Smart Garbage Management System

Parth Jajoo
B.E Student
Dept. of Computer Engineering.
UCOE, Mumbai, India
parthjajoopj@gmail.com

Sushmit Mehta
B.E Student
Dept. of Computer Engineering
UCOE,Mumbai,India
mehtasushmit16@gmail.com

Akshata Mishra
B.E Student
Dept. of Computer Engineering.
UCOE, Mumbai, India
akshatamishra97@gmail.com

Vivek Solvande
Asst. Professor
Dept. of Computer Engineering.
UCOE, Mumbai, India
vivek.njoy1988@gmail.com

***Abstract*— Swacch Bharat Abhiyan and digital India is a campaign by the government of India to keep infrastructure of the country clean and to make the cities smarter. Day by day the population of India is growing rapidly. At the same time, the garbage also is growing at the same rate. As a result the garbage management is a problem that is quite hectic issue to solve. All Citizens of India are aware about the process followed to collect the garbage in the society. The Brihan Mumbai Municipal Corporation (BMC) sometimes fails to collect the garbage in some area. It may cause pollution which leads to sanitary issues and disease. Therefore, some of the major steps have to be carried out to solve the management of waste. The existing system is collection of garbage arbitrarily. So, some of the areas get left sometimes which may lead to unodoured smell and hence public health gets affected. The smell of the garbage can also be fatal to some of the little ones in some areas. The proposed system describes the solution to the existing drawback. The proposed system monitors the garbage bin. While monitoring the garbage bin it sends the notification to the authority about the level of garbage filled. If the lower authority ignores the notification, the next notification goes to the higher authority. The proposed system will help them to actually know that where and when to go to collect the garbage. The proposed system manages the effort to check the area by visiting there. The proposed project is quite helpful for both the Brihan Mumbai Municipal Corporation (BMC) and the citizens in that area by time to time interaction between Brihan Mumbai Municipal Corporation (BMC) and the proposed system. Hence the proposed system makes a better way to manage garbage.**

Keywords*— *Arduino UNO R3, Wi-Fi Module ESP 8266, Ultrasonic Sensor, 16x2 LCD Screen, IoT, Stakeholders

I.INTRODUCTION

The nation is growing widely but there is lack of public awareness towards the waste management. In public places, there is a very common situation where the garbage is overloaded and that garbage is spilled out. This ultimately leads to pollution. This also increases number of diseases as large number of insects as well as mosquitoes breed on it. There is a unsystematic and inefficient way method to disposal of garbage and in which we can see that there is an overflowing of the garbage from the bins. Research says that population growth is directly proportional to waste generation. The Overall Collection of the solid Waste expenditure 80-95% of the Survey. So to make a Digital India we should ensure a clean and a healthy global to protect the environment. So to overcome above problem the paper is written. Although the IoT concepts are older, but the implementation are still on the verge of the new born concepts. The great help that would be taken is from IoT (Internet of Things). The level of garbage is monitored constantly and hence it provides the efficient way to manage garbage. When the bin is ought to be full, the authority is alerted or notified. It's promoting dynamic scheduling and routing of the garbage collection is the approach to the world that it goes catchy. By comparing to the conventional static scheduling and routing, this dynamic scheduling and routing are said to allow operational cost reduction, by reducing the ingredients. This paper presents an alternative in managing domestic waste especially in flat areas via a smart garbage monitoring system, which is developed based on Arduino Uno. This system will monitor the garbage level in the bin and will alert the authority in the case where the bins are almost full.

II.LITERATURE REVIEW

In the paper title "Smart Dustbin-An Efficient Garbage Monitoring System," [1] have proposed a idea of between the existing dustbins and their population. This study and first part and the distribution of dustbins in some areas were taken palace of Dhaka city using averaging function and then the nearest neighbour functions of GIS . Remarkably, the procedure of the dustbins used today is one of the concern that

is concentrated on the smart dustbin. The insufficient of the existing dustbins will have the number of number which will be calculated in it.It has measure the extent of pollution which is caused by the existing dustbins was also one of the level of the research part. It is found that the dustbins are burnt with wastes and has disturb and has cause pollution to the environment.

