SMART GARBAGE SEGREGATOR USING IOT

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1.Abstract :-

Waste segregation and recycling are effective ways of reducing trash. Segregation at the source is the key in solid waste management especially when we have limited economical resources. Segregation of waste and creating awareness of different types of waste is new boom. We divide solid waste into three categories Wet, Dry and hazardous waste. According to solid waste management rule, 2016 it is responsibility of generators to segregate waste into these three categories. The main objective of this project is to design a system using Arduino Mega for automatic segregating of waste at source and capable of cleaning. IR sensor estimates the distance and the status of the bin will be send through IFTTT (If this then that) for sending SMS. This bin can be used at places like offices, apartments, shopping malls etc. This system will be useful in making Waste Management in smart cities automated without the human intervention.

Keywords:- Segregation, Solid Waste Management, IFTTT, Advanced Bin Segregator

2.INTRODUCTION :-

In today's world common problem faced in waste collection and dumping is mainly: overflowing garbage bins and waste segregation as per its type. Nearby 62 million tons of waste is generated each day by 377 million people living in urban India of which 45 million of waste is left untreated and disposed of unhygienically causing severe health problems and environmental degradation. A rage of notable inflation in the municipal solid waste generation has been registered. Worldwide due to overpopulation, industrialization and economic growth and overflowing landfills are impossible to reclaim because of the improper disposal of wastes on outskirts of cities causing vital environmental entanglement in terms of water pollution and global warming causing a reduction in average lifetime of the manual segregator. In India, rag pickers and conservancy staff play a crucial role in the recycling of urban solid waste and have higher jejuneness due to infections of the skin, respiratory system, gastrointestinal tract, and other allergic disorders. This can be diminished if segregation takes place at the source of the municipal waste generation which will also give a higher quality of the material is preserved for recycling there by recapturing more value from the waste. This not only reduces occupational hazard for rag pickers but also reducing the processing time of segregating the waste after collection. The economic value of the waste generated is realized after it is recycled completely and there are different techniques available to recycle and reuse the municipal solid waste. When the waste is segregated into basic categories such as wet, dry and metallic, it has an intense perspective of improvement, and accordingly, recycled and reused. Thus in this paper, we have done a comprehensive survey of different existing techniques for automation of waste segregation

3.LITERATURE SURVEY AND SUMMARY :-

- In [1] Rapid increase in volume and types of solid and hazardous waste due to continuous economic growth. It is estimated that in 2005-06 the total amount of municipal solid waste generated globally reached 2.02 billion tones, representing a 7% annual increase since 2003. The segregation, transport, handling, and disposal of waste needs to be properly managed to minimize the risk to the health and safety of patients, the public, and the environment. This paper proposes an Automated Waste Segregator (AWS) which is a cheap as well as easy to use solution for a segregation system for household use, so that it can be sent directly for processing. It is designed to sort the refuse into dry and wet waste. The AWS employs capacitive sensors to distinguish between wet and dry waste. Experimental results show that the segregation of waste into wet and dry waste has been successfully implemented using the AWS.

- In [2] Waste management, both indoor and outdoor, is almost done manually. This is unhygienic, and requires significant amount of valuable human resource to get it done. Outdoor waste management is automated to an extent. Therefore, a proposal to fully automate indoor waste management, by making the existing disposal outlets more intelligent and using a movable waste collecting robot, is discussed in this paper. The filling of the dustbin is monitored by ultrasonic sensors and if it is filled to the brim, the Arduino Nano controller transmits the data to the robot with the aid of wireless Zig bee 802.15.4 protocol. The robot is designed in such a way that it effectively tracks the location of the filled dustbin and collects the waste in its storage part. The RSSI (Received Signal Strength Indicator) value from the message received is used to identify which dustbin is full and its location based on Wave Front Algorithm. In comparison with the existing systems, the proposed system exhibits appreciable efficiency in power consumption and making it an ideal candidate for waste management.

