

Design and Development of Automated Dumpster Management System

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Abstract: Waste is an important issue, which needs to be tackled smartly. Due to the improper disposal of waste, it causes many diseases. The improper disposal of waste causes water borne diseases like Hepatitis, Cholera, Dysentery, and Typhoid, air borne diseases like respiratory infections, allergies, nausea and vomiting due to foul smell, vector borne diseases like malaria and Dengue. This improper disposal of waste causes unhealthy environment which leads to approximately 12.6 million death every year. This diseases spread can be solved by proper disposal of waste. We can use modern technique to design the automatic garbage collection. The proposed system automatically open the lid of the dustbin when the human presence is detected. The shaking mechanism is implemented for evenly filling of the dustbin. The message is send to the corresponding authority to clean the waste.

Keywords: arduino, GSM module, Servo Motor, DC Motor, UltraSonic Sensor.

I. INTRODUCTION

The report of united nations Nation predicted that on 2025 there would be increase in the world population by 20% and population reach up to 8 billion [1]. This will increase the demand and consumption of commodities which also increases the generation of waste. So a large scale waste management system is needed. The dustbins are kept at many places in the city and the municipal authorities clear the waste in the dustbin at the regular intervals. Sometimes the dustbin may not be filled and they turn in empty handed. Sometimes waste fills fast, before their reach and degradation of waste will leads to the growth of bacteria and viruses. This creates air pollution which creates respiratory diseases like Chronic Obstructive Pulmonary diseases (COPD), asthma, etc.

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The 90% of the people suffers from Chronic Obstructive Pulmonary Disease (COPD) because of the foul smell caused by the garbage and about 235 million suffers from asthma due to unpicked waste [2]. The authorities spent on collection and transfer of waste is 75–80% of the solid waste management budget allocated by the government [3]. In cities, physically checking is waste and it does not suit to the modern technical era in which everything is getting automated and systematic to put the waste in the dustbin. So, some modern technology is proposed to the automatic garbage collection.

The proposed system uses the ultrasonic sensor to detect the level of the dust bin and the servo motor to automatic opening of the dustbin when the person is approaching near the dustbin. The DC motor to shake the dustbin for evenly filling of the dustbin. This is explained in the below chapters.

II. LITERATURE REVIEW

Ankitha S, Nayana K B, Shravya S R, Smt. Lovee Jain[4] proposed the use of id number to all the dustbin. When the bin is full the SMS is sent to the server from where all the garbage collection vehicle is allocated. The load cell is used to weight the dustbin. When the weight cross the level the SMS is sent. After that, the garbage collection vehicles is arrived at the location. The proposed system focus mainly on the traffic management when compared to waste management

Balamurugan S, Abhishek Ajith, Snehal Ratnakaran, S. Balaji, R. Marimuthu, proposed projected work about the uses Arduino (Uno) board, a GSM module, a servo motor, a gas sensor, a LED+ and an ultrasonic sensor. The system continuously monitors the level of the can and the level of decomposition of that trash inside. On either the level or the decomposition has reached its predefined limit, the trashcan will be locked and a message will be sent to inform the authority so that the trashcan collected. The servo can be unlocked by the authorized personnel by resetting the system or by serially communicating with the microcontroller. The sensor and that of the gas sensor can be varied on coding it as per the requirement. The main point of this paper is that there must be collection of waste frequently when the decomposition is obtained and three may also cause damage in the gas sensor [5].

Thompson A.F, Afolayan A.H, Ibidunmoye E.O [6] projected work about the internet-based platform for the organization and monitoring of waste collection, discarding and carrying etc. This is comprised of the client, server and storage. The client is the device which can access the pages and forms used by web application e.g. PDAs, phones, laptops etc. the desktop is a program that launches the application and makes it performs over the internet. In this, the back-end system is the web server and database management system that supervise the data used by the function to monitor the movement of data between user and system. This paper intimates that it only shows the location of the bin in the web page.

SauroLonghi, DavideMarzioni, EmanueleAlidor, Gianluca Di Bu` o, Mario Prist, Massimo Grisostomi and MatteoPirro [7] proposed, garbage collector supported by using sensor motes which is providing information and status about the bin and also sending the retrieved data through DTN (Data Transfer Nodes). This bin has a custom prototype instead of basic installation of sensor nodes. The whole system is designed for allowing heterogeneous sensor for communication. A wireless sensor network is helped for controlling bin by gathering data from motes. This paper mainly tells the information about the bin is not directly transferred to the server or to the client; it needs to be sent through the Data Transfer Nodes.