In the paper titled "IoT Based Waste Management for Smart City" [2], it is being proposed in the paper that has the introduction and the combination of the integrated system combined with an RFI, IGPS, GPRS, GIS and web camera which will solve the problem of waste They will help us to analyzed the actual performance of the system.To the study of the paper we determine that the characterization of the waste and the current system of management activities. The paper gives us the highlights and a overview of the municipal solid waste management (MSWM) system of Municipality and it concludes with a few suggestions, which may be beneficial to the authorities to work towards further improvement of the current management system.

In the paper titled "Pawar2International Journal Of Engineering And Computer Science " [3] is being proposed system in that novel prototype of solid waste bin monitoring system using network. The architecture will uses Zigbee and GSM(global service module) it has the communication technology as well and a set of chosen sensors it will monitor the status of garbage bins in real time. The paper is divided into three parts lower tier, middle tier, upper tier. The low tier will have the sensor installed into the garbage bins, the middle tier will have the collection and then it that will give the information to the control station .In the upper tier we will store the data for future use. An algorithm of an energy is used in the first tier operation to collect the bin level.

In the paper “A Survey on Smart Garbage Management in Cities using IoT” [4] has proposed a dustbin which is interfaced with a microcontroller system in which we will having wireless systems along with central system showing the updated status of garbage, on web browser with html page by Wi-Fi Module. Hence the status will be updated on the html page. we have to reduce human efforts along with the enhancement of a smart city vision. Considering the modern technology, then we have a smart garbage bin can be costing but considering the amount of dustbin we all need in India, so there for then we have used sensors to reduce the cost and make it efficient in applications. And they used only a Wi-Fi module to send and receive data. But the consideration of weight sensor will have the detection of garbage level which was there in the dustbin. It will only detect the weight of the waste. The message can be sent directly to the cleaning vehicle instead of the contractor's office.

In the paper title “Garbage Monitoring System for Smart Cities,” [5] proposed a model for which there is the collection of garbage in real time. There is a network which established using the sensors, which are placed into the garbage bin and have set at a level. Sensors will send a signal to the nearest vehicle driver if the level of garbage is crossed to empty the bin and hence the bin gets updated from time to time. Fig. 3 shows the Architectural Diagram, which consists major three modules; Sensor Module, in which sensors are used to sense the garbage levels once and connected to the Arduino board, Communication Module, in which Bluetooth is used for communication between the sensors and Arduino Uno board, and last module is Analysis and Monitoring Module, in which collected is sent to the admin for analysis.

In the paper title “MATEC Web of Conferences 97, 01098,” [6], the level of the garbage in each bin is measured by using the sensor. The information of the sensor is then received and processed by the Arduino Board. It will determine whether the garbage level has been reached to the threshold. For the research part, two marks have been made as a reference. The first is at the 70% and the second is at 90 %of the total bin height. If the garbage level in the bin is crossing the first reference level, then the first warning message is generated and sent to the municipality. Besides, the green LEDs responds to alert all the residents at every floor. Next, if the garbage level in the bin is crossing the second reference level, then the second warning message is generated and sent to the municipality. In that case, all the people will be alert when the red LEDs are at the high at their data pins.

In paper title “Multipurpose Garbage Monitoring System Using IoT” [7] which paper have consideration of waste management issues been solved by smart bin, interface of GSM and ultrasonic sensor with the help of microcontroller based arduino people get best solution to management of waste this is replacement of traditional dust bin into smart bin one. ARM 7 have been used for controlling Zigbee and global communication, it gives the indication and sending the message using GSM. Sensors are placed in the bin. This bin made and wireless sensor node attached to dustbin send the signal to road side unit real time show status of the bin. Other same signal from RSU reaches the Garbage Collecting Vehicle (GCV) which arrives the particular place to collect garbage. Many technology uses to recycling the garbage. For unhygienic condition people face more problems regarding to health Such situation is control by providing unique ID to garbage bin and identify ID number is given to each can if bin is fill then send SMS to the server. In this paper uses microcontroller ATMEGA 16 and certain sensors like PIR sensor, Hall Effect sensor, solar sensor, and LDR sensor. These sensors are connected to microcontroller through an interfacing circuit and an amplifier. The output could view in LCD display, sensor is sense the light and presence sensor sense car or human so light turn on . This paper is based on efficient of automatic street lighting system based on low cost microcontroller controlling LED based on street automatically lighting levels control and light sensor, rain sensor, laser sensor and a set of the light emitting diode (LED) have been used brightness in of light will be directly proportional to number of traffic light Operate like ON or OFF accordingly during night and heavy raining or bad weather.