- In [3] In last few decades garbage management has become a perilous matter in the developing country along with the rapid growth in the population and pollution. In most of the areas it is revealed that overflowed garbage bins are not emptied on time thus creating disease ridden environment and infirm countries. Collection of garbage in bins faces daily variation in quantity according to time as well. Waste picking vehicles of Municipal Corporation which are at fixed intervals has dwindling reliability and unmonitored collection system. The proposed model makes an IOT based smart garbage monitoring system which can detect the garbage level of the dustbin and via Wi-Fi and GSM the status and location of bins can be displayed on web server. This system will improve the coordination between the transportation process and garbage collection.

- In [4] This research aimed to design and develop an autonomous robot to feasibly address waste disposal issues in common indoor places. The researchers found a path to improve plan by using Fuzzy Logic Control (FLC). And also, they utilized the Microcontroller unit to control sound, input proximity and IR sensors, and output geared DC motors through machine learning and electromechanical interface. They simulated an adaptive algorithm using Mamdani-type FLC model, implemented this algorithm using C programming language, then downloaded as machine code to a real prototype. Based on test results, the waste robot accurately detects human involvement, a feature that would be pivotal in overcoming individual indifferences on waste management. This research chronicled how a waste management robot prototype was designed and developed as feasible solution to address waste disposal issues in strategic locations such as households, offices.

- In [5] An Automated Waste Control Management System (AWCMS) has been designed which includes an electronic waste detection device and a central control unit. An infrared sensor is used for sensing waste levels, GPS is used for location identification, Arduino Board having a microcontroller and GSM Module is used for sending the message which contains the information regarding the status of the bin. The central control unit consists of a receiving device which receives a message through GSM Module and sends it to the computer software using Arduino Board's microcontroller. The software has a proficiently designed GUI which helps the user to perform and monitor all the required actions for waste monitoring and detection of waste bins placed in an area or a city. All the information is displayed in the GUI of the software in the event of a wastebin getting full and then being emptied by municipal waste trucks or field workers. So that all the components in this entire system work in

an efficient manner to make waste management automation possible so the waste is collected and disposed to the landfill at proper time.

▪ In [6] This paper detects the wastes in the dustbins with the help of sensor devices and as soon as the waste is detected, it will be segregated and right away information is transferred to cloud via IOT. Microcontroller is used between the sensors and IOT module. Ultra-sonic sensor is used to detect the nearness of the waste material. The moisture sensor is used to analyze and report the moisture content in the waste, and if there is moisture content available then the waste cannot be put in the dustbin. Image processing algorithm is used to identify the plastics and degradable items and is separated to another separate sections. The dustbin data are uploaded to the cloud in real time.

4.CATEGORIES OF WASTE :-

Waste can be classified into different categories. Moreover, some types of wastes can be recycled and others may not.
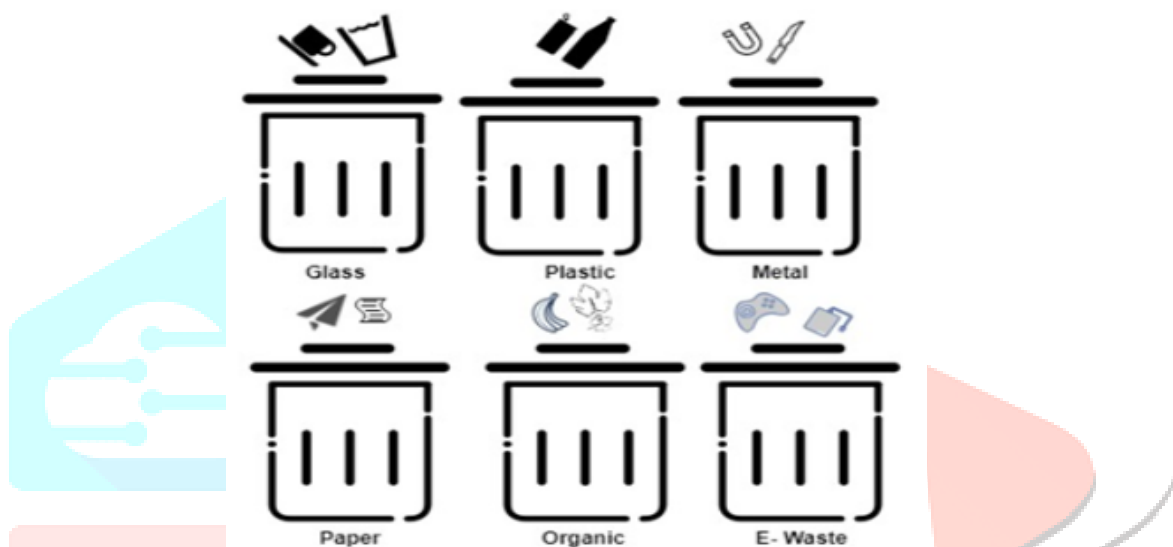
Liquid Waste :- Liquid waste is usually found both in homes as well as in industries. It includes dirty water, wash water, organic liquids, even rainwater, and waste detergents.

