WASTE MANAGEMENT IN SMART CITIES USING IoT

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Abstract—In this project an automated system is provided for segregating types of wastes as biodegradable, non-biodegradable and metallic wastes. A mechanical setup can be used for separating wastes into separate containers where sensors are used for separating the wastes. In this process, the color sensor detects the type of waste according to the RGB color scale. The sensing range is from 0-1024 in digital value and 0-5 volts in Analog value. If the detected value is from 0 to 500 then the particular waste is detected as bio-degradable waste and if it is from 500 to 1024 then the detected waste is termed as Non-biodegradable wastes and then that detected waste is putted into that particular container. The metal wastes are detected with the help of metal sensor these sensors create an EM field for detection of the waste. These containers are embedded with ultrasonic sensors at the top, the ultrasonic sensor is used for measure the level of waste. This makes it possible to measure the amount of waste in the containers if the containers attain a certain level, an alert message containing the location of the dustbin is sent to the garbage collector if the garbage is collected and the bin is emptied an acknowledgement is sent to the municipality corporation if not a complaint is filed against the garbage collector. This proposed system will give an enhanced waste management system for segregating and managing the wastes.

Keywords—Color sensor, Metal sensor, Waste, Garbage bin, Segregation, Garbage collector

I. INTRODUCTION

Waste management is one of the major alarming threat all over the world. Poorly managed waste leads to contamination of the oceans. Clogging drains and transmitting of new diseases. The current systems cannot cope up with the current volumes of wastes generated by the increasing urban population. The world generates about 2.01 billion tons of municipal solid waste annually, with at least 33 percent of that extremely conservatively not managed in an environmentally safe manner. Worldwide, waste generated per person per day averages 0.74 kilogram but ranges widely, from 0.11 to 4.54 kilograms. That too in the developing countries like India due to the rapid urbanization and industrialization the waste generated increases day by day. According to the recent data from MNRE Report, India is generating exponentially about 145 million tons of waste per year and further it is expected to reach approximately 260 to 300 million tons per day in the year 2047.The wastes are best at when it is recycled and treated. This waste has to be managed effectively and efficiently in order to have healthy environment to have a safer environment. The major problems affecting the solid waste management are unscientific treatment, improper collection of waste, and ethical problems. This in turn leads to hazards situations like environmental degradation, water pollution, soil pollution, and air pollution. In this project we have proposed a model for proper collection and segregation the wastes are segregated into Bio-degradable, Non-biodegradable, e-wastes with the help of color sensors and the metal wastes are detected using the metal sensor. After the detection of the type of waste the detected waste is put into the particular dustbins, these dustbins are embedded with the ultrasonic sensors which are used to measure the level of the dustbin ,if the dustbin attains a certain level an alert message containing the location of the dustbin is sent to the garbage collector if the garbage is collected and the bin is emptied an acknowledgement is sent to the municipality corporation if not an complaint is filed against the garbage collector.

II. PROPOSED METHODALOGY

As shown in the figure 1 block diagram represents how the sensors and other components are connected to the Arduino. In our model the waste is placed in the plate fitted with the color sensor and the metal sensor. When the waste is placed in the plates with the help of the color sensor the type of waste is detected, the detection is based the RGB color scale. The color sensor works on the principle of intensity of reflected light. Each object has different intensity of reflected light with these differences the waste is segregated as Bio-degradable and Non-bio degradable. For Bio-degradable waste the sensing value is

