Advanced waste management system for Municipal Waste Collection in Smart City

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Abstract : In the present scenario, we see the dustbins are placed on the roadside and dustbin is overflowing .This overflow of dustbin is due to the increase in the population and the wastage from hotels, industries etc. This overflow of dustbin will make our environment ugly and cause many diseases to the public. To avoid this situation we planned to design "Advanced waste management system for municipal waste collection in smart city" .In this proposed system, multiple dustbins from the different areas throughout the cities are connected using IoT Technology. In this the dustbin is provided with low cost embedded devices and it will sense the level of dustbin, then the information is uploaded in to the cloud. By This information the truck driver can go and collect the waste from the filled dustbins. Ultrasonic sensor will sense the level of dust in dustbin .In this paper we also proposing a system to separate both the wet waste and dry wastes automatically by using the moisture sensor.

Keywords—ultrasonic sensor, moisture sensor smart city, IoT(internet of things)

I. INTRODUCTION

Things that are connected to the Internet and those devices controlled from the Internet is called Internet of Things .In this system, The smart bin is connected with the internet to display the exact information about the dustbin level and to which area it belong. In present there was a rapid growth in the population which leads to large quantity of waste disposal in the cities. The overflow of dustbin will create a unpleasant environment and it affect many people by spreading the deadly disease. The implementation of proper waste management system will avoid the spreading of such disease. The dustbins are properly managed and information is seen regularly by the truck driver. If the dustbin is filled the truck driver will go immediately and collect the waste form the dustbin. Multiple dustbin are connected through the cities. The Dustbins are integrated with ultrasonic sensors. The ultrasonic sensor is used to detect the level of dust in the dustbin. After detecting the level of dustbin the information is send to the cloud and Internet connection is enabled through the Wi-Fi module which was internally built in Ardiuno NodeMCU .The data is Received and processed in the cloud. This information is send to the web and we are fetching that information in to the mobile application for the garbage collector to collect the waste from the filled dustbins.

When both the dry and wet wastes are mixed and that dustbin in overflown. This will leads to the cause of many disease as many number of insect and mosquito breed on it .There is also a lot of substance that cause dangerous diseases .In order to avoid these problem we are proposing a system where the dry and wet wastes are separated automatically.

Our Prime Minister of India, Sri Narendra Modi has introduced the development of smart cities In India. City administration needs understanding of the generating reports, control overpricing. District administrations are interested in controlling the process of waste collection, checking quality of service, quick and legal ways for solving disputes and problems.

This paper will give the efficient way to keep the environment clean and green. Waste trucks owning companies need platform for organizing and optimization of their business process. waste truck drivers need navigation system and reporting problem system .Citizens want to have better service, lower cost and having easy accessible reports.

II. BLOCK DIAGRAM DESCRIPTION

In this each dustbin consists of a NodeMCU integrated along with an ultrasonic sensor, moisture sensor, infrared sensor and a servomotor .Where NodeMCU is a great choice for the IoT based projects because it consists of wifi soc Esp8266 internally. Infrared sensor, moisture sensor and servometer are combinely formed a system to separate both the wet and dry wastes automatically. . The ultrasonic sensor is used to detect the level of dust in the dustbin. After detecting the level of dustbin the information is send to the cloud and Internet connection is enabled through the Wi-Fi module which was internally built in Ardiuno NodeMCU .In this system many number of dustbins are designed with this setup and all are connected through the internet.