Solid Waste :- Solid waste can include items found in your household along with commercial and industrial locations.

Paper Waste :- Includes packaging material, newspapers, cardboard, etc. Paper can be recycled and reused thus should be disposed of in recycling bin.

Metallic Waste :- Mostly generated as industrial or household waste. It can be recycled thus should be preferably disposed of separately.

Plastic Waste :- Consists of bags, jars, bottles, etc. that can be found in the household. It is non-biodegradable, but most of them can be recycled.

Organic Waste :- Organic waste includes food waste; garden waste, manure, and rotten meat are classified as organic waste. Approximately 300-400 kg of compost can be produced from 1 ton of biodegradable waste and can be utilized as organic fertilizer in agriculture or landscaping.

Over time, as organic waste is turned into manure by microorganisms, in landfills they cause the production of methane, so wet waste must be discarded separately.

Hazardous Waste– It includes all types of wastes that are combustible, toxic, eroding and reactive. These items can injure you as well as the environment and must be disposed of rightly.

5.RECYCLING OF WASTE :-

Recycling is the method of improving waste materials into new materials. It is an alternative to "traditional" waste disposal that can not only help lower greenhouse gas emissions but also save resources. As discussed above some can be recycled and some cannot be so the below table shows the statistics of recycling of different waste.

Recycling Rates Over Time
% Recycled for Select Materials
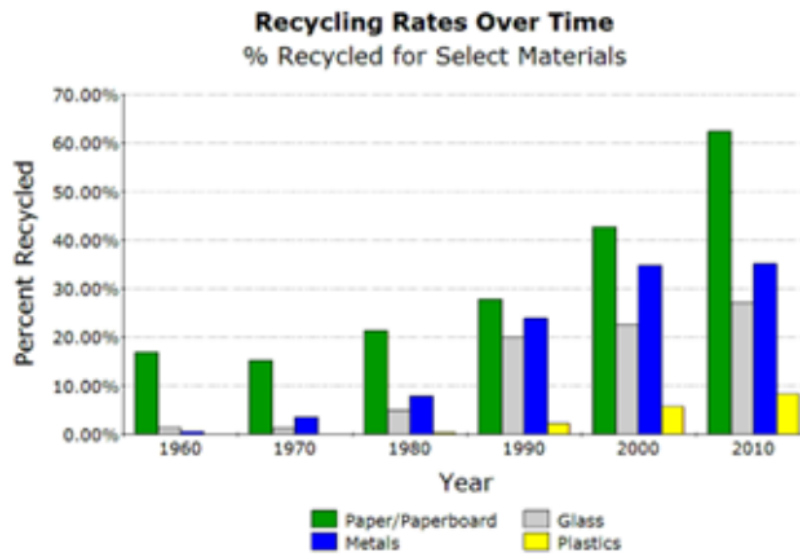
Above bar graph compares American recycling rates for paper, glass, metals, and plastics over a fifty-year time frame, using ten-year intervals. Large green bars on represent paper recycling rates between 1960 and 2010. If we segregate solid waste at source then we can recycle the solid waste very efficiently. In the case of dry waste we can adopt proper recycling methods and waste become useable. Recycling is the recovery and reuse of materials from wastes. Delhi needs a decentralized and individual centric approach to recycle the solid waste. If we achieve segregation of waste at source then we can adopt different measures for segregated wastes.

