**INTRODUCTION**

* 1. **PROJECT OVERVIEW:**
  2. **PURPOSE:**

Day by day the population is rapidly growing and the economic

broadening of the country, there is a very vast growth of the waste of management also. There is no actual right way of its solution or proper chain system to track and monitor the waste and disposal system. And cities are getting smart nowadays, but waste is not. Regardless of all the cities, the dustbins and waste are not getting tracked, sometimes the garbage in the bins gets to above the point, where it blemishes outside the garbage pail and open out in whole areas and causes so many health issues to the citizens. In this work, the prototype schema which we are trying to address the waste management issues with several solutions like by using the smart bins which will indicate the level of the garbage inside the bins and will alert the admin to pick the garbage from the particular region. Next, as it is a smart waste management system, we are giving some approach to society. People can also trail the waste in its particular society or close by it. And regardless of the garbage collector not attending to the particular society or particular area, the society member can record the issue through the user app, and that can be reached directly to the admin. The motive of making this prototype is to put one step into the solution of waste management.

**2. LITERATURE SURVEY**

**2.1 EXISTING PROBLEM:**

The problem of waste management is getting worse day by day. The attention to this problem needs to be addressed to avoid further problems and issues in society. The prototype consists of smart bins with RFID tags, garbage collector vehicle tracking using GPRS module, and the User App apart from this there is another side of the prototype is the Admin Panel where the admin can have track of all the details in one go and able to generate the report on the daily basis. The prototype goes in this way, basically, the smart bins will be tracked using the sensors, the level of the bins will be generated and monitored to the garbage collector and will be alert to the admin also. Next, the garbage vehicle will be tracked using the GPRS module and RFID tags, when the garbage vehicle comes in contact with the particular dustbins, the RFID tag on the dustbins will be activated and it will store the results in the cloud that the garbage has been collected from the particular region or the society. Next, the results of this will be reflected back to the user app and to the admin also. Users also can track the vehicle details and other information related to the waste.

**2.2 REFERENCES:**

* Shyam , Gopal Kirshna, Sunilkumar S. Manvi , and Priyanka Bharti. "Smart waste management using Internet-of-Things (IoT)." IEEE Computing and Communications Technologies (ICCCT), (2017) pp. 199-203.
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* Folianto, Fachmin, Yong Sheng Low, and Wai Leong Yeow. "Smartbin: Smart waste management system." Tenth IEEE International conference on Intelligent Sensors, Sensor Networks and Information Processing (ISSNIP), (2015).
* Vu, Dung, and Georges Kaddoum. "A waste city management system for smart cities applications." (2017).2017 Advances in Wireless and Optical Communications
* Kumar, S. Vinoth, T. Senthil Kumaran, A. Krishna Kumar, and MahanteshMathapati. "Smart garbage monitoring and clearance system using internet of things." IEEE Smart Technologies and Management for Computing, Communication, Controls, Energy and Materials, (2017).
  1. **PROBLEM STATEMENT DEFINITION:**

Main problem in our country is the delay in the collection and disposal of waste. This is mainly due to the human intervention involved in the process of waste management. Smart Waste Management System deals with everyday problems of waste disposal by reducing this human intervention. Garbage levels are not noted and weighed and the garbage is not empytied in time so people hesitate to use the garbage collectors to dispose the waste products.

**3. IDEATION &PROPOSED SOLUTION**

**3.1 EMPATHY MAP CANVAS:**



.**3.2 IDEATION &BRAINSTORMING:**

**3.2.1 DEFINE PROBLEM STATEMENT:**

The garbage cans are not empytied when filled, this makes the excess waste products to be thrown out irrespective of places .

**3.3 PROPOSED SOLUTION:**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No.** | | **Parameter** | **Description** |
| **●** | **1**  **.** | **Problem Statement (Problem to be solved)** | **\*Indiscriminate disposal of solid waste is a major issue in urban cen-ters of most developing countries and it poses a serious threat to the healthy living of the citizens.**  **\*The rate at which solid wastes are produced in most developing countries is becoming alarming.** |
| **2.** | | **Idea / Solution description** | **\*The smart, sensor based dustbin will judge the level of waste in it and send the message directly to the municipal corporation.**  **\*It can sense all types of waste material either in the form of solid or liquid.**  **\*According to the filled level of the dustbin, the vehicles from the municipal corporation will choose the shortest path with the help of the “TRANSPORTATION SOFTWARE '', which will save their time.**  **\*It emphasizes on “DIGITAL INDIA ''.** |
| **3.** | | **Novelty / Uniqueness** | **\* With the help of proper technology (GPS & SOFTWARE APPLICATIONS) we can guide the trucks to choose the shortest path.**  **\*It also favours the “SMART CITY” project and “DIGITAL INDIA”.**  **\*Introducing Iot makes it smartest and easiest.** |

**3.4 PROBLEM SOLUTION FIT:**

STEP 1

Problem Solving Cards

-Basic question

\*Problem Statement

1 . Whats most valuable to the customer?

2.What are we the best at?





—try

da

Previously there were numerous initiatives on waste management and educating people to dispose waste properly, and as they failed to achieve significant results, we have figured out the scopes that could be develop. To solve this problem, we have designed a process that ensures proper disposal and efficient waste collection. The procedures we designed involves creative initiative that will inspire people to dump in designated area or bins, and innovative method by using Decreasing Time algorithm or DTA for monitoring garbage generation and collection of the garbage's.

**3.5.USER ACCEPTANCE TESTING (UAT):**

The purpose of this document is to briefly explain the test coverage and open issues of the Smart Waste Management System project at the time of the release to User Acceptance Testing (UAT).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| This report shows the number of resolved or closed bugs at each severity level, and how they were resolved **Resolution** | **Severity 1** | **Severity 2** | **Severity 3** | **Severity 4** | **Subtotal** |
| By Design | 10 | 4 | 3 | 3 | 20 |
| Duplicate | 1 | 0 | 3 | 0 | 4 |
| External | 2 | 3 | 0 | 1 | 6 |
| Fixed | 11 | 2 | 4 | 20 | 37 |
| Not Reproduced | 0 | 0 | 1 | 0 | 1 |
| Skipped | 0 | 0 | 1 | 1 | 2 |
| Won't Fix | 0 | 5 | 2 | 1 | 8 |
| Totals | 24 | 14 | 13 | 26 | 78 |

**4.FUNCTIONAL REQUIREMENTS:**

**