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Smart Waste Segregation and Monitoring System using IoT

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ABSTRACT

The amount of waste has been increasing due to the increase in human population and urbanization. In cities, the overflowed bin creates an unhygienic environment. Thus degrades the environment, to overcome this situation "Automatic Waste Segregator" is developed to reduce to work for the ragpickers the wastes are segregated by the human beings which leads to health problems to the workers. The proposed system separates the waste into three categories namely wet, dry and metallic waste. This developed system is not only cost efficient also makes the waste management productive one. Each of the wastes are detected by the respective sensors and gets segregated inside the bins which is assigned to them the details of amount of waste disposal is updated in the server regularly.

Keywords— Segregation, motor, IR sensor, Metal detector, Moisture sensor, pic microcontroller

1. INTRODUCTION

The abundant increase in population led to the improper waste disposal. Managing the garbage consumes more time and requires a lot of man power. In recent years the waste disposal is becoming a huge cause. The most of common method of waste disposal is unplanned and it is dumped at the landfill sites this method causes ill effects to all living beings. This method can generate liquid leachate and other fungus which pollute the surface and underground water also accelerates harmful dieases which leads to the degradation of a aesthetic value of environment. In India recycling of solid waste is done by the ragpickers who play an important role in this process while doing the ragpickers get affected with many health problems such as skin infections ,respiratory problems the dependent of ragpickers can be reduced if the automatic waste segregation takes place in the dustbin. The wastes is segregated into basic main streams such as metallic ,dry and wet these waste has a large potential of recycled and reused . even through there are multiple industrial waste segregators present , it is always better to segregate the waste at source itself. The advantage of doing this type of segregation is, there is no need of rag pickers to segregate the waste. In addition to it the segregated waste can be directly sent to the recycling plant, instead of sending the waste to segregation plant and then to recycling plant. Currently there is no such system for the automatic segregation of waste into dry, wet and metallic waste, the main purpose of this project is compact, low cost and user friendly waste segregation system for urban cities to streamline the waste management process.

2. EXISTING SYSTEM

The garbage is collected from the streets, houses and other establishments on circadian basis, which is not an effective management system. Cleaning of garbage bin is not done when it is

needed. According to the recent survey, it has been calculated that garbage production in India is around 1.3 pounds per person per year. In developing countries, more than 377 million urban people live in towns. They generate more than 62 million tonnes of municipal solid waste per annum. Out of these only 43 million tonnes of the waste are collected by the municipality. Rest of the wastes are left scattered in the streets due to poor maintenance of garbage bins. The traditional way of manually monitoring the garbage bins is a complex, clumsy process and utilize more human effort, time and cost. The existing system have no proper planning regarding the collection of garbage which makes the city or town unhygienic. Existing system don't regularly update the level and odour of the garbage bin to the authority. It intimates the municipality only through SMS alert. In some systems RFID tag and reader is used so whenever the garbage truck comes near the bin it updates the current status of the bin to the worker in the truck. The worker then cleans the bin when it is filled. This method has a disadvantage of more fuel consumption and time consuming too. The labours who are cleaning the dustbins are also not taking any responsibility which makes the system worse in urgent cases. Proper monitoring of wastes is obligatory to run the city clean and green. The conservative and manual garbage monitoring and collection system is only available. The labours cannot always monitor the elevation and scent of the dustbin manually around all places of the city. No internet technology oriented systems which is more systematic, cost- effective and energy- efficient exist.

3. PROPOSED SYSTEM

Most of the times, the garbage bins are overflowing with excess waste and are scattered out in the street. These scattered wastes get either decayed or burnt in that place or overflows all over which leads to serious health issues to humans. The wastes which are dumped are segregated by Humans which leads to health problems to them. To overcome this problem a well organised waste segregation and monitoring system has been designed. It is an IoT based Waste Segregation and Monitoring system which is an innovative way to keep the cities clean and healthy. Since the population of our world is increasing rapidly, the environment should be clean and hygienic in order to lead a better life. This is a model for Waste Segregation for Smart cities.