6.CURRENT SCENARIO :-

In the present world of digitizing everything in our surroundings has been equipped with modern technology and the internet to ease our work and gain more efficiency. But the systems existing today for waste management are the same as they were before in most of the countries. Currently, for the collection of waste in some countries, we have door to door collection systems that require a lot of efforts and money. A waste collector has to visit everybody's place, knocking the doors and has to wait until each resident brings the waste to them. Moreover, residents have to be available in order to get their waste collected at that particular time which brings in a major disadvantage of this system.

Also in some countries, systems do exist in which waste is collected from the trash bins of each colony, but this system also brings a disadvantage that many a time dustbins are overfilled and waste isn't collected from it, as waste is collected on a particular day and not according to its status. This also makes dustbins, a place facilitating bacterial growth, feeding animals and a breeding place for insects.

Also at times, it happens that dustbin collection is done in prior resulting in wastage of fuel and increasing costs of waste collection. So, at each step, a lot of fuel and money is invested unnecessarily for the process.

7.NEED OF WASTE SEGREGATION :-

Waste segregation is extremely crucial due to the fact that if all waste materials such as polythene bags, old furniture, and e-waste get mixed up in the landfills, could lead to contamination of the land and water through leaking harmful substances in the atmosphere. Moreover, non-segregation also affects climate change which may lead to drought conditions. Thus, it is essential to separate waste before disposing into the landfill. Waste segregation is also not only important but also beneficial for human beings. The recyclable parts of the waste can be recycled into useful resources after the segregation process. It has a large meaning for the current society which is facing the problem of resource shortage.

If we segregate waste at the source itself, it solves more than half of our task and the main problem that we face in managing solid waste would lessen considerably. Only we need to behave responsibly to accomplish the goal of waste separation. To increase the activity of recycling, a basic requirement is to concentrate on waste segregation that helps to recognize the degradable and non-biodegradable parts of the waste. Since the degradable waste is organic, its disposal does not cause any harm. The non-biodegradable waste is the inorganic part that is good for recycling. The biggest danger is when the inorganic waste finds its way back to the earth and raises the pollution measurement besides causing other damages to the environment. The inorganic waste reaches the market that deals in scrap materials where further segregation breaks it into its elements like paper, plastic, metal, etc. These materials ultimately pass through the market chain and reach the manufacturers who use it as raw material.

