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**INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH
TECHNOLOGY**
**REVIEW OF AUTOMATED SOLID WASTE COLLECTION & DISPOSABLE
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ABSTRACT

The on-going present day scenario have subsisted provocation to persist its existence due to expressly and meteorically increasing population, urbanization and negligence towards waste. The smutty, illegitimate& irregular handling of waste and filth is increasing at an inchmeal rate. The day by day piling solid waste is deteriorating the environment and the denizens of that place. Day by day we are progressing and becoming smart but our management techniques are still obsolete and we are pinned to old traditional waste ejection and disposal modus operandi. This snags and hurdles necessitate a genuine & conventionally established solid waste and rubbish management and governing structure i.e. a well maintained automatized waste monitoring and ejecting methodology or system. The paper bestows an IOT & ML rooted framework for palpable actual self-activating, self -regulating and self-executing garbage survieling and jettisoning system. A multifarious model which employs features of alerting end-users, tracking vehicles, trash bin levels and alerting the zonal municipality employee. The design and plan of quick-witted intelligent robot bins having learning ability will be the onset of a devastating change in solid waste management system. A bin with intelligent logics and sensors to govern waste. The astute bin concept ameliorate Quandary to an another level by smashing & squashing trash on an exhaustive or large scale. This bins or canisters will tends to manage waste so effectively that it irradiates all diseases and problemsand will maintain and promote a clean environment.

Keywords: Automatization, IOT, Quandary management, self-learning, astute bin, waste squashing.**1. INTRODUCTION**

The intelligent bin concept is an IOT-Internet of things based mechanism. Internet of things is the cluster of worldly physical objects approachable via the net. IOT is the notion of objects hitched and anchored to the web. In Internet of things, the locution 'things' principally refers to sensors or objects which are ample proficient to assemble data and to convey it over the web automatically without physical human intercession. The engrafted & implanted technology in the sensors i.e. objects help them to intelligently and logically sound to intramural and extraneous environs and ultimately an apt and felicitous decision is computed after the analysis of sensor's data. It models and empowers an object to monitor, recognize and study a state by itself with no manual assistance. The objects are efficient enough to exhibit them electronically and hence can be operated from any part. IOT helps in data study and scrutinization to prepare new conclusions and to generateapt results. It helps in cost optimisation, better performance & processing, expanded employment and easy tracking which saves time and money. IOT aids in generation of smart results, running hour intuitions. The proliferating data, escalating need and improving processing can be handled efficiently using IOT. It connects inanimate and living things together. IOT is an escalating automatic data squashing system having a tight clutch on net, discerning, data and artificial intelligence to work effectively and for generation of befitting result. The most important part of IOT is things i.e. sensors example: temperature sensors, proximity sensors, image sensors, light sensors, gas RFID sensors etc. IOT has now become a platform for communicating digitally at global level. It bestows to implement physical world into an automatic computer-based self -learning system using internet, machine learning algorithms and sensors to read the data.

The motive of the paper is to present the requisites for an astute smart bin concept and to make attempts to redefine & refurbish the contemporary system of bins in the environ. This IOT based conceptualization of bin is

a multitudinous rostrum for a litter free surrounding. It is a wireless technology which reports bin status to user & sweeper, manage route optimisation and administer the whole process of waste management.

The paper posits an astute bin idea which will monitor waste type, reports the end users and maintain its own status. It will have an automatic compaction mechanism and an automatized waste segregator mechanism. It maintains and senses the bin status and its waste filling level with the help of an ultrasonic sensor. The bin location can be tracked with GPS and the end users can be informed via GSM hinged to it. The whole program and process is boiled up in a microcontroller using Aurdino software. The Aurdino board is a motherboard or an interface between the sensor and other modules. It will dispatch a mail or text to the municipal corporation when the bin is 80% full. The operatives can govern and eyeshot the actual fill level of bins. It will even trigger an automatic updation in the status when the bin will be emptied. It will be transportable and a green collar product. The hopper design will even maintain pests and avert overrunning garbage and flurrying trash. This mechanism is based on WSN-wireless sensor network technology which will serve as a boon to sustain the challenges of MSWM-municipal solid waste management. IOT is the step used here for Automatization. This concept will catalyse and promote waste management and disposal system.

2. PROBLEM CLINCHED

To contrive & enact a intelligent astute bin constructed on an IOT platform assisted by the use of microcontroller equipped rostrum of Aurdino Uno board which function as an coupler and interface between sensors and modules and will punctually report about the receptacle to municipal or zonal authority who take care of the waste governance of that area.

3. LITERARY REVIEW

This is not an authentic or indigenous idea, for an astute intelligent bin rather this concept existed for many years. This concept of smart bin proposed in this paper is a new on or is a refurbishment of the existing one.

This is, rather an aboriginal scheme of a bin with sensors, modules, self-learning techniques of data.