The foremost goal of this project is to automatically segregate the wastes and to perceive the level of the dustbins which is delivered through wireless mesh network. With such information, litter bin providers and cleaning contractors are able to make better decision for the efficient disposal . IR sensor identifies the objects, Moisture and metal sensors detects the wet and metal waste. Ultrasonic sensor observes the levels of bin. The waste is dropped inside the bin where the sensor identifies the type of the waste. The Bin consists of three partitions inside were each bin collects each waste respectively. The motor then rotates and respective partitions gets opened and respective wastes are collected. The status of the bin is displayed in Thing speak server.

4 . ARCHITECTURE DIAGRAM

The sub-bins for the different types of waste are made into two separate layers. The sub-bins are removable for cleaning purposes. The design uses a dual motor and tray mechanism. The waste is disposed off into a common waste tray, the only part visible to the user. It is detected by the IR sensor. This activates the moisture sensor which is fitted on the tray. There is a pre-set threshold value for classification as dry or wet waste. If the moisture sensor reading is above that value, it is classified as wet waste else it is classified as dry waste. The pre-set value may be suitably chosen to provide accurate segregation. The three bins for dry waste , wet waste and metal waste are fixed in position below, on the left and right sides of the tray. The Ultrasonic sensor senses the levels of the garbage in the bin. And the sensed data is sent through the PIC Microcontroller. The PIC Microcontroller is programmed in Embedded C . Thus obtained status will be notified in the Thingspeak, It is an open-source Internet of Things (IoT) application

and API to store and retrieve data from things using the HTTP protocol over the Internet or via a Local Area Network.