III. ALGORITHM

- Start.
- The ultrasonic sensor automatically detects when the person is near to the dust bin to put the waste and the servo motor helps to open the bin.
- When the waste is put into the dustbin, it automatically closed.
- The sensor fixed in the lid is used to monitor the level of the garbage
- When the garbage is throw in to the dustbin ,it get shaken by the dc motor
- Repeat the process
- When it reaches 80% intimation is given
- When it reaches the level 100%, the SMS is send to the corresponding cleaning person to drive the vehicle to clean.
- End

IV. FLOW CHART

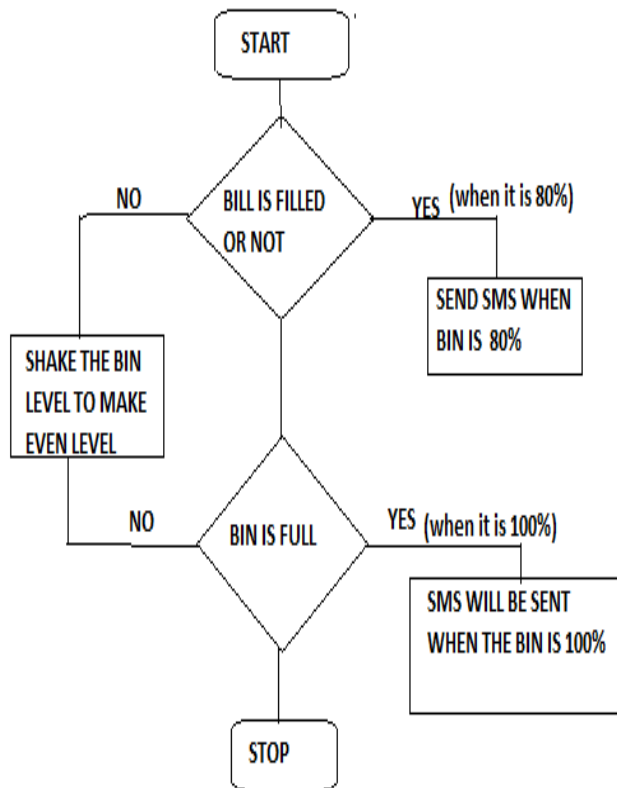


Fig. 1 Flow chart of the project

V. DESIGN OF SMART DUSTBIN

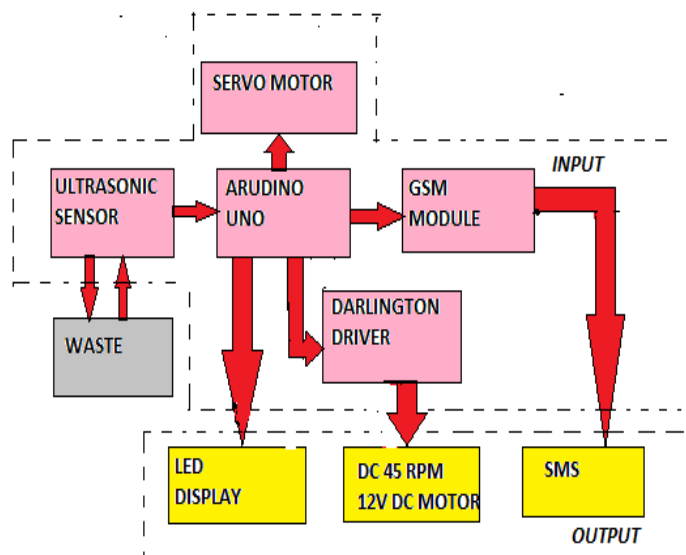


Fig. 2 The Block diagram



The diagram (Fig.2) describes the block diagram of the dumpster management system. The components programmatically connected through ARDUINO UNO. The components are Darlington driver, GSM Module, Servo Motor, Ultrasonic sensor. The level of the garbage is get through the devices LCD display, DC Motor, SMS through GSM.