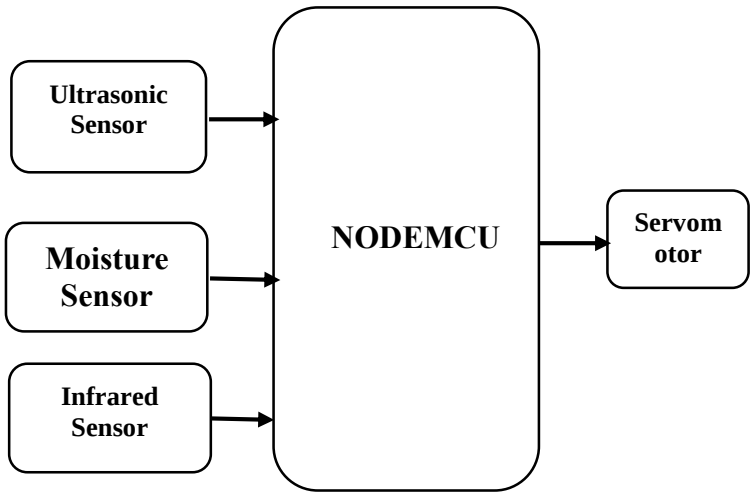

Fig 1: Block diagram

NodeMCU is programmed to perform the task to measure via sensor and give output. NodeMCU is connected to internet by the wifisoc present in it and the filling status of the dustbins are uploaded into the cloud.The garbage collector continuously monitor all the dustbins in our system through an Android application.with that information he selected a particular route to collect the filled dustbins.

III. EXISTING SYSTEM

In the existing system there is no indication whether the dustbin is over flown. It is more time consuming task and it is less effective. It leads to the wastage of time since the truck will go and clean whether the dustbin is full or empty. This system need high cost. This system will create a unhygiene environment and make the city unclean.In this system the level of the dustbin will not be known and create the bad smell spreads and cause illness to human beings. It also make more traffic and noise.

IV. PROPOSED SYSTEM

In present day if the dustbin is overflown,the proposed system will help to avoid the overflow of dustbin. It will give the real time information about the level of the dustbin. It will notify immediately when the dustbin is full.we are also proposing a new system in order to separate both the wet and dry wastes automatically with the level of moisture present in the waste. Deployment of dustbin based on actual needs. Cost of this system is minimum .The resources are available easily. Improves environment quality by reducing the smell and make the cities clean. It has effective usage of dustbins. It will also reduce the wastage of time and energy for truck drivers.

V. FLOW CHART

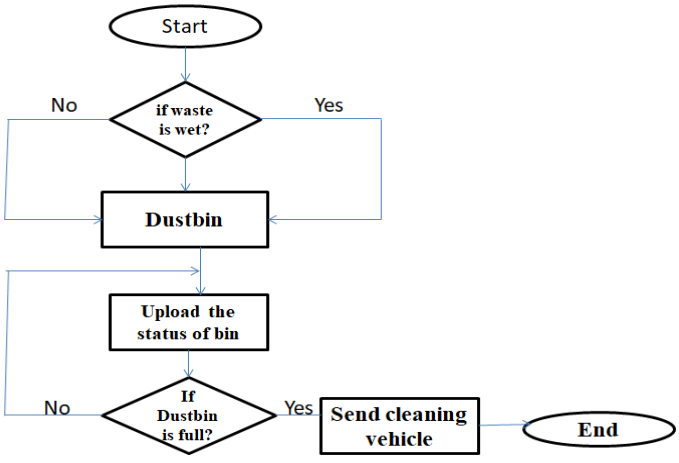

Fig 2: flow chart

VI. METHODOLOGY

Ultrasonic sensor

Fig 3.1: ultrasonic sensor

The sensor is used to detect the level of the dust in the dustbin. It uses a sound transmitter and receiver .An ultrasonic sensor create a ultrasonic pulse called ping and listen for the reflection of pulse .The sound pulse is created electronically using a sonar projector consisting of signal generator, power amplifier, and electro-acoustic transducer array .A beam former is usually employed to concentrate the acoustic power into the beam.

It measures the distance of an object by using sound waves .It sends out a sound wave at a specific frequency and listening for that sound wave to bounce back.