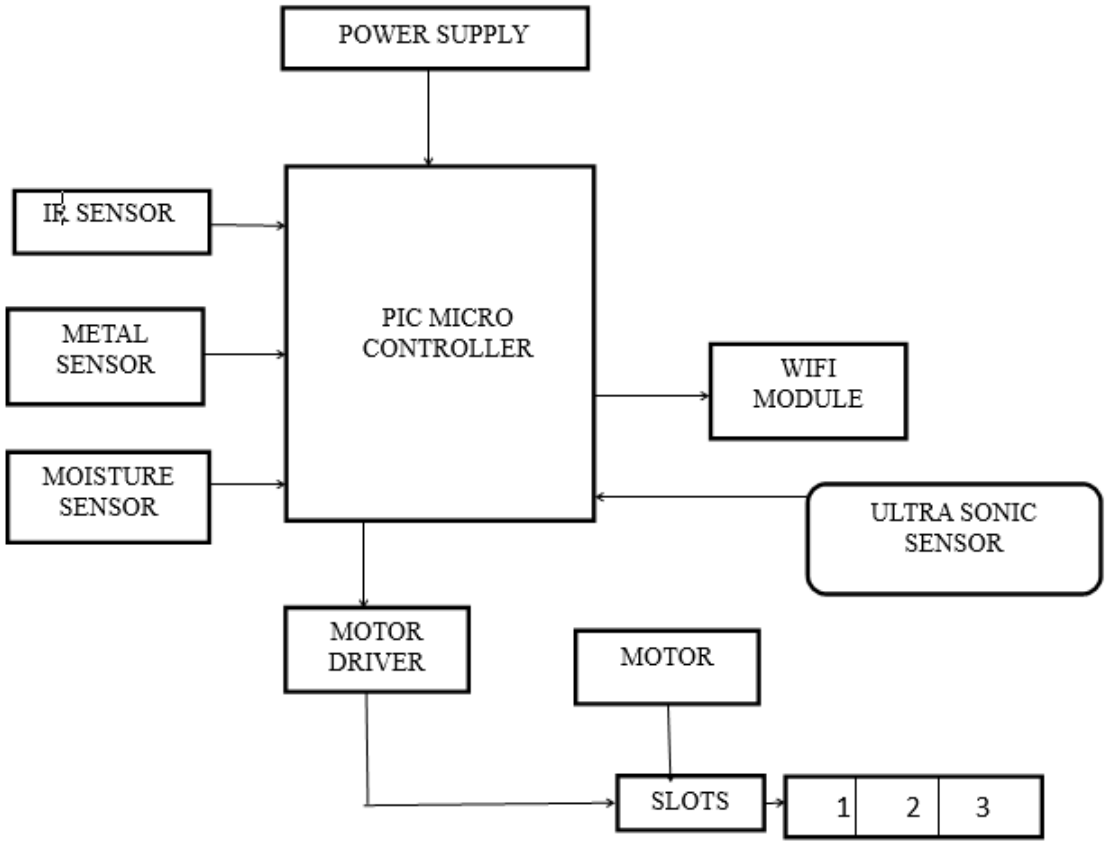

Fig 1. Block diagram

5. COMPONENTS USED

5.1 HARDWARE COMPONENTS

The required hardware components are Pic Microcontroller, Infrared sensor, Moisture sensor, Metal detector, LCD, DC motors, ESP 8266.

5.2 PIC MICROCONTROLLER

The PIC (Peripheral Interface Controller) Of Configuration (PIC16F877A) is a standout amongst the most eminent microcontrollers in the business. This controller is exceptionally helpful to utilize. The coding or programming of this controller is additionally less demanding. One of the primary favourable circumstances is that it can be written-erased whatever number circumstances as could be allowed as it utilizes FLASH memory innovation. It has an aggregate number of 40 pins and there are 33 pins for input and output. PIC16F877A discovers its applications in an enormous number of gadgets as shown. It is utilized as a part of remote sensors, security and wellbeing gadgets, home robotization and in numerous mechanical instruments.

5.3 INFRARED SENSOR

An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measures only infrared radiation, rather than emitting it that is called as a passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These types of radiations are invisible to our eyes, that can be detected by an infrared

sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, The resistances and these output voltages, change in proportion to the magnitude of the IR light received.

5.4 MOISTURE SENSOR

The Moisture sensor is used to measure the water content(moisture) of soil when the soil is having water shortage, the module output is at high level, else the output is at low level. This sensor reminds the user to water their plants and also monitors the moisture content of soil. It has been widely used in agriculture, land irrigation and botanical gardening. The Soil Moisture Sensor uses capacitance to measure dielectric permittivity of the surrounding medium. The dielectric permittivity is a function of the water content. The sensor creates a voltage proportional to the dielectric permittivity, and therefore the water content of the soil. The sensor averages the water content over the entire length of the sensor. There is a 2 cm zone of influence with respect to the flat surface of the sensor, but it has little or no sensitivity at the extreme edges. The Moisture Sensor is used to measure the loss of moisture over time due to evaporation and plant uptake, evaluate optimum moisture contents for various species of plants, monitor soil moisture content to control irrigation in greenhouses and enhance bottle biology experiments.

5.5 METAL DETECTOR

A metal detector is an electronic instrument which detects the presence of metal nearby. Metal detectors are useful for finding metal inclusions hidden within objects, or metal objects buried underground. They often consist of a handheld unit with a sensor probe which can be swept over the ground or other objects. If the sensor comes near a piece of metal this is indicated by a changing tone in earphones, or a needle moving on an indicator. Usually the device gives some indication of distance; the closer the metal is, the higher the tone in the earphone or the higher the needle goes. Another common type are stationary "walk through" metal detectors used for security screening at access points in prisons, courthouses, and airports to detect concealed metal weapons on a person's body.