8.DESIGN METHODOLOGY :-
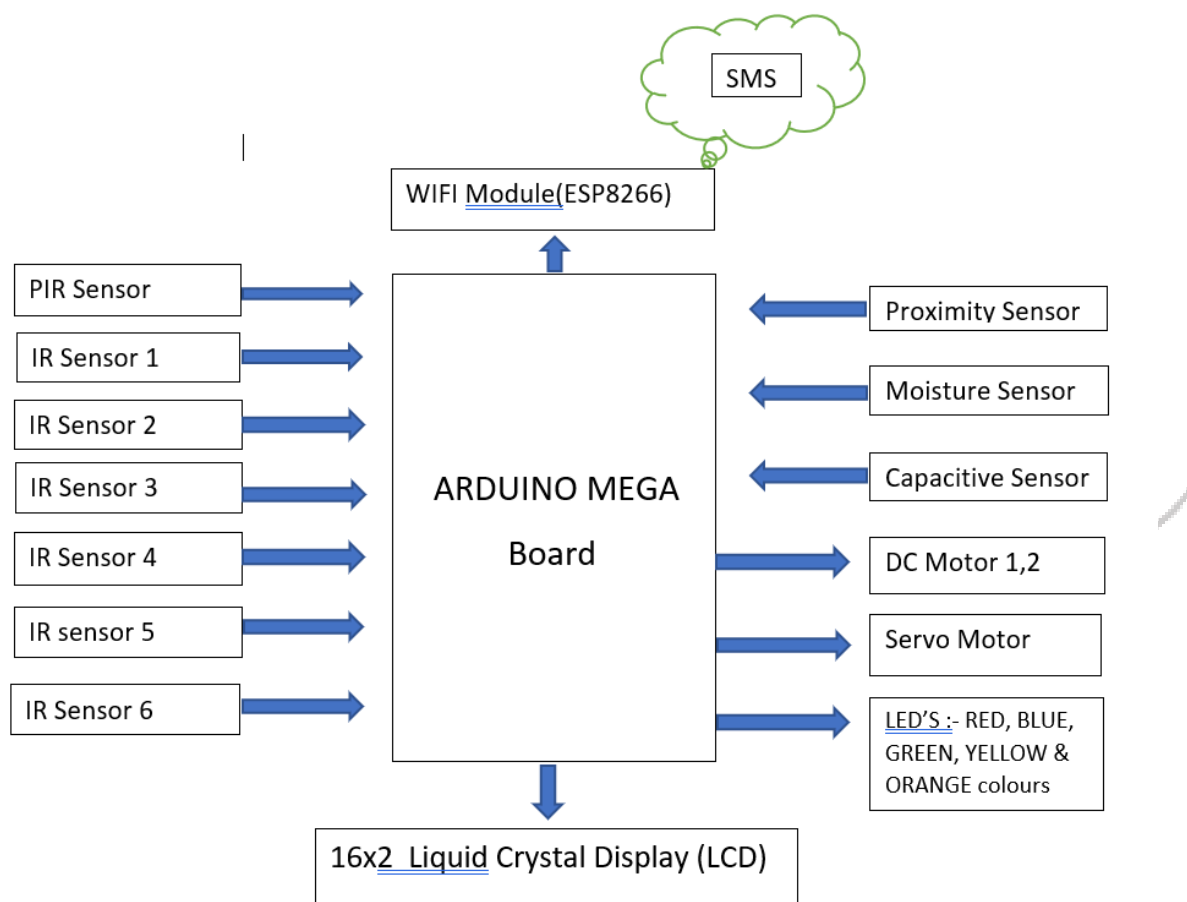
BLOCK DIAGRAM
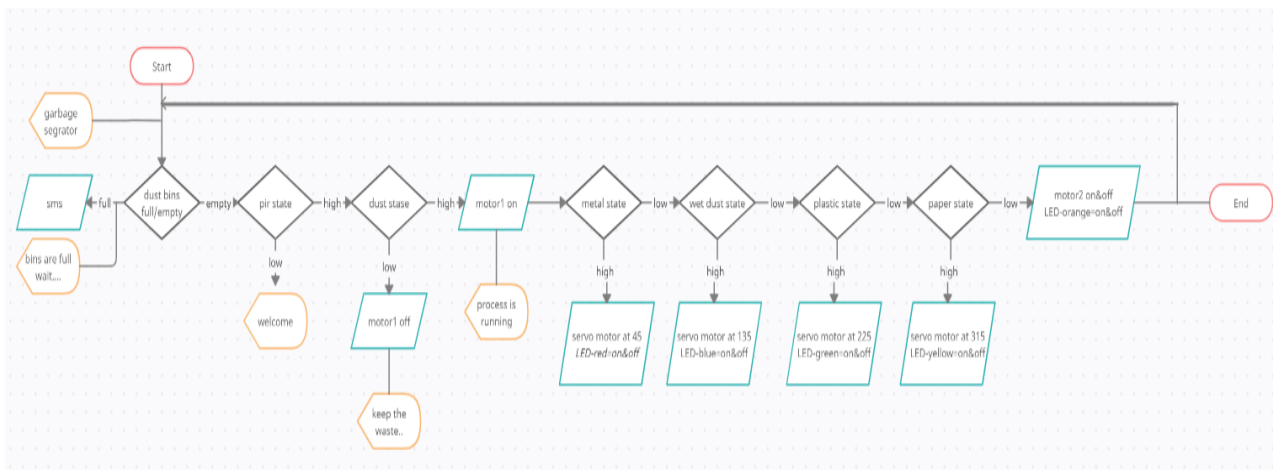
FLOW CHAT

9.COMPONENTS REQUIRED :-

Arduino Mega:- The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

PIR Sensor :- PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to use and don't wear out. For that reason they are commonly found in appliances and gadgets used in homes or businesses.