In Hiransahi Akminand[8] we are using two ultrasonic sensors which sense the level of garbage bin and two gas sensors which detect the harmful gases in the air .This sensors are

connected to the avr family microcontroller which is interfaced with LCD display which shows the status of bins .We also used Wi-Fi module which is used to transmit data for webpage applications .We are using one buzzer which gives beep whenever any dustbin is full. The whole system is powered by 12V transformer. Here, we are indicating Four levels Low, Medium, High and Full by using Embedded C programming. In first case when both the dustbins are empty webpage and LCD will display Low level. Then according to the different levels of garbage it will show Medium, High or Full level on LCD as well as webpage. When any of the dustbin is full it gives beep and when both the dustbins are full it gives loud beep. Along with this the web page and LCD will display the level of harmful gases in the surrounding. In this way Authority can collect the garbage whenever dustbin is full.

In paper titled "Bio-hydrogen, bio-methane, bioelectricity as crucial components of biorefinary of organic waste" [9], the aim of the work was to critically assess selected bioenergy alternatives from organic solid waste, such as biohydrogen and bioelectricity, to evaluate their relative advantages and disadvantages in the context of biorefineries, and finally to indicate the trends for future research and development. Biorefining is the sustainable processing of biomass into spectrum products viz. energy, materials, chemicals, food and feed. Series systems show a better efficiency than one-stage process regarding substrate conversion to hydrogen and bioenergy

The dark fermentation also produces fermented by-products (fatty acids and solvents), so there is an opportunity for further combining with other processes that yield more bio energy. Photo heterotrophic fermentation is one of them: photosynthetic heterotrophs, such as non-sulphur purple bacteria, can thrive on the simple organic substances produced in dark fermentation and light, to give more H_2. Effluents from photo heterotrophic fermentation and digestives can be processed in microbial fuel cells for bioelectricity production and methanogenic digestion for methane generation, thus integrating a diverse block of bioenergies. Several digestates from bio energies could be used for bio products generation, such as cellulolytic enzymes and saccharification processes, leading to ethanol fermentation (another bioenergy), thus completing the inverse cascade. Finally, biohydrogen and similar products came up to contribute in the improvements for solid organic waste management worldwide.

In paper titled, "Municipal Solid Waste Characterization and quantification as a measure towards effective waste management" [10] the aim of the study was to generate a comprehensive data at the regional and national level for use in planning and implementation of relevant waste management activities in Ghana. The study will also assess how well households in three different socioeconomic areas are able to separate their wastes into organic and non-organic wastes labeled on the bins as biodegradables, except papers (food waste, yard waste, wood and manure) and other wastes (paper, plastics, metals, textiles, rubber and leather and any other waste). Sorting and separation of waste using a one way separation system which basically sorted into 'biodegradable (except papers)' and all 'other wastes' was tested in this study and the outcome averaged for each study area. From the questionnaire administration results, out of 1000 respondents from all the study areas, 924 (92.4%) were willing to separate their waste while 4.8% were unwilling and 2.3% did not respond. The reason for their willingness to separate waste was because it had the potential for a cleaner environment, it was a good waste management practice and good for recycling but for those not willing to separate waste it was because there was no motivation to do it. Sorting and separation into the correct bins was effective in most of the areas as it averaged above 80% for the "biodegradables except paper waste" and above 75% for the "other waste". In the municipality however all the sorting and separation were below 60%. A nationwide average of 84% was obtained for separation into the biodegradable waste bin/bag and 76% for the other waste bin/bag. The high separation efficiency is an indication that the one way separation system employed was convenient for the participating households. This simple sorting and separation system could be recommended for communities learning to separate waste. It is therefore imperative for the MMDAs or city authorities or planners to start rolling out a source sorting process in the various cities. The organic fraction in the waste was the highest in the waste stream and ranged from 48% to 69%.