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from 0-500 in digital value or 0-2.5 v in analog value as volts and for the Non-biodegradable waste the sensing value is from 500-1024 in digital value or 2.5-5.0 v in analog value as volts. The metal sensor is used to detect the metal waste like copper, silver, steel, iron, lead, aluminium and etc. The sensing range for ferrous metals like steel, iron, aluminium is 3-5 cms and for non-ferrous materials like silver, tin, lead is 1-1.5 cms. These sensed values are given into the Arduino UNO, it acts as analog to digital convertor, these converted digital values are fed into the Node MCU, the node mcu has integrated Wi-Fi module which is used for communication. The dustbins are embedded with the ultrasonic sensors at the top to calculate the level of garbage in the dustbins. After the segregation part, when the dustbin attains a certain level (75%) an alert message is sent to the respective garbage collector with the location of the dustbin to collect the waste. If he collects the waste and empties the dustbin an acknowledgement is sent to the municipality corporation. If the waste is not collected after a period of time a warning message is sent to the garbage collector even then if he didn't collect the waste a complaint is filed against the garbage collector at the municipality corporation. And then the process continues
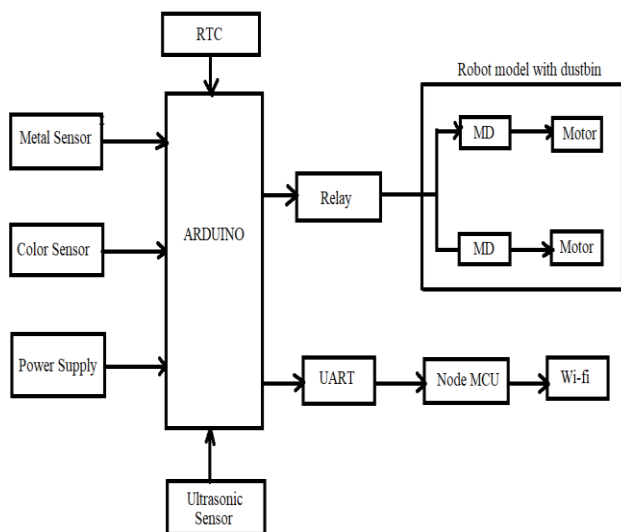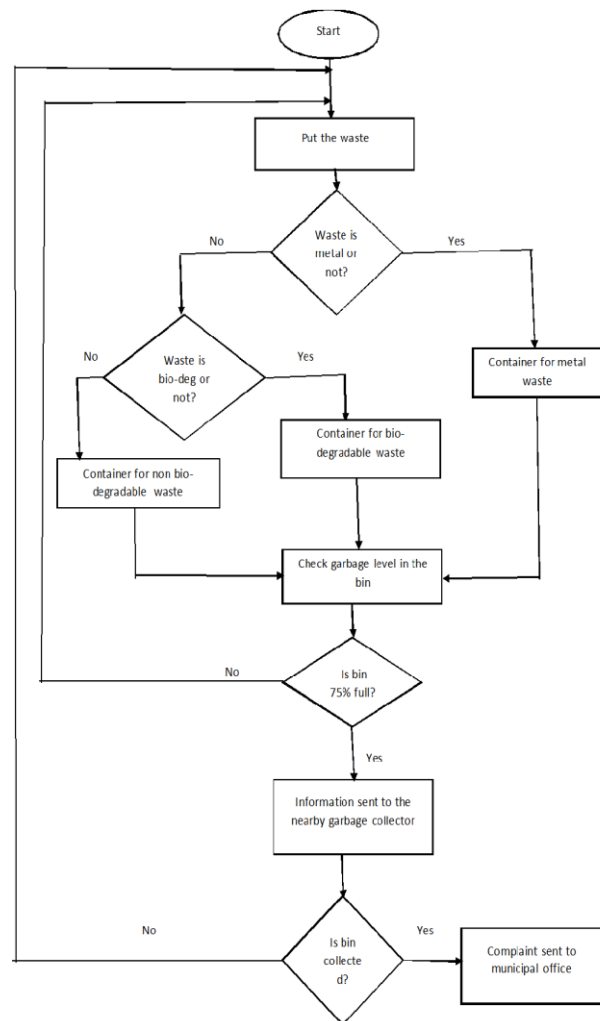