[1].In a state of the art paper by P. Suresh, Vijay. Daniel, R.H. Aswathy, Dr. V. Parthasarathy on Internet of Things. It supplied the understanding of IOT and all the necessities regarding it. The genuine sharp-witted domain and various routines regarding IOT.

[2]. IOT based intelligent bins for smart cities by Meghana K C & Dr. K R Nataraj. She posited the idea of ultrasonic sensors in order to get to know the status of bin empty/full. She presented a bin with three sections and three ultrasonic sensor at each .At any moment the trash cross the extent then sensor sense the data and the data about bin is analysed. Now according to her concept, a problem arises in the scene that ultrasonic sensors at such variety of sections will increase the cost & expenditure of the bin and the prospects of sensors being corrode and getting vandalize due to waste raises.

[3].Alexey Medvedev, Petr Fedchenkov, Sergei Khoruzhnicov, Arkady Zaslavsky, Theodoros Anagnostopoulos, Waste Management as an IOT-Enabled Service in cities; and their Top-k Query based dynamic scheduling for IoT-enabled small city waste collection. The latter paper proffered the idea of organised dynamic scheduling necessitated for bin sponging and rinsing. The mechanism of TOP-K Query enabled us to do priority based scheduling and collection of waste and the former offered a study and an analysed report on present day bin status and the remarkably serving population. The survey supervised in Dhaka and the report surveyed & stated the dimensional allocation and issuance of dustbins. The final conclusion clinched proclaimed that the bins are visualised in bunch and clutches observed via GIS and a severe need of ancillary bins. According to survey report this supplementary bins will even amenities in pollution control.

[4].A Novel Approach to Garbage Management using Internet of Things for Smart cities by H. Manasi kasliwal and Smit kumar Suryawanshi; it gave the info exchange mechanism using WSN technology for analysis and decision making at last. This concept has been implemented at Gangnam district, Seoul, Korea as pilot project and this examination pictured that food waste can even be reduced by 33%. Better battery lifetime, Stand-alone operations and cooperation based operations.

[5].The Smart Garbage Collection Bin Overflows Indicator Using Internet of Things by Vishesh Kumar Kurrel. In the state of this he pictured an idea of constructing a framework in which a surveillance cam will be installed at every bin sites together with the weight sensor below the garbage canisters. The cam will continuously snapshots the scene of bin. The limen limit is laid that is periodically juxtaposed with the camera produce and

sensor output via a microcontroller and accordingly information gets processed and analysed. This is a good concept but economically and practically it is completely unreliable.

[6]. In the state of art paper, Smart Garbage Management System by Vikrant Bhor, Pankaj Morajkar, Maheshwar Gurav, Dishant Pandya ; It assisted with supplementary details and schemes needed for flow governance of garbage while squashing.

[7]. The paper “City Garbage collection indicator using RF(Zigbee) and GSM technology” supplied the information for the module necessitated for the data transfer to the end user’s place. Initially our work depends on GSM technology but later on the use of Wi-Fi module will come in the scenario for much better efficiency.

[8]. In State of the study paper “IoT-Based Smart Garbage System for efficient food waste management by Insung Hong, Sunghoi Park, Beomseok Lee, Jaekeun Lee, Daebeom Jeong, Sehyun Park”, a full image was pictured about functioning of IOT sensors and the concept of smart bins with food management.

Specifications:

The intelligent astute bin is constructed on an Arduino rostrum interfaced with GSM modem. It is equipped with a PIR sensor & ultrasonic sensor

4. REQUIREMENTS

- GSM modem
- Servo motor
- Arduino Board
- Ultrasonic Sensor
- Connecting leads
- Breadboard
- PIR Sensor

🔧 Arduino Uno:

Arduino is an open-source platform comprises a combination of microcontroller i.e. a physical programmable circuit board and a software, or IDE (Integrated Development Environment) that sprints on your device, and is utilized to write and run codes & to sync them to the board. The Arduino foremost gadget to commence with any IOT project. Arduino Uno is a microcontroller board established on the ATmega328P.

It has 14 digital input/output pins, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to assist the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

It is based on a Microchip ATmega328P microcontroller and developed by Arduino.cc. It is programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable. It can be powered by a USB cable or by an external 9 volt battery, though it accepts voltages between 7 and 20 volts. It communicates using the original STK500 protocol.

The Arduino IDE comprises of a text editor for writing code, a text console, simply a message area with a set of tools and a series of menus. The codes or programs written via Arduino IDE are called sketches and they possess an extension .ino, The editor provides features like cutting, pasting, searching, copying, undoing, replacing, saving etc... Generally the code is written using programming languages as C/C++.



Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	54(15 for PWM output)
Analog Input Pins	16
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	256 KB (8 KB utilised by boot loader)
SRAM	8 KB
EEPROM	4 KB
Clock Speed	16MHz
Length	101.52 mm
Breadth	53.3 mm
Weight	37 g

✚ **GSM modem:**

The GSM-Global System for Mobile Communications is a second generation (2G) digital mobile telephone standard using a variation of Time Division Multiple Access (TDMA) & a standard for mobile networks. The GSM standard works on three different carrier frequencies: the 900 MHz band, which was used by the original GSM system; the 1800 MHz band uses digital signaling and speech channels. GSM stands for Global System for Mobile Communication. It is a digital cellular technology used for transmitting mobile voice and data services. The concept of GSM emerged from a cell-based mobile radio system at Bell Laboratories in the early 1970s. GSM is the most widely accepted standard in telecommunications and it is implemented globally. GSM is a circuit-switched system that divides each 200 kHz channel into eight 25 kHz time-slots. GSM operates on the mobile communication bands 900 MHz and 1800 MHz in most parts of the world. In the US, GSM operates in the bands 850 MHz and 1900 MHz. GSM makes use of narrowband Time Division Multiple Access (TDMA) technique for transmitting signals. GSM was developed using digital technology. It has an ability to carry 64 kbps to 120 Mbps of data rates. GSM provides basic to advanced voice and data services including roaming service. Roaming is the ability to use your GSM phone number in another GSM network.

The GSM network can be divided into three broad parts

- The subscriber carries the mobile station
- The base station subsystem controls the radio link with the mobile station
- The network subsystem performs the switching of calls between the mobile users and other mobile and fixed network users

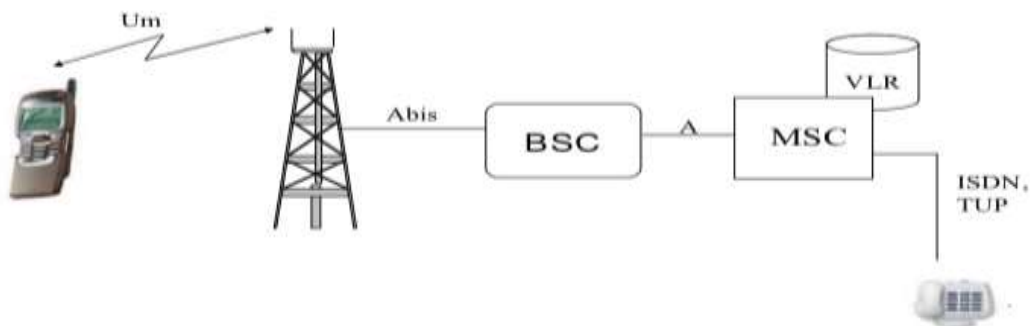
A GSM network comprises of many functional units. The GSM network can be broadly divided into:

- The Mobile Station (MS)
- The Base Station Subsystem (BSS)
- The Network Switching Subsystem (NSS)
- The Operation Support Subsystem (OSS)

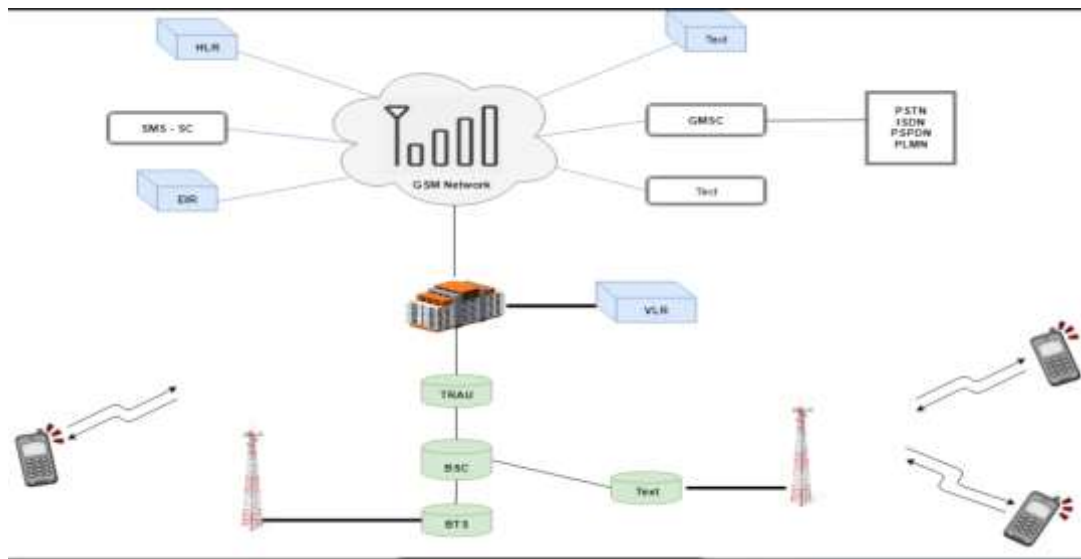


The additional components of the GSM architecture comprise of databases and messaging systems functions:

- Home Location Register (HLR)
- Visitor Location Register (VLR)
- Equipment Identity Register (EIR)
- Authentication Center (AuC)
- SMS Serving Center (SMS SC)
- Gateway MSC (GMSC)
- Chargeback Center (CBC)
- Transcoder and Adaptation Unit (TRAU)



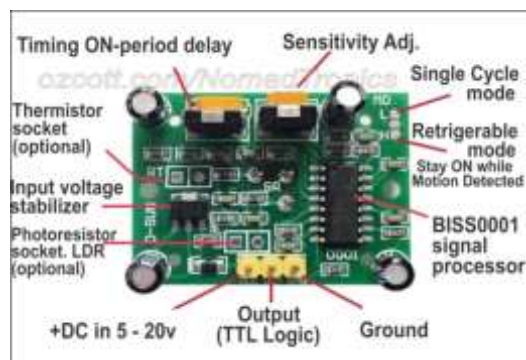
In GSM system the mobile handset is called Mobile Station (MS). A cell is formed by the coverage area of a Base Transceiver Station (BTS) which serves the MS in its coverage area. Several BTS together are controlled by one Base Station Controller (BSC). The BTS and BSC together form Base Station Subsystem (BSS). The combined traffic of the mobile stations in their respective cells is routed through a switch called Mobile Switching Center (MSC). Connection originating or terminating from external telephone (PSTN) are handled by a dedicated gateway, Gateway Mobile Switching Center (GMSC).



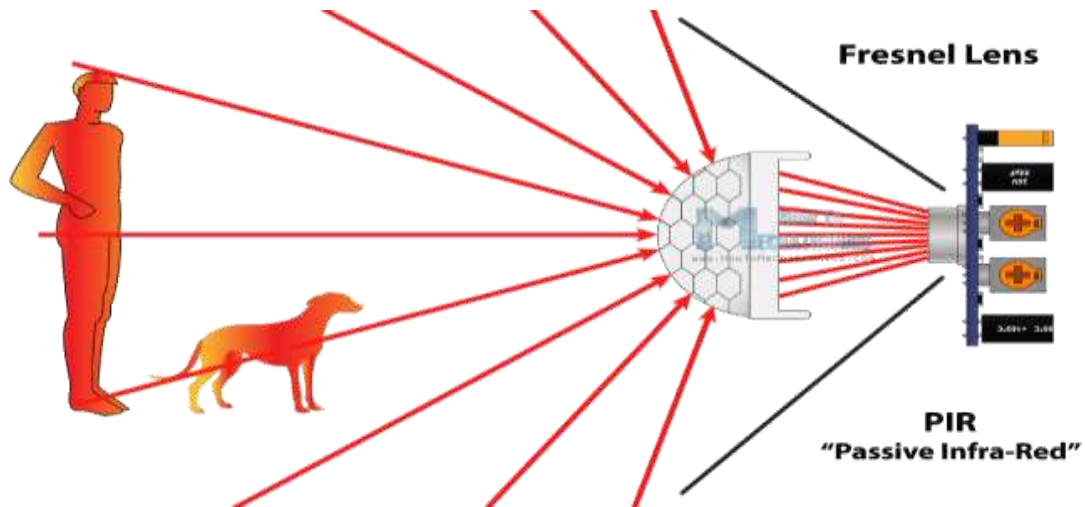
PIR Sensors:

The term PIR is the short form of the Passive Infrared. The term “passive” Indicates that the sensor does not actively take part in the process, which means, it does not emit the referred IR signals itself, rather passively detects the infrared radiations coming from the human body in the surrounding area. The detected radiations are converted into an electrical charge, which is proportional to the detected level of the radiation. Then this charge is further improved by a built in FET and fed to the output pin of the device which becomes applicable to an external circuit for further triggering and amplification of the alarm stages. The PIR sensor range is up to 10 meters at an angle of +15o or -15o.

The PIR sensors are more complicated than the other sensors as they consist of two slots. These slots are made of a special material which is sensitive to IR. The Fresnel lens is used to see that the two slots of the PIR can see out past some distance. When the sensor is inactive, then the two slots sense the same amount of IR. The ambient amount radiates from the outdoors, walls or room, etc.