NodeMCU :- NodeMCU is a low-cost open source IoT platform.

LCD 16X2 :- The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multi-segment light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc.

Motor :- A DC motor is any of a class of rotary electrical motors that converts direct current electrical energy into mechanical energy.

Servo Motor :- A servo motor is a type of motor that can rotate with great precision. Normally this type of motor consists of a control circuit that provides feedback on the current position of the motor shaft; this feedback allows the servo motors to rotate with great precision.

IR Sensor :- An infrared (IR) sensor is an electronic device that measures and detects infrared radiation in its surrounding environment.

Soil Moisture Sensor :-Soil moisture sensors measure the volumetric water content in soil.

Proximity Sensor :- A proximity sensor is a sensor able to detect the presence of nearby objects without any physical contact.
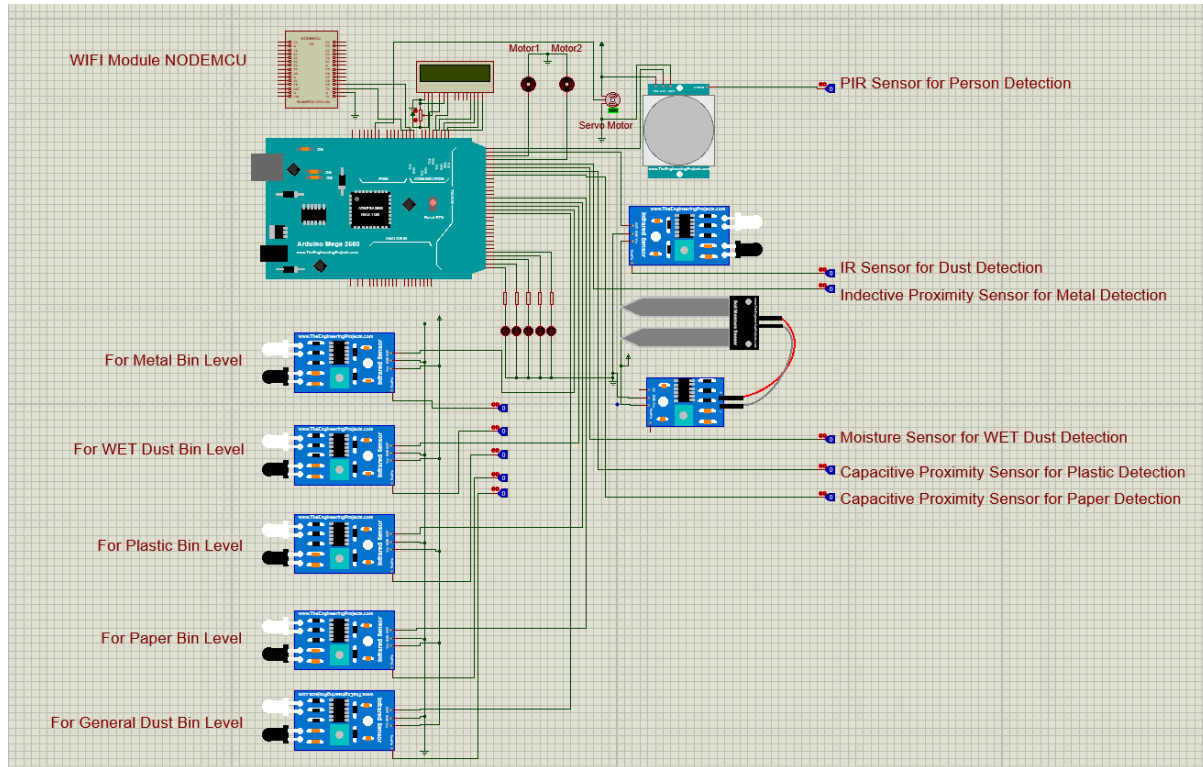
Capacitive Sensor :- Capacitive proximity sensors are non-contact devices that can detect the presence or absence of virtually any object regardless of material. They utilize the electrical property of capacitance and the change of capacitance based on a change in the electrical field around the active face of the sensor.