5.6 LCD DISPLAY

A liquid-crystal display (LCD) is a level panel display or other electronically adjusted optical gadget that uses the light-tweaking properties of liquid crystals. Liquid crystals don't discharge light straightforwardly, rather utilizing a backlight or reflector to deliver images in shading or monochrome. LCDs are accessible to display subjective images (as in a universally useful PC 24 display) or settled images with low information content, which can be displayed or covered up, for example, present words, digits, and 7-segment displays, as in an advanced clock. They utilize a similar fundamental innovation, with the exception of that self-assertive images are comprised of countless pixels, while different displays have bigger elements.

5.7 DC MOTORS

An electric motor is an electrical machine that converts electrical energy into mechanical energy. Most electric motors operate through the interaction between the motor's magnetic field and winding currents to generate force in the form of rotation. Electric motors can be powered by direct current (DC) sources, such as from batteries, motor vehicles or rectifiers, or by alternating current (AC) sources, such as a power grid, inverters or electrical generators. An electric generator is mechanically identical to an electric motor, but operates in the reverse direction, accepting mechanical energy (such as from flowing water) and converting this mechanical energy into electrical energy.

5.8 ESP8266

The ESP8266 is a low-cost Wi-Fi microchip with full TCP/IP stack and microcontroller capability produced by manufacturer Express if Systems in Shanghai, China .The chip first came to the attention of western makers in August 2014 with the ESP-01 module, made by a third-party manufacturer Ai-Thinker. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. However, at first there was almost no English-language documentation on the chip and the commands it accepted. The very low price and the fact that there were very few external components on the module, which suggested that it could eventually be very inexpensive in volume, attracted many hackers to explore the module, chip, and the software on it, as well as to translate the Chinese documentation.

5.9 SOFTWARE COMPONENT

The required software components are Pic C Compiler, Thingspeak, Putty,VNC Viewer.

PIC C COMPILER

PIC C compiler is fully optimised for use with PIC microcontrollers. Build in functions make coding the software very easy. The integrated C development gives developers a fast method to produce efficient code from an easily maintainable high level language. This integrated C development environment gives developers the capability to quickly produce very efficient code from an easily maintainable high level language.

THINGSPEAK

Thing Speak is an open-source Internet of Things (IoT) application and API to store and retrieve data from things using the HTTP protocol over the Internet or via a Local Area Network. Thing Speak enables the creation of sensor logging applications, location tracking applications, and a social network of things with status updates. Thing Speak was originally launched by iot ridge in 2010 as a service in support of IoT applications.

6. IMPLEMENTATION AND RESULTS

6.1 PROGRAMMING THE PIC MICROCONTROLLER

The following steps should be followed to embed the code into the PIC microcontroller, STEP 1: Download and install the PIC C Compiler

STEP 2: Open the software and select File->New->Source File

STEP 3: Write the code, compile it and run.

STEP 4: Then dump the code into pic microcontroller using pic kit loader.