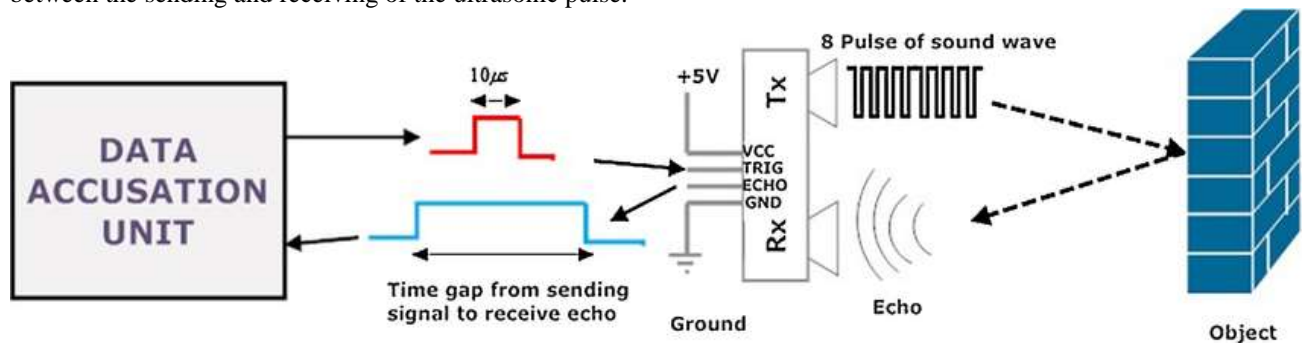
When a human body or any animal passes by, then it intercepts the first slot of the PIR sensor. This causes a positive differential change between the two bisects. When a human body leaves the sensing area, the sensor generates a negative differential change between the two bisects. The infrared sensor itself is housed in a hermetically sealed metal to improve humidity/temperature/noise/immunity. There is a window which is made of typically coated silicon material to protect the sensing element.



✦ Ultrasonic Sensors:

Ultrasonic sensors measure distances based on transmitting and receiving ultrasonic signals. An ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves.

An ultrasonic sensor uses a transducer to send and receive ultrasonic pulses that relay back information about an object's proximity. High-frequency sound waves reflect from boundaries to produce distinct echo patterns. Ultrasonic sound vibrates at a frequency above the range of human hearing. Transducers are the microphones used to receive and send the ultrasonic sound. Our [ultrasonic sensors](#), like many others, use a single transducer to send a pulse and to receive the echo. The sensor determines the distance to a target by measuring time lapses between the sending and receiving of the ultrasonic pulse.



✦ Servo motor:

A **servomotor** is a [rotary actuator](#) or [linear actuator](#) that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. A servomotor is a [closed-loop servomechanism](#) that uses position feedback to control its motion and final position. The input to its control is a signal (either analogue or digital) representing the position commanded for the output shaft



✚ **IR Sensors:**

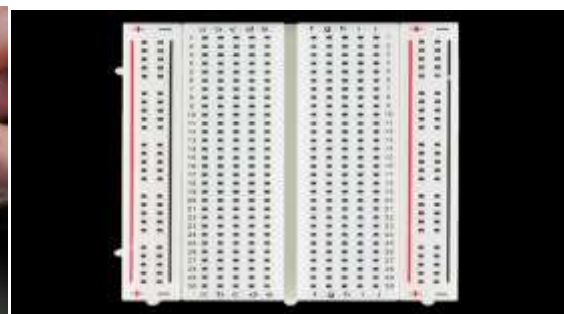
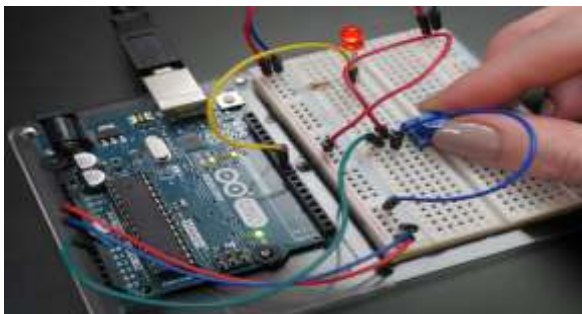
An infrared sensor is an electronic instrument that is used to sense certain characteristics of its surroundings. It does this by either emitting or detecting infrared radiation. Infrared sensors are also capable of measuring the heat being emitted by an object and detecting motion. All objects which have a temperature greater than absolute zero (0 Kelvin) possess thermal energy and are sources of infrared radiation as a result.



✚ **Weight Sensor:**



✚ **Breadboard:** It is a construction base for prototyping whole electronics.