Fig.1: Block Diagram of Proposed System

Fig.1: Flow Chart of Proposed System

## III. COMPONENTS

A)Arduino UNO:

Arduino UNO is an open-source microcontroller which is easy to use with variety of applications. It has 14 digital pins and 6 Analog pins. Its operating voltage is 5volts.The advantage of the Arduino Uno over other microcontrollers is that it has a built in Analog-Digital convertor and Digital-Analog convertor.
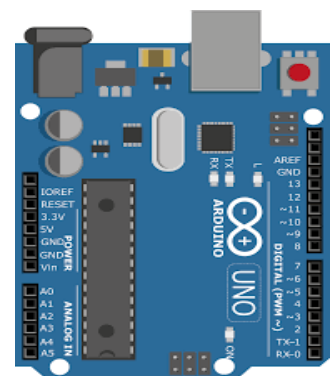
B)Node MCU:

The Node MCU is an open-source IoT platform device consisting of ESP8266 module having a 32-bit ARM microprocessor with integrates WI-FI network support. It consists of 10 GPIO pins but it has only one Analog pin(A0). Its operating voltage is 3.3v. Its advantages are low energy consumption and low cost.
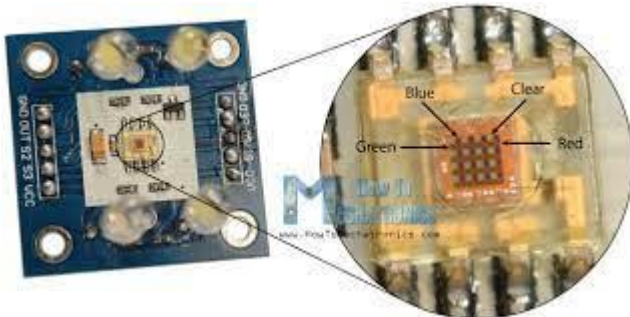
C)Color sensor:

The color sensor is a complete color detector which detects the color and object using the reflected light intensity which differs from object to object. It consists of TAOS TCS3200 RGB sensor chip and 4 white Led's. It consists of 8 pins. The reflected light is sensed with the help of color filter filters out the primary color in the scattered rays and calculates the proportion of the primary color. With these calculated values the waste are segregated as Bio-degradable and Non-biodegradable. If the output is between 0-2.5v the detected waste is bio-degradable and if the value is from 2.5-5v the detected waste is non-biodegradable.

D)Metal sensor:

The metal sensor consists of a coil and an oscillator that generates an EM field in the surrounding of the sensing range, presence of any metallic substance in the sensing range causes dampening of oscillation amplitude with this the metal is detected. The sensing range for ferrous metals like steel, iron is 3-5 cms and for non-ferrous metals like copper is 1-1.15 cms.

E)Ultrasonic sensor:

The ultrasonic sensor measures the distance of the targeted object by emitting ultrasonic sound waves and converts the reflected sound in to electrical signal $D=\frac{1}{2}(TC)$ where T is the time taken and C is the speed of sound (343m/s). In this proposed system ultrasonic sensor is used to measure the level of garbage in the dustbins.

F)Real time clock:

Real time clock is used to measure the passage of time. An RTC generally contains a long-life battery to allow it to keep track of the time even when there is no power applied. In our proposed system the RTC is used to keep track of the garbage collection that is to check whether the waste is collected on tie or not.

G)GSM module:

GSM is used to provide message service to enable communication. Using GSM module, the concerned person will receive message regarding the dustbin location through SMS.

IV. CONCLUSION

The proposed system will provide a better waste management system. With proper use of integrity of software and hardware, this idea can develop a better waste control in over populated cities and town. Continuous monitoring of the level of the dustbin prevents the overflow of the dustbin which in turn leads to a greener environment. Since the dustbin the cleaned with standard time intervals foul smell of the garbage is prevented. Segregating of waste at the Basic stage will make the waste management more productive and useful. Eco friendly system.

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