered waste compacting system, To reduce human efforts, time consumption and the operational cost of the entire usual process, To result in a healthy and waste free environment.

III. PROPOSED WORK

Rather than utilizing a lot of dustbins in an unusual manner across the city, fewer quantities of smart dustbins can be utilized. Utilizing just a single ultrasonic sensor rather than three separate sensors makes it reasonable as well as accomplishes a similar outcome. By making use of the compaction module, it gives additional space to fill the waste and furthermore diminishes the frequent transfer of junk by the municipality cleaners. This likewise minimizes the fuel utilization, labor and diminishes time utilization. As this proposed work incorporates solar energy, electric power utilization can be limited and has a long life. The propose work block diagram as shown in fig 1 and flowchart as shown in fig 2,

A GSM modem is a specific kind of remote modem that works with a GSM remote framework. It recognizes a SIM card, and works over a participation to a versatile

administrator, much the same as a mobile phone. GSM Modem sends and gets data through radio waves. Advantage is that it we can use its RS232 port to communicate and develop embedded applications. The GPS QUESTAR is an all in one GPS module where easy integration of the system can be done. The receiver tracks all satellites and gives precise satellite situating information.

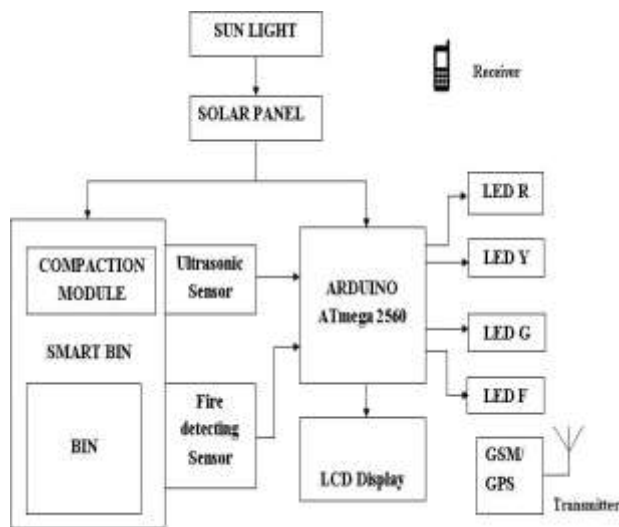


Fig 1: Block diagram of proposed work

Ultrasonic distance sensors utilize a sound transmitter and a receiver. This sensor creates an ultrasonic, regularly called a "ping", and then tunes in for reflections of the pulse. This sound pulse is electronically utilizing a sonar projector comprising of a signal generator, power amplifier and electro-acoustic transducer. A DC motor is a rotating electrical machines which changes over direct current electrical energy into mechanical energy. To minimize the speed and raise the torque output of the motor, reduction gear boxes are often required. The direction of voltage applied across the terminals controls the direction of motor rotating. The board used here is ATmega 2560. The mega 2560 is a microcontroller in light of the ATmega2560. It comprises of 54 computerized input/output pins, 16 simple data sources, 4 UARTs, a 16 MHz crystal oscillator, a USB association, a power jack, an ICSP header, and a reset button.

L293D is motor driver where DC motors can be interfaced which can be controlled in clockwise and in addition anticlockwise heading. Pulse width modulated signals to empower pins controls the speed of the motor. Solar panels are a PN junction which absorbs the sunlight and convert the sun's energy into electricity. Photovoltaic cell is the smallest unit of a solar panel which converts the solar energy. The Fire sensor is utilized to detect fire flares. The module utilizes Fire sensor and comparator to distinguish start up to a scope of 1 meters. It consists of a LED with 3 pin connector with 5 volt DC input voltage.

IV. METHODOLOGY

Today, the garbage accumulation is inefficiently performed physically, a few dustbins are nearly empty making waste gathering pointless and some are flooding causing unnecessary cleanup costs. This kind of in-effectiveness wastes the time and cash causing sway in the environment.

This task is an answer which gives a coordinated programming and hardware system to improve garbage accumulation by sparing time and cash while lessening the unfriendly impact on our condition.

This smart bin is a solar based waste compactable gadget in which bins can be inserted and expelled in view of its fill level. It plays out a savvy gathering of waste; screens fill level data progressively and send the data to the concerned authorities. Solar panel is being used to the system work. The smart bin is outfitted with a compaction module whose working is controlled by DC Motor. As waste accumulates the smart bin monitors the ultrasonic sensor, once the limit is reached it automatically activates the compaction cycle and compresses the waste which has been collected.

The LED indicator shows the fill level and working status of the bin. On the off chance that LED-G is shining then itShows the trash is in Level-1, LED-Y demonstrates Level-2 and LED-R demonstrates Level-3. When the LED-R glows the compaction module gets actuated and compresses the trash accumulated in the bin. At the point when no longer the compression is possible the LED-R gleams and GSM sends the message to the experts that the container must be cleaned immediately. With its intense compaction, the smart bin adequately builds its inner limit permitting holding more waste to fill in it than an ordinary one. In the case of fire, LED-O glows and the bin fire detecting sensor triggers the prompt warning of crisis to the concerned experts by sending continuous messages and additionally activates the compaction module to put off the fire.

The Smart bin transmits the information with the goal that concerned experts pick up the basic data, for example, fill level through GSM. It tells the experts when the collection of garbage is required and exact location of the bin will be shown. These bins can likewise be utilized as a commercial board for public awareness/vacancies through LCD display and furthermore from which the revenue will be created.