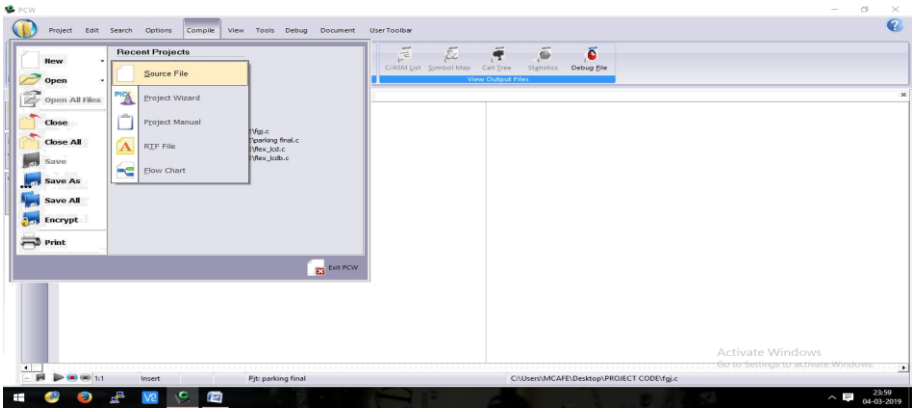

Fig 2. Opening new source file

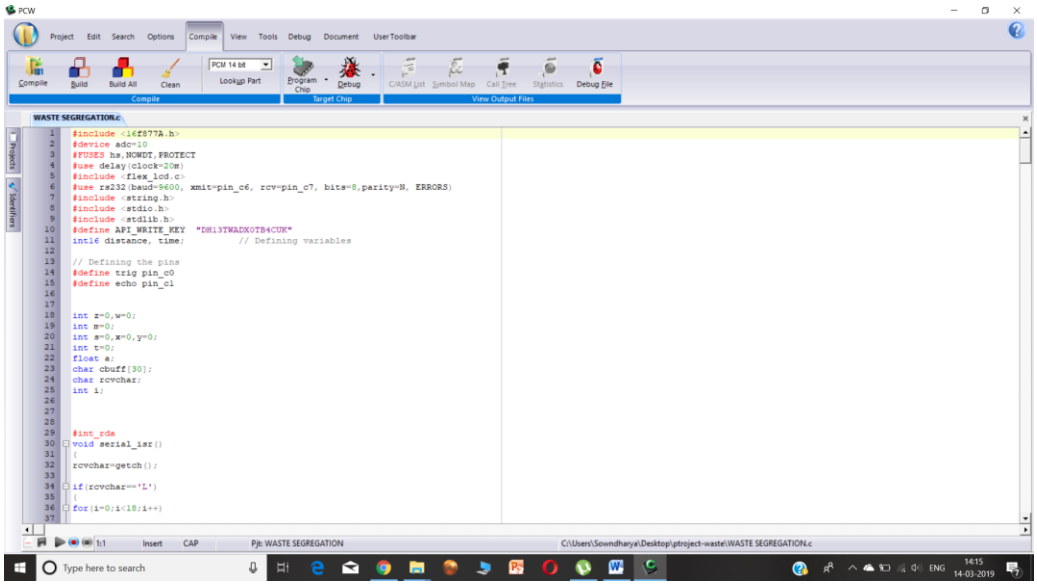

Fig 3 Code to display the type of waste

7. RESULTS AND ANALYSIS

7.1 RESULTS

Initially the location of the bin is fetched through the GSM. So that the status of the bin is easily maintained. After getting GPS location it is displayed in the LCD.

Fig 4 GPS location

After getting the GPS location, the IoT gets initialized. The below figure represents the LCD display of IoT initialization.

Fig 5 Notification of IoT Initializing

The smart bin was experimental with various items which are disposed on a regular bases. The wastes such as vegetable peels, wet tissue, where used to test the effectiveness of segregation of wet waste, it was observed that the system started to function only offer the waste is placed on the upper bin, following a three second delay period, the materials thrown by the user was correctly segregated into its respective wet waste sub bin.

Fig 6 Notification of wet waste

Similarly the dry waste segregation test condition was experimented by using paper, foil, wrapper. It was observed that the functioning started only after the trash items was placed on the upper bin. Followed by the second delay period, The trash items was correctly segregated into its respective dry waste sub bin.

Fig 7 Notification of plastic waste

The metal waste segregation is experimented by using the key, ring and coin. It was observed that the functioning started only after the garbage items was placed on the upper bin, followed by the three second delay period, the trash items was correctly segregated into its respected metal waste sub bin.

Fig 8 Notification of metal waste

The data collected by the sensors is sent through the wifi module ESP8266. The ESP updates the waste count in the Thingspeak server.

Fig 9 Notification of esp updating display

After each wastes are detected by the sensors, the tray is opened and the respective wastes are dropped in respective bins. After all the process gets over, the LCD gives the notification stating that Process over.