Ardiuno NodeMCU

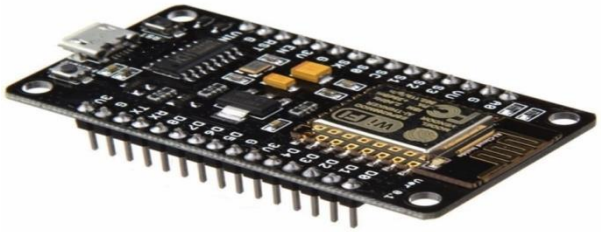

Fig 3.2: Ardiuno NodeMCU

NodeMCU is a single board microcontroller type with Extended Operating system .It contains memory of 128 KB and a storage of 4 MB. It is an open source IoT platform device. It has 10 digital pins and an analog pin where every GPIO can be PWM, I2C, 1-wire. It is wifi enabled device.It internally consists of the firmware like ESP8266 Wifi soc.

The ESP866 is a low-cost Wi-Fi chip with full TCP/IP stack and microcontroller capability .This small module allows microcontrollers to connect to a Wi-Fi network.

Moisture sensor

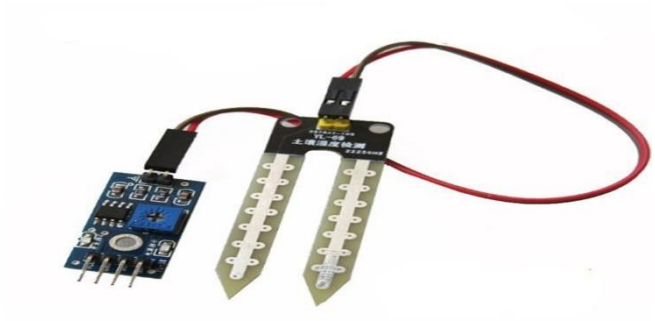

Fig 3.3: moisture sensor

Analog moisture sensor for arduino can read the amount of moisture present in the substance. It has two probes to pass current through the substance and then it reads the resistance to get the moisture level present in that substance.

Servomotor

Fig 3.4: servomotor

Tiny and lightweight with high output power. Servo can rotate approximately 180 degrees (90 in each direction), and works just like the standard kinds but smaller. You can use any servo code, hardware or library to control these servos. Good for beginners who want to make stuff move without building a motor controller with feedback & gear box, especially since it will fit in small places. It comes with a 3 horns (arms) and hardware.

Infrared sensor

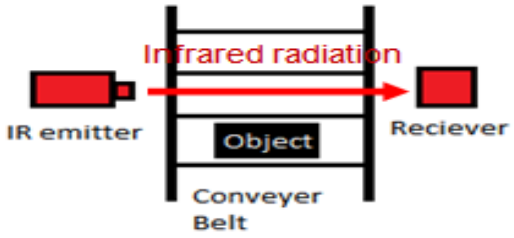

Fig 3.5: infrared sensor

we are using Break beam type of IR sensor. IR beam is emitted continuously towards the receiver. The flow of IR can be interrupted by placing an object between the emitter and receiver .If the IR is transmitted but altered then receiver generates output based on the change in radiation.

In combination of the moisture sensor, Infrared sensor and the servomotor we are going to separate both the wet and dry wastes. Based on the moisture level present in the substance the controller is programmed to rotate the servomotor on a particular directions in order to separate the wet and dry wastes

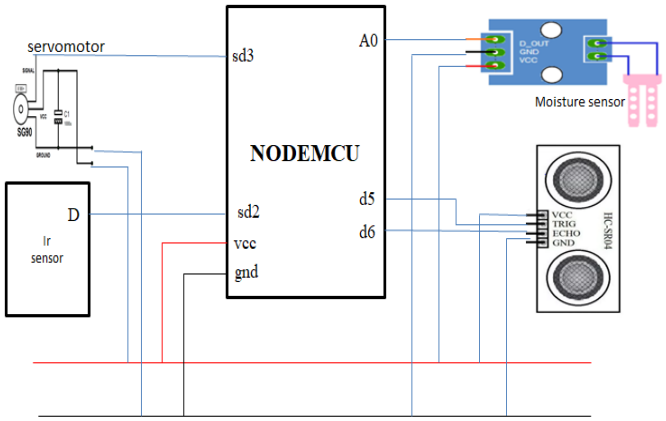

Fig 3.6: circuit diagram

VII. RESULTS AND DISCUSSIONS

The following are the results which obtained from this work,

- Waste Level detection inside the dustbin
- Transmit the information wirelessly to concerned
- The data can be accessed anytime and from anywhere
- The real-time data transmission and access
- seperation of both dry and wet wastes automatically
- Avoids the overflows of Dustbins

This IoT based waste management is very useful for smart cities in different aspects. We have seen that, in cities there are different dustbins located in the different areas and dustbins get over flown many times and the concerned people do not get information about this. Our system is designed to solve this issue and will provide complete details of the dustbin located in the different areas throughout the city. The

concerned authority can access the information from anywhere and anytime to get the details. Accordingly they can take the decision on this immediately.