III. Proposed System

In this particular system the sensors which are mentioned will detect the level of the garbage. Once the level of the garbage reaches to a particular limit the system will give a notification to the particular authority via certain means.

In case where the bins are already full or almost full, it will generate a warning message which will be sent to the municipality via notifications, by using the WI-FI module. This will help them to actually know that where and when to go to collect the garbage. This manages the effort to check the area by visiting there. This project is quite helpful for both the BMC and the citizens in that area. Also when the lower authority ignores the notification, the next notification goes to the higher authority. This gives us the management of garbage efficiently. Also supporting android application is made to help the collectors give an update to the authority when the garbage is being collected. This establishes end to end communication.

Modules

Phase 1 describes the initial state where the dustbin is not used. When the dustbin comes into the process and when the garbage are being overflowed as well as the garbage spills out then the device and sensors which is installed in it and then the threshold height is set. The bin is in the use by the users.

Phase 2 starts as the threshold level is filled then the notification are then sent to the concerned authority via certain

means. This notification is helpful to authority to take the actions for that particular dustbin.

Phase 3 is the android application phase to back up the whole process as the acknowledgement. The collecting van after cleaning the garbage, android application is to be executed and click a button as acknowledgement.

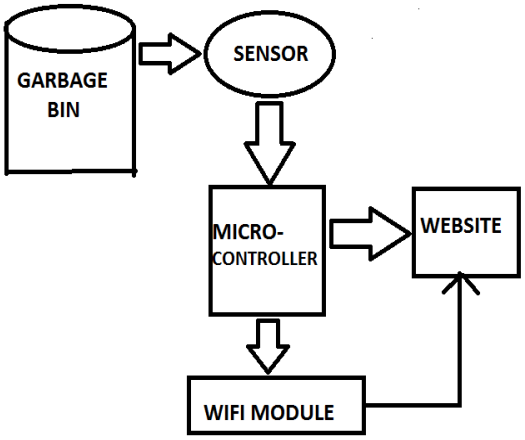

Fig.3. Block Diagram of Smart E-Dustbin

Arduino Uno R3:

The Arduino Uno R3 is a microcontroller board. It is based on the ATmega328. It contains everything needed to support the microcontroller. We just need to simply connect it to a computer with a USB cable or power it with a AC-to- DC adapte or battery to get started

Fig.4. Arduino Uno R3 Board

Wi-Fi Model ESP8266:

The ESP8266 Wi-Fi Module that gives Arduino Uno R3 microcontroller access to Wi-Fi network. Using this we can send or receive alert messages. Even the data collected can be used to determine the annual waste generated. The ESP8266 is capable of hosting all Wi-Fi networking functions from another application processor.

Fig.5. ESP 8266 Wi-Fi Module

Ultrasonic Sensor:

An Ultrasonic sensor is used to measure the level of garbage collected in dustbin, for which it measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back from object in our case soiled garbage. So, this sensor is used determine whether the dustbin is filled or not and accordingly would be used to send alerts.

Fig.6. Ultrasonic Sensor

Lcd Screen:

LCD Screens are used to display alert messages when the bin is full. So, people can use another bin. It consists of 16 pins which help to interface information to outside world.