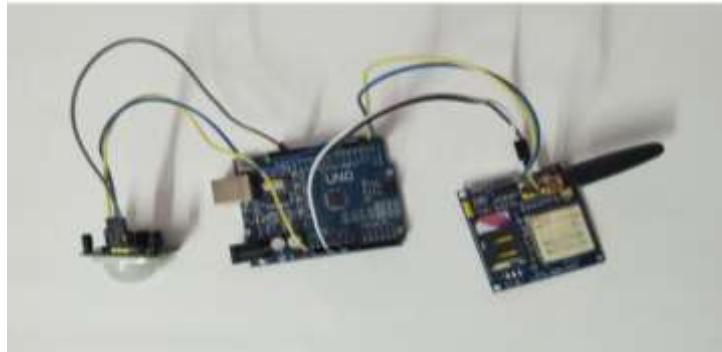
✚ **Connecting leads:**



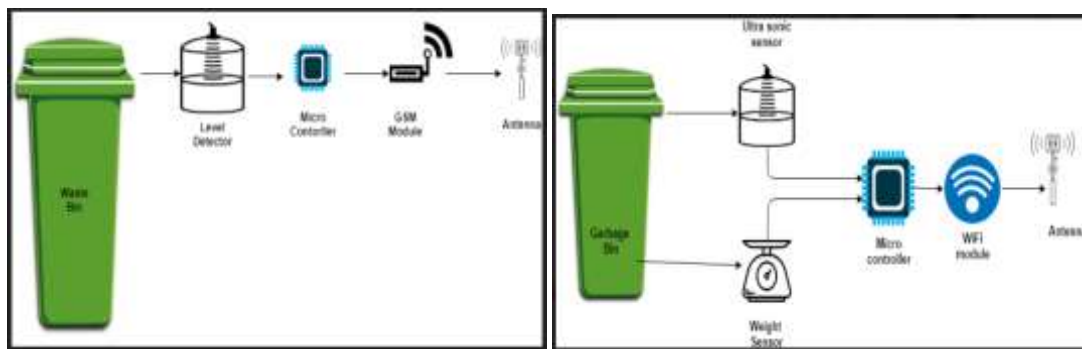
System Design:

Communication and conveying information to end user's and municipal authority is one of the main tasks at the end of the work. The usage of Bluetooth mechanics for shuttling news to the end user's but this technology is

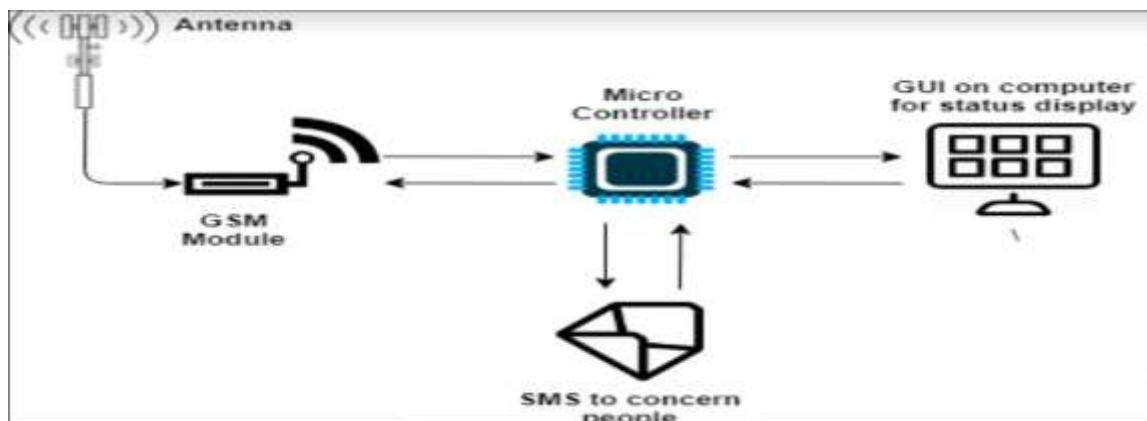
now too obsolete as it is slow, short range, have low complexity & data speed, thus the utilisation of GSM modem is in Scenario. GSM is a peculiar kind modem that operates on a GSM wireless net. It handles and manages a SIM and intervenes on an endowment to end users. It can be any extrinsic gadget say PC/PCMCIA card which is connected via a USB. After the connection setup, now liaison over web can be done. GSM has numerous applications like providing net association, sending message, receiving text, MMS texting etc...GSM operates on radio waves.
 We will use GSM for communing data.