Waste level detection inside the dustbin

Fig 4: Smart bin

- Where ultrasonic sensor inside the dustbin is used to find the level of filling of the waste.

Separation of both dry and wet wastes:

Fig 4.2: smart bins at waste separation

- Designed a hardware setup over the dustbins inorder to separate both the Wet and Dry wastes automatically.

The data can be accessed anytime and from anywhere by using the mobile applications:

- we are designed an android application by using the MIT app inventor. So, that the truck driver can possess the information about the filling of the dustbins.

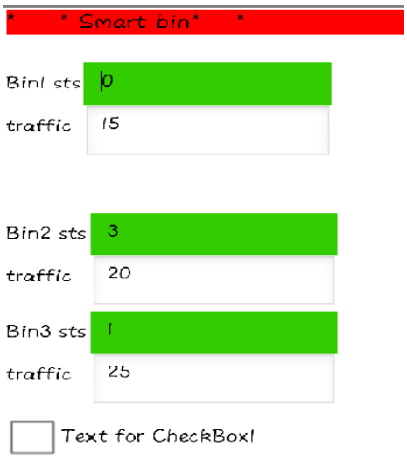

Fig 4.3: Mobile application with filling information

- By the information provided in the application the truck drivers easily get the information about the clearing process and do their work immediately. They can identify the filled bins and can able to clean the completely filled dustbins. It will also reduce the wastage of time and energy for truck drivers.

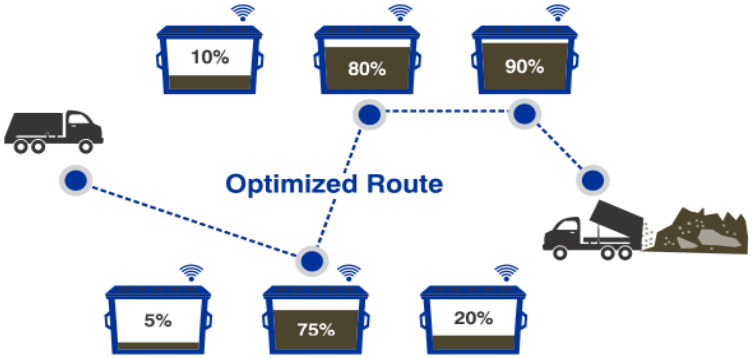

Fig 4.4: Optimised route decided by the truck driver

VIII. CONCLUSION

The objective of the project is for the real time access of information about the dustbin.This waste Management System using IOT has implemented the management of waste in real time using smart dustbin to check the fill level of dustbin to check if it is full or not. In this information about the filling of dustbin is send and action is taken immediately based on the aspect.It is accessed from anywhere in the world continuously.It is able to be understand easily by all kind of people.It does not have any complicated work. This IoT based management of waste is very useful for smart cities in many aspects.This system will prevent the overflow of dustbin and make the environment neat and clean.In this we can separate both the wet and dry wastes automatically.It will reduce the wastage of time, cost and energy of the human.It will also prevent the occurrence of any disease.The truck drivers easily get the information about the clearing process and do their work immediately.

FUTURE WORK

The future scope of the project is using the time stamp.The system can be implemented with the time stamp in which the real clock is used to display to the person at what time the dustbin is full and when the truck driver has collected the waste from the dustbin. We can manage the food waste that is dump in the dustbin.Since this management of food waste will reduce the outcome of nasty smell.Since the food waste is managed properly there is no such smell that will pollute the city.

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