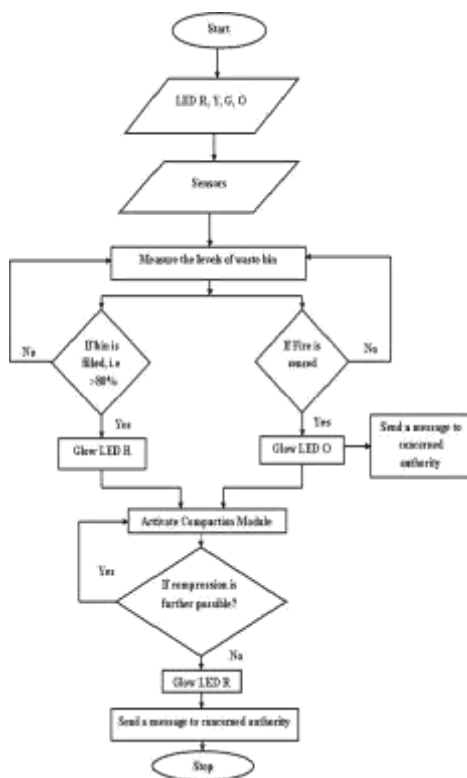


Fig 2: Flowchart of proposed work

The prototype model is as shown in fir 3,



Fig 3: Final Prototype model

V. CONCLUSION AND FUTURE WORK

The implementation of “Solar photovoltaic powered smart garbage monitoring system using GSM/GPS” was done. The smart bin here additionally has a feature of compaction module which compresses the garbage. It effectively increases its internal capacity allowing holding more garbage than a normal one and makes the bin available for further garbage disposal. This system basically detects three levels of the garbage and also the fire detecting sensor is used, these are indicated by the respective LED's. In case of fire, the fire detection sensor triggers the immediate notification of emergency to the concerned authorities, and also attempts to put off the fire by activating the compaction module. The compaction module continues to work till the garbage in the bin is no longer compressible, then it is signified that the bin is maximum and the SMS will be sent to the concerned authorities through the GSM module to empty bin. There is an incredible scope for the modifications of smart bin in future. The system can be upgraded by including new functionalities. With the addition of battery, this system can be used even during night times effectively in future. This system can be made durable and cost effective.

REFERENCES

- [1] Narayan Sharma, Nirman Singha, Tanmoy Dutta, "Smart Bin Implementation for Smart Cities", *International Journal of Scientific & Engineering Research*, vol 6, Issue 9, 2015, pp.787-789.
- [2] K. Vidyasagar, M. Sumalatha, K. Swathi and M. Rambabu, "Eco-friendly Environment with RFID Communication Imparted Waste Collecting Robot", *Journal of Academia and Industrial Research (JAIR) Volume 4, Issue 2 July 2015*, pp.43- 47.
- [3] Twinkle Sinha, Magesh Kumar, P.Saisharan, "Smart Dustbin", *International Journal of Industrial Electronics and Electrical Engineering, SRM University, India, vol-3, Issue-5, 2015*, pp.101-104.
- [4] S.S.Navghane, M.S.Killedar, Dr.V.M.Rohokale, "IoT based Smart Garbage and Waste Collection", *International Journal of Advanced Research in Elec- tronics and Communication Engineering (IJARECE) Volume 5, Issue 5, May 2016*.
- [5] S. V. Kumar, T. S. Kumaran, A. K. Kumar and M. Mathapati, "Smart garbage monitoring and clearance system using internet of things," *2017 IEEE International Conference on Smart Technologies and Management for Computing, Communication, Controls, Energy and Materials (ICSTM)*, Chennai, 2017, pp. 184-189.
- [6] Insung Hong, Sunghoi Park, Beomseok Lee, Jaekeun Lee, Daebeom Jeong, and Schyun Park, "IoT-Based Smart Garbage System for Efficient Food Waste Management", *The Scientific World Journal, Volume 2014 (2014)*, Article ID 646953.
- [7] Prof. R.M.Sahu, Akshay Godase, Pramod Shinde, Reshma Shinde, "Garbage and Street Light Monitoring System Using Internet of Things", *International journal of innovative research in electrical, electronics, instrumentation and control engineering Vol. 4, Issue 4, April 2016*.
- [8] K. Nirde, P. S. Mulay and U. M. Chaskar, "IoT based solid waste management system for smart city," *2017 International Conference on Intelligent Computing and Control Systems (ICICCS)*, Madurai, 2017, pp. 666-669.
- [9] M.T.H. Shubho, M.T Hassan, M.R. Hossain and M. N. Neema, "Quantitative Analysis of Spatial Pattern of Dustbins and its Pollution in Dhaka City—A GIS Based Approach", *Asian Transactions on Engineering (ATE ISSN: 2221-4267) Volume 03 Issue 04*.
- [10] Meghana K C, Dr. K R Nataraj, "IoT Based Intelligent Bin for Smart Cities", *International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169 Volume: 4 Issue: 5 IJRITCC May 2016*.
- [11] N. S. Kumar, B. Vuayalakshmi, R. J. Prarthana and A. Shankar, "IoT based smart garbage alert system using Arduino UNO," *2016 IEEE Region 10 Conference (TENCON)*, Singapore, 2016, pp. 1028-1034.