Fig 10 Notification of process over

Fig 11 Structure of Sub bins

7.2 UPDATION IN THE SERVER

When the information is sent from the sensors and to the pic microcontroller and the same data is updated to the IoT server. We can login to it to find the waste information such as plastic,wet and metal waste entries and its corresponding time and date.

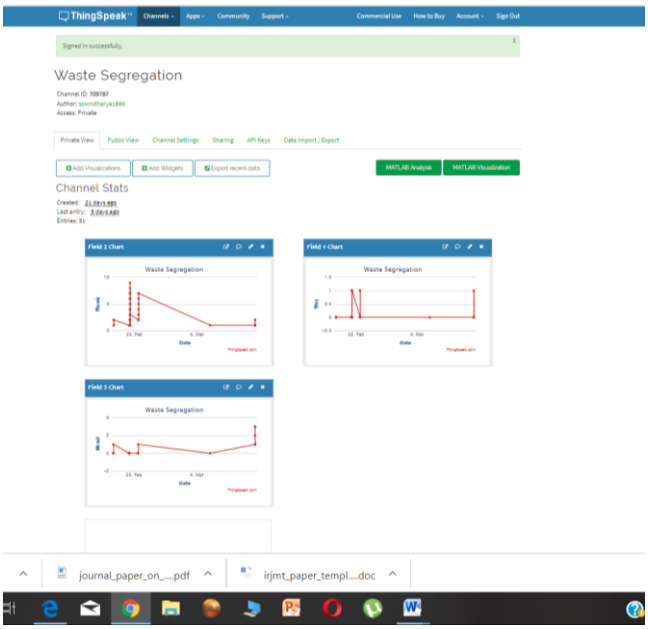

Fig 12 Field chart in the server

In this charts, the amount of wastes dropped in the bins are represented. It also tells the date and time of the wastes collected.

8.CONCLUSION

With growing urbanisation and increasing population, effective waste disposal is a major concern. Manual waste segregation is very expensive, time consuming and inefficient. This paper presents a smart and cost effective solution for waste segregation. The proposed SmartBin is an

efficient waste segregation system that requires no human intervention to separate dry and wet waste and paves the path for timely collection and disposal. The proposed system can be deployed a domestic scale in households or on a large scale in public places.

9. FUTURE SCOPE

The Automatic Waste Segregator has been implemented for the segregation of waste into dry , wet and metallic waste.Smart dustbin is an innovative step in the direction of bringing a change in the current garbage disposal system. Further the self-changing technology can be implemented so that the battery of the smart bin is low on power then using solar tracker the smartbin.

REFERENCES

[1] ManishaJayson(2018),Lakshmi H R ,"SmartBin-automatic waste segregation and collection". Second International Conference on Advances in Electronics, Computer and Communication(ICAE CC-2018).

[2] JayshreeGhorpade- AnaghaWadkar,Janhairkamble ,Vijajendrapagare,"Smart Dustbin An Efficient Garbage Management Approach for a Healthy Society",IEEE 2018.

[3] SaurabhDugdhe,PoojaShelar,SajuliJire and AnujaApte,"Efficient Waste Collection System",IEEE 2016..

[4] BL Theraja, AK Theraja, A Text Book of Electrical Technology, volume 2, S Chand &co.,2005.

[5] SubhasiniDwivedi, Michael Fernandes, RohitD'souza, "A Review on PLC based Automatic Waste Segregator", IJARCET, Volume 5, Issue 2, February 2016.

[6] Prof B S Malapur,VaniR.Puttanshetti(Pg),"IoT based Waste Management: An Application to SmartCity",IEEE 2017.

[7] Sharanya,.A,U.Harika,N.Sriya,SreejaKochwila."Automatic Waste Segregator",IEEE 2017.

[8] DavideAnghinolfi,MassimoPaolucci,MichelaRobba,"Optimal Planning of Door-to-Door Multiple Materials Separated Waste Collection",IEEE 2016.

Conflict of Interest

None of the authors have any conflicts of interest to declare.