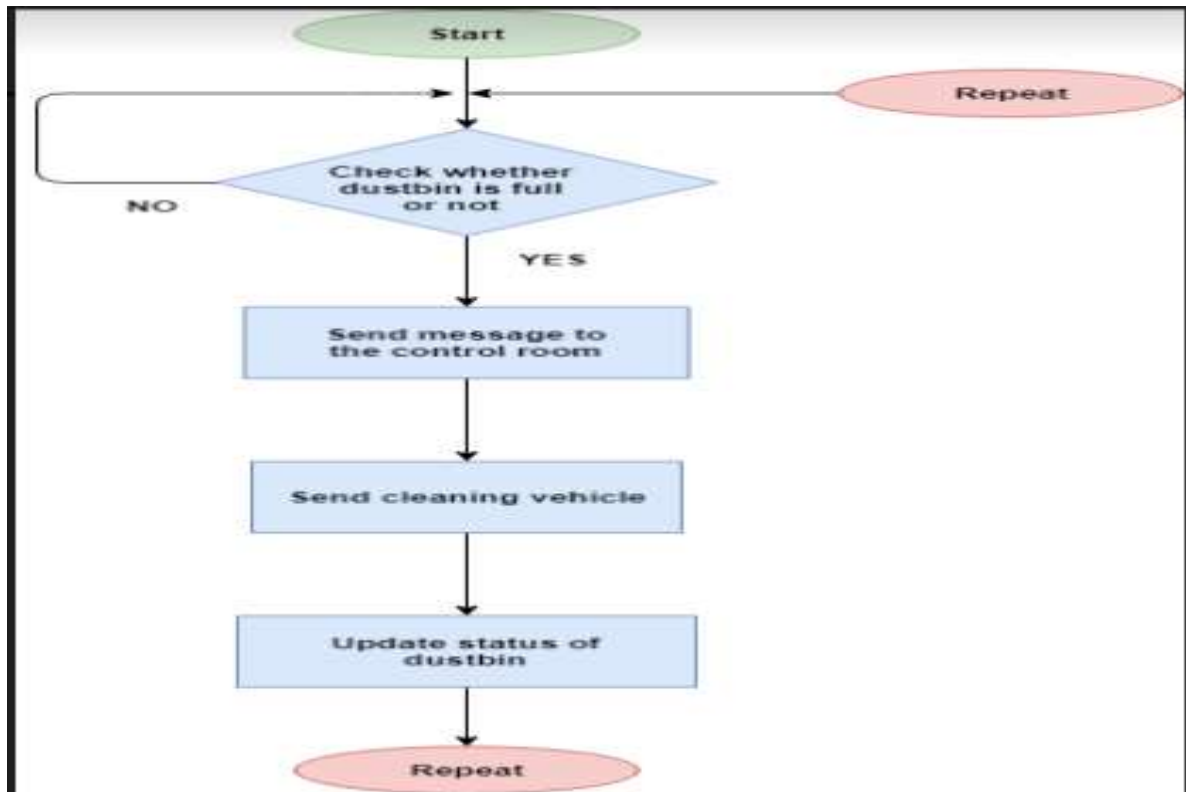


At the broadcasting or transfer segment, the garbage level is studied and detected by the level detector comprising of an IR sensor. This studied material is further conveyed to the microcontroller. When garbage in bin reaches the threshold and message is broadcasted to control room of Municipality via GSM.

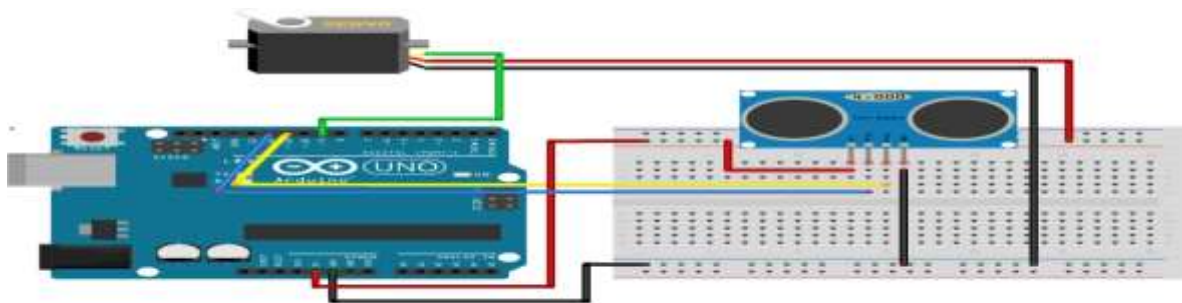


Now at that instant only at the receiver section i.e. the municipality control room. The individual at the control room govern the whole system on a GUI and when bin sends him a text, he will inform the cleaner immediately for squashing bins.