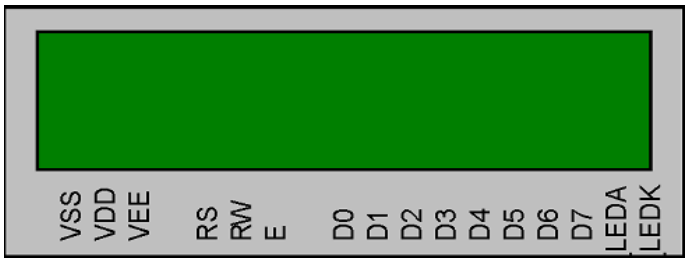

Fig.7. 16x2 LCD Screen

IV. Result And Discussion

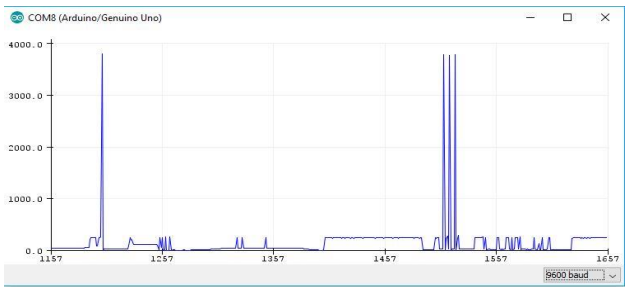

Fig.8. Graph for Ultrasonic sensors

oThe graph shown in figure 8 represents the relation between the height of the garbage filled and remaining. The garbage level when increased then the level of the graph degrades. The vice-versa is also true i.e. when the garbage level reduced then the level of graph goes up. As a result, both of the parameters are inversely proportional. This graph is one of the examples and there can be many such examples as different dustbin are installed at different places and each dustbin has different heights. The graph gives the pictorial representation of how exactly the flow is carried out. The graph also identifies the flow control of the project.

Fig.9. Implementation

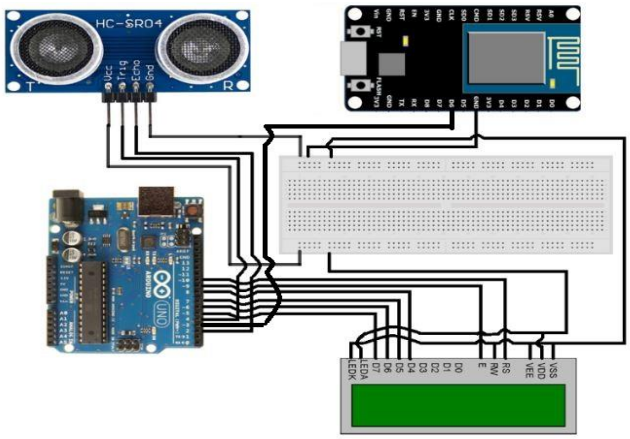

Fig.10. Circuit Diagram

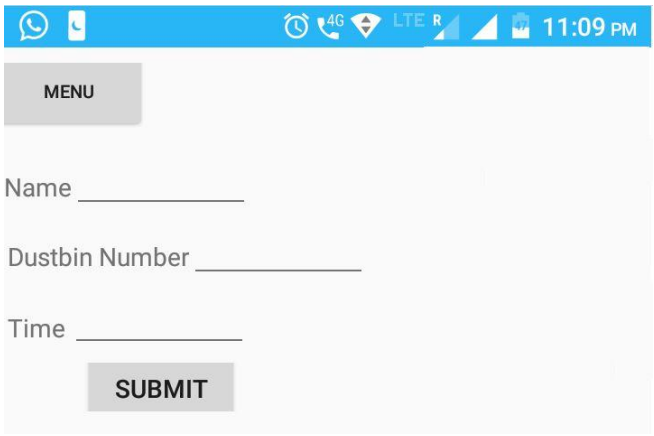

Fig.11. Android GUI

V. CONCLUSION

To fulfill the luxurious needs of humans and to save time for the busy world and to give proper service to all without any delay was the main concern which gave an idea for implementing this particular system. The Smart E- Dustbin can be used at public places, educational institutes, corporate world, governmental offices and many more, which serves in user friendly manner and helps in maintaining the world clean and green. The boon part is the end to end communication that it establishes in the real world. This type of communication of course satisfies all the stakeholders.

In this project, implementation is done only for a single bin. Integration of many bins each with a unique ID can be done by implementing the principles of IOT and creating database for each bin which can be maintained by using SQL technology and a login webpage is created to ensure authorized entries. Apart from this, dry trash bin and wet trash bin collecting plastic dry waste and biodegradable waste can be installed as there will less complexity for separation and recycling of waste if any. GPS module can be interfaced to each dustbin which sends the status and location of the dustbin, which can be displayed on the GUI maintained by the respective authority of the city. Further the whole system can be made water resistant.

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