**SMART WASTE MANAGEMENT SYSTEM USING IBM WATSON SERVICES**

**A Project Documentation**

Submitted in partial fulfillment of the requirement for the evaluation of internship project.

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**ABSTRACT**

* In the present day scenario, many times we see that the garbage bins or Dust bin are placed at public places in the cities are overflowing due to increase in the waste every day.
* It creates unhygienic condition for the people and creates bad smell around the surroundings this leads in spreading some deadly diseases & human illness, to avoid such a situation we designed **“Smart Waste Management System Using IBM Watson Services ”.**
* In this proposed System there are multiple dustbins located throughout the city or the Campus, these dustbins are provided with low cost embedded device which helps in tracking the level of the garbage bins and an unique ID will be provided for every dustbin in the city so that it is easy to identify which garbage bin is full.
* When the level reaches the threshold limit, the device will transmit the level along with the unique ID provided. These details can be accessed by the concern authorities from their place with the help of Internet and an immediate action can be made to clean the dustbins.

**PROBLEM STATEMENT**

The current process of waste management starts with the waste being created by people in the cities and disposed in trash bins near its creation point. The disposed trash is collected by municipality or private company trucks at the predefined times and transferred to temporary collection centers. The trash at the collection centers is then sent for recycling. This process in current city setting solves the waste problem partially while it creates other problems such as;

* Some trash bins are overfilled while others are under filled by the trash collection time.
* Overfilled trash bins create unhygienic conditions.
* Unoptimized truck routes result in excessive fuel usage and environmental pollution and
* All collected trash is combined which complicates sorting at the recycling facility.

Some of these problems can be mitigated by implementing smart waste management systems.

**PROJECT WORKING PROCESS**

At first, the level or the height of the garbage in each bin is measured by using the

ultrasonic sensor. This information is then received and processed by the Arduino Uno. It

will determine whether the garbage level has been surpassing the threshold level or not. For

this research purpose, there are two threshold levels sets: the first threshold is at 70% of the

bin height, and the second threshold is set at 90% of the bin height.

If the garbage level in the bin is crossing the first threshold level, then the first warning

message is generated and sent to the municipality. Besides, the green LEDs will be turned

ON in order to alert all the residents at every floor. Next, if the garbage level in the bin is

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At first, the level or the height of the garbage in each bin is measured by using the ultrasonic sensor. This information is then received and processed by the Arduino Uno. It will determine whether the garbage level has been surpassing the threshold level or not. For this research purpose, there are two threshold levels sets: the first threshold is at 70% of the bin height, and the second threshold is set at 90% of the bin height. If the garbage level in the bin is crossing the first threshold level, then the first warning message is generated and sent to the municipality.

**ABOUT COMPONENTS USED**

**HARDWARE COMPONENTS:**

1) Ultrasonic sensor

2) Node mcu - Wifi module-ESP8266

3) Jumper Wires

* ULTRASONIC SENSOR:

The Ultrasonic Sensor sends out a high-frequency sound pulse and then times how long it takes for the echo of the sound to reflect back. The sensor has two openings on its front. One opening transmits ultrasonic waves, (like a tiny speaker), the other receives them, (like a tiny microphone).The speed of sound is approximately 341 meters (1100 feet) per second in air. The ultrasonic sensor uses this information along with the time difference between sending and receiving the sound pulse to determine the distance to an object.

* NODEMCU-WIFI MODULE-ESP8266:

The ESP8266 WiFi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any micro controller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much WiFi-ability as a WiFi Shield offers.

* JUMPER WIRES:

A jump wire is an electrical wire or group of them in a cable with a connector or pin at each end (or sometimes without them – simply “tinned”), which is normally used to interconnect the components.

**SOFTWARE COMPONENTS:**

1) Arduino IDE

2) IBM Watson Cloud Platform

* ARDUINO IDE:

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and other open-source software. This software can be used with any Arduino board. It contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus.

* IBM WATSON CLOUD PLATFORM:

IBM Watson from other analytics software is its direct relevance to business problem solving. Watson has the ability to rapidly analyze gargantuan repositories of data, documents, and other artifacts; it also comes with a level of human speech pattern recognition and language understanding that was elusive for many artificial intelligence applications in the past. IBM Watson uses cognitive learning practices that combine the data analytics and statistical reasoning of machines with uniquely human qualities, such as self-directed goals, common sense, and ethical values.

**FINAL CODE**

**CODE:**

#include <ESP8266WiFi.h>

#include <PubSubClient.h>

//-------- Customise these values -----------

const char\* ssid = "GUEST";

const char\* password = "12345678";

//#include "DHT.h"

//#define DHTPIN D2 // what pin we're condefine ORG "17qph2"

#define ORG "kphn5v"

#define DEVICE\_TYPE "bruno2.0"

#define DEVICE\_ID "01"

#define TOKEN "1234567890"

//-------- Customise the above values --------

char server[] = ORG ".messaging.internetofthings.ibmcloud.com";

char topic[] = "iot-2/evt/Data/fmt/json";

char authMethod[] = "use-token-auth";

char token[] = TOKEN;

char clientId[] = "d:" ORG ":" DEVICE\_TYPE ":" DEVICE\_ID;

WiFiClient wifiClient;

PubSubClient client(server, 1883,wifiClient);

const int trigPin = D1;

const int echoPin = D2;

// defines variables

long duration;

int distance;

void setup() {

pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output

pinMode(echoPin, INPUT);// Sets the echoPin as an Input

Serial.begin(115200); // Starts the serial communication

Serial.print("Connecting to ");

Serial.print(ssid);

WiFi.begin(ssid, password);

while (WiFi.status() != WL\_CONNECTED) {

delay(500);

Serial.print(".");

}

Serial.println("");

Serial.print("WiFi connected, IP address: ");

Serial.println(WiFi.localIP());

Serial.println("connected sucfly");

}

void loop() {

// Clears the trigPin

digitalWrite(trigPin, LOW);

//digitalWrite(trigpin1,LOW);

delayMicroseconds(2);

// Sets the trigPin on HIGH state for 10 micro seconds

digitalWrite(trigPin, HIGH);

delayMicroseconds(10);

digitalWrite(trigPin, LOW);

// Reads the echoPin, returns the sound wave travel time in microseconds

duration = pulseIn(echoPin, HIGH);

// Calculating the distance

distance= duration\*0.034/2;

// Prints the distance on the Serial Monitor

Serial.print("Distance: ");

Serial.println(distance);

delay(5000);

PublishData(distance);

}

void PublishData(int distance){

if (!!!client.connected()) {

Serial.print("Reconnecting client to ");

Serial.println(server);

while (!!!client.connect(clientId, authMethod, token)) {

Serial.print(".");

delay(500);

}

String payload = "{\"d\":{\"distance\":";

payload += distance;

payload += "}}";

delay(1000);

if (client.publish(topic, (char\*) payload.c\_str())) {

Serial.println(payload);

Serial.println("publish okay");

}

Serial.println();

}

}

**CONCLUSION**

Monitoring the fullness of bins through the use of sensors, it is possible to achieve a more efficient system than the current existing. Our idea of “Smart waste management system”, mainly concentrates on Monitoring the waste management, providing a smart technology for waste system, avoiding human intervention, reducing human time and effort and which results in healthy and waste ridden environment. The proposed idea can be implemented for smart cities where the residents would be busy enough with their hectic schedule and wouldn’t have enough time for managing waste. The bins can be implemented in a city if desired where there would be a large bin that can have the capacity to accumulate the waste of solid type for a single apartment. The cost could be distributed among the residents leading to cheaper service provision.