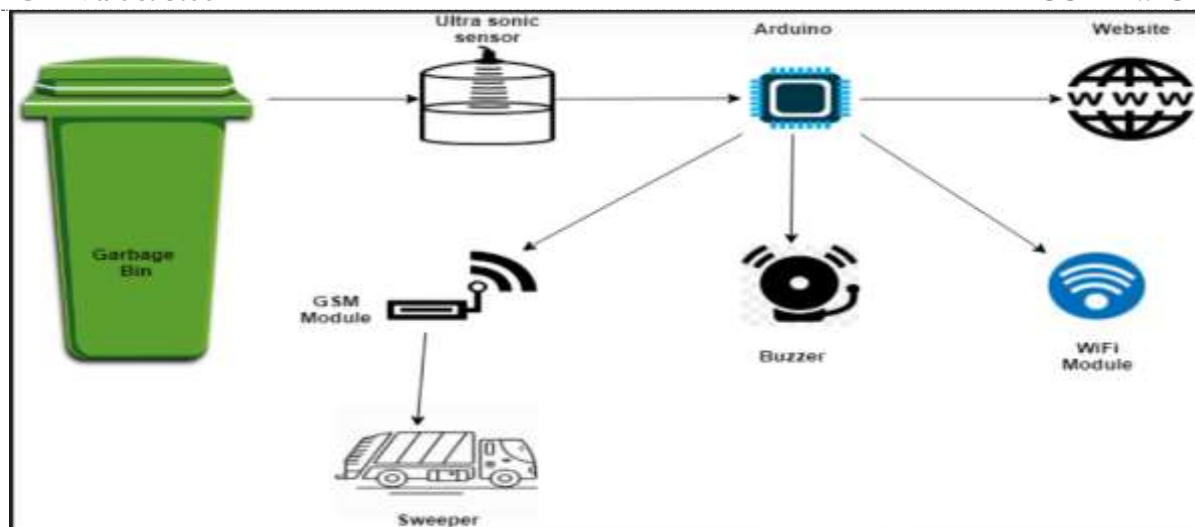


Flow of process

The bin hopper will open when the PIR Sensor detects or diagnose a person near trash bin. The lid opens due to the servo motor activation.



The ultrasonic sensor is at top. Even a buzzer is provided which inform the people that bin is full doesn't put more garbage.



5. TEST INSTANCES & ULTIMATE RESULTS

The enactment and execution of this intelligent astute bin idea can work on different rostrums and under diverse scenes. The hopper of the trash bin is automatized. The hopper of heavy waste collection bins in a society is limited only for the use of society members for via face detection & fingerprint detection. Even there are smart small bins for outsiders whose lid will open via a motor and a PIR sensor when it notice or diagnose any kind of locomotion. When the garbage bin is 80% full i.e. when it is just to cross the threshold, the sensor assemble information from bin and automatically transfer it to the municipal cooperation. After the squashing of bin and automatic cleaning, the bin status is again updated.

6. CONCLUSION

The advanced concept of this astute dustbin is also a step to the implementation & enactment or execution of a well profiled and expanded garbage administrating system. The current system is enhanced by the perfect and complete utilization of sensors. The implementation of Wi-Fi module and microcontroller intensify and amplify the features of on-going system. It provides efficient squashing and cleaning of trash cans on time and instant updation in bin status. If proper bin cleaning steps are not taken on time a message will be soon dispatched to higher municipal authorities. The negligence of waste collecting person i.e. the truck driver is averted by GPS tracking and fingerprint detector. The unwanted trips of drivers are reduced as they have to accumulate waste only when they get a text from bin. This system is cost effective and eco-friendly.

7. FUTURE SCOPE & ADVANCEMENT

The proposed system can be modified by the addition of new features & functionalities in it. Squashing and dumping of garbage from trash cans can be done automatically without human access and interference. The astute bins can be monitored via a GUI. This idea can be amplified from streets to houses, buildings, hospitals, bus stands, railway junctions etc...The bins can be innovated with the addition of perfumes and pest control mechanisms. To innovate it more an automatized system can be added as supplement which will pick up waste in and out of the trash can and will separate then and collect at different bins. Even more add-ons can be done to prevent pollution and filthing due to garbage.

REFERENCES

- [1]. [1]. Alexey Medvedev, Petr Fedchenkov, ArkadyZaslavsky, Theodoros, Anagnostopoulos Sergey Khoruzhnikov, "Waste Management as an IoT-Enabled Service in Smart Cities".
- [2]. S.S. Navghane, M.S. Killedar, Dr.V.M. Rohokale, "IoT Based Garbage and Waste Collection Bin", May 2016.
- [3]. Microtronics Technologies, "GSM based garbage and waste collection bins overflow indicator", September 2016.
- [4]. "Smart garbage management system" International Journal of Engineering Research &Technology (IJERT) ISSN: 22780181.www.ijert.orgIJERTV4IS031175 Vol. 4 Issues 03, March2015.
- [5]. "A Novel Approach to Garbage Management Using Internet of Things for Smart Cities". H. Manasi



- kasliwal and Smit kumar Suryawanshi.
- [6]. “Smart Garbage Collection Bin Overflows Indicator using Internet of Things”, by Vishesh Kumar Kurrel.
 - [7]. Solid waste management challenges for cities in developing countries”. Journal of Waste Management.
 - [8]. Meghana K C, Dr. K R Nataraj, “IOT Based Intelligent Bin for Smart Cities”.
 - [9]. Guerrero, L.A., Maas, G., Hogland, W.: “Solid waste management challenges for cities in developing Countries”. Journal of Waste Management.
 - [10]. Ghose, M.K., Dikshit, A.K., Sharma, S.K. “A GIS based transportation model for solid waste disposal – A Case study on Asansol municipality”. Journal of Waste Management.

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