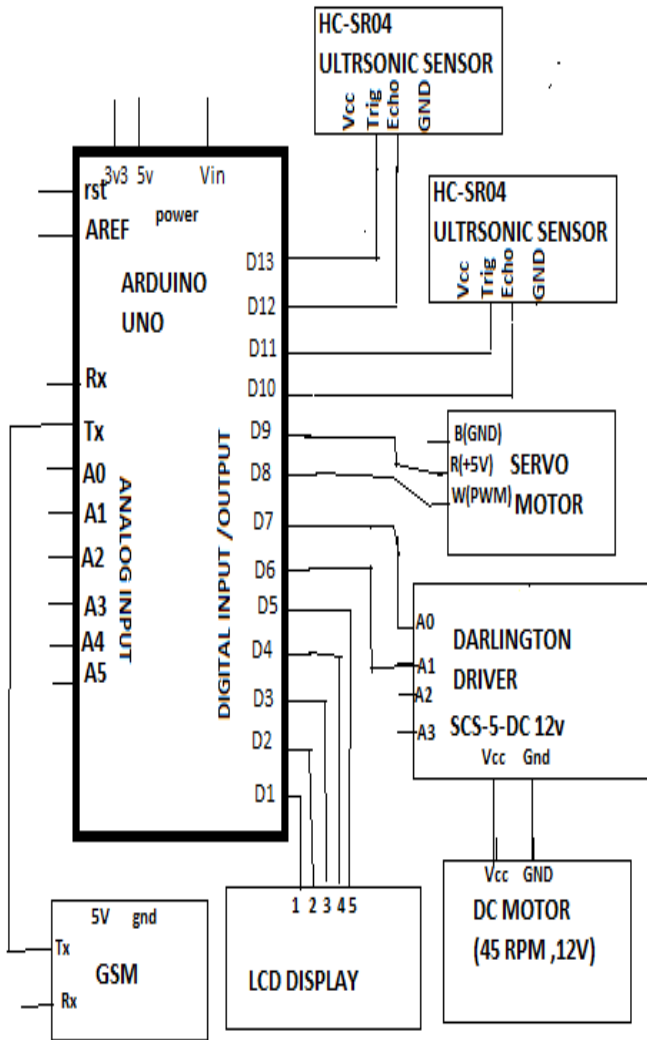


Fig. 3 The Interface Diagram with sensor and motors

The diagram (Fig.3) describes interface diagram of the components with arduino. The program are programmed in the Arudino Uno. The two ultrasonic sensor(HC-SR04) is used. The first one is fixed inside the lid to measure the level of the bin. The second one is fixed in the front side of the bin to detect the obstacles(i.e Human Detection) which is illustrated in the below diagram(Fig.4). The servo motor is used for the automatic opening and closing of the dustbin. When the obstacle is detected through the second ultrasonic sensor, the lid of the bin get opened. When we put the dust

inside the bin , it automatically closed which is illustrated in the below diagram. The servo motor is fixed in the edge of the lid for the automatic opening and closing

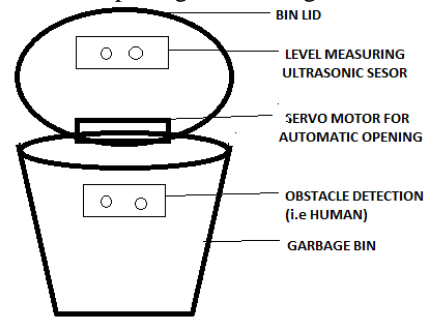


Fig. 4 The Design of the Dustbin

The Shaking mechanism is described in Fig.5 and Fig.6 . It illustrates that the waste which is unevenly filled makes the height to reaches quickly and intimated but maximum spaces are not filled. To fill this space, the dustbin is shaken to make it even which helps to fill most space.

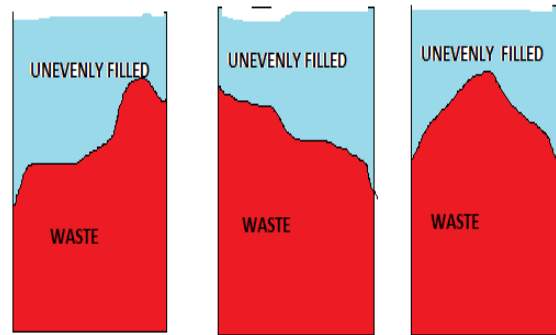


Fig. 5 Before Shaking Mechanism

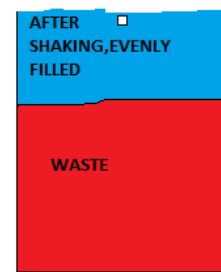


Fig. 6 After Shaking Mechanism

The dustbin is fixed in the weightless box. Under the weightless box, the DC Motor 12V DC 45 RPM is used for shaking mechanism which is described in Fig.7. When the garbage is put into the dustbin, the shaking mechanism get initiated and shakes for 5 seconds. The Darlington driver(SCS-S-BC12V) is used for driving the motor.



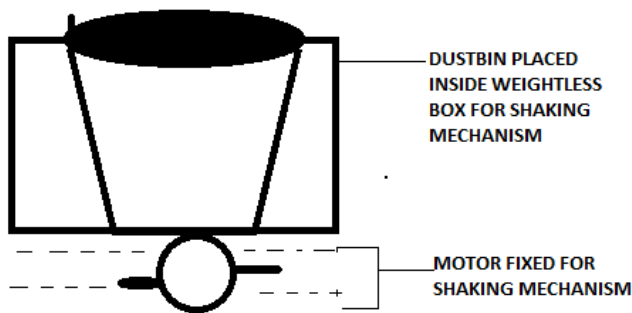


Fig. 7 Fixation Motor for Shaking Mechanism

It is designed on the basis that when dustbin get filled to 80%, the intimation is send to the corporation authority through GSM[4] and when the dustbin gets filled for 100%, the intimation is send to the corporation authority and dustbin cannot open for further detection(i.e human). The intimation sending can be viewed LCD Display. This helps the municipal person to collect the waste.

VI. WORKING OF SMART DUSTBIN

The ultrasonic sensor is used to detect the level of the bin is fixed inside the lid. For every operations, the level gets detected when we put the dust but when it reaches 80% or 100% it gets intimated. The Ultrasonic sensor which is fixed in front side of the bin get activated when the person is willing to put the dust. It activates the servo motor for automatic opening of the lid of the dustbin. When the waste is put into the dustbin it automatically closed. The below diagram illustrates above further process Fig7 and Fig.8.



Fig. 8 LCD intimation of Dump open and Dump Close



Fig. 9 Fixing of the Ultrasonic Sensor

After putting the garbage the shaking mechanism get initiated. The Darlington Driver get initiated which initiates the DC Motor for shaking mechanism. The Fig.10 tells how the dustbin is fixed inside the weightless box (Fig.10).



Fig. 10 DC Motor for Shaking Mechanism

The above steps are continued till all the dust gets filled for 100%. When it reaches 100% the lid of the dustbin cannot open for the human detection. When the level of the bin reaches 80%, it gives intimation via GSM which can be viewed through LCD. When it reaches 100%, it gives intimation to collect the dust. The below digram illustrates the fuction of the ultrasonic sensor which detects the height and message sending by GSM(Fig.11 , Fig.12, Fig.13).

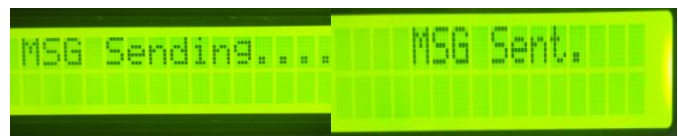


Fig. 11 Message sending for 80% and 100%

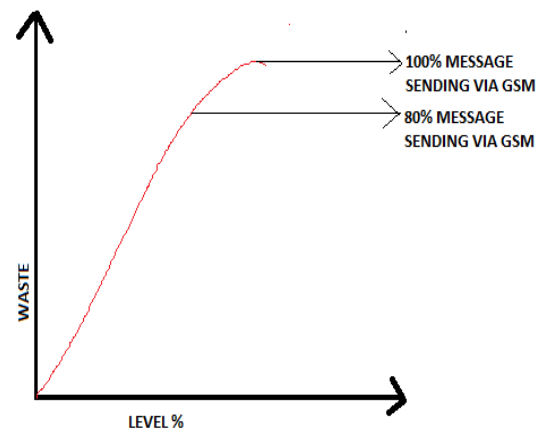


Fig. 12 Graphical representation of the level and waste

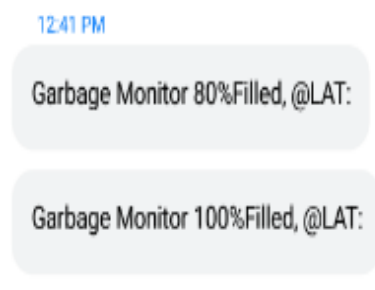


Fig. 13 The message send to mobile via GSM



The below tabulated form explains about the overall process of the bin (Fig.14). This illustrates the corresponding process and their shaking mechanism.

LEVEL IN %	INTIMATION THROUGH GSM	BIN FULL OR NOT	SHAKING MECHANISM
0	NO	NO	YES
40	NO	NO	YES
60	NO	NO	YES
80	YES	NO	YES
100	YES	YES	YES

Fig. 14 The level waste and response

VII. CONCLUSION

The automatic garbage collection project helps us to intimate the level of the dustbin when it reaches the particular level. The shaking mechanism is used for maintaining the even level of the dustbin to fill more waste. When this mechanism is not installed, there is only unevenly filling of the dustbin. The automatic opening of the dustbin is used to protect the germs spread outside. This project deals mainly on the non-spreading of the germs, to fill more dust and avoid unevenly filling, the automatic opening of the dustbin. This can be further developed by fixing solar panel for power consumption

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