10.SOFTWARE REQUIRED :-

Arduino IDE:- The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. This software can be used with any Arduino board.

Thing Speak:- ThingSpeak is an IoT analytics platform service that allows you to aggregate, visualize and analyze live data streams in the cloud. ThingSpeak provides instant visualizations of data posted by your devices to ThingSpeak. With the ability to execute MATLAB® code in ThingSpeak you can perform online analysis and processing of the data as it comes in. ThingSpeak is often used for prototyping and proof of concept IoT systems that require analytics.

IFTTT :- If This Then That is a service that allows a user to program a response to events in the world of various kinds. There is a long list of kinds of events to which IFTTT can respond, all detectable via the Internet.

CIRCUIT DIAGRAM

11.WORKING :-

It is a IOT based project that is which We are using different types of sensors like PIR, IR sensor, moisture sensor, Proximity sensor, capacitive sensor and ultrasonic sensor. These sensors will be programmed on Arduino mega for excellent and accurate output, the complete setup will be installed in such a way that the bins which are used for dumping the garbage and the bins will be segregating the wastes according to its type (wet waste, paper waste, plastic waste, metal waste and general waste). The sensors are responsible for judging the type of waste dumped in the bin like, moisture sensor will capture liquid or moist wastes, proximity sensor will be used for metal wastes, capacitive sensor will be responsible for judging plastic waste and paper waste with different density values and IR sensor will be responsible for taking care about the limit of bin, if the bin is full, the system will be able to send a "CAUTION" message to the worker or the supervisor, using online software IFTTT and Thing Speak mentioned above which will help in quick and effective management and proper continuation of dumping the wastages in the bin. It will done with the help of NodeMCU, it is a Wi-Fi module that will help in sending the sensor values to Thing Speak, via connecting with the Wi-Fi.

Now talking about the most interesting part that is segregation part, how this system will work:

- First we have to give power supply to the Hardware, it is loaded with program. If any person is detected through the PIR sensor it will start the mechanism of the hardware and also gives directions through LCD display weather they have to keep the waste on conveyor belt or not, if any of the bin is full it will show that "bins are full please wait.." else it will show "please keep the waste on conveyor belt".
- If any of the dust particle is detected on the front side of conveyor belt through IR sensor, it will start the motor to run the conveyor belt to segregate the waste and also it will display "waste is segregating ". Else the motor of the conveyor belt is in off mode and it will display the "please keep the waste on conveyor belt" .

- Conveyor belt is running and sensors are placed sides of the conveyor belt to detect the different types waste on the conveyor belt and four different coloured dust bins are placed on the servo motor with different angles at the end of the conveyor belt so that the each bin will receive different waste particles (metal waste-red coloured bin with 45^0 angle etc..).

- If metal particle is detected by inductive proximity sensor, the servo motor will rotate the bins to 45^0. The metal particle will be placed at particular bin in 45^0 place.

- If wet particle is detected by moisture sensor, the servo motor will rotate the bins to 135^0. The wet particle will be placed at particular bin in135^0 place.

- If plastic or paper particle is detected by capacitive sensor with different densities of thickness and hardness (paper 10-40, plastic 60-100). For plastic the servo motor will the bins to 225^0, for paper the servo motor will rotate the bins to 315^0.

- If the dust particle is not detected by any of the sensor, the motor will be OFF and motor2 will be ON. Motor2 will push that dust to general bin, after that motor2 will be OFF and motor will be ON.

- At the end/start of this mechanism the bins level is measured through IR sensor, if any one of the bin is full the SMS will be sent to particular department to change the bins. Else the mechanism will continue...

12.CONCLUSION :-

In this paper, we have studied various ideas proposed for proper waste segregation. Since a stabilized system is needed for preventing harm caused to the environment due to improper disposal. The study shows that mainly IoT based techniques are mostly used for waste segregation but the cost of implementing IoT based system is very high. We can use AI (Artificial Intelligence) in future for making it more effective and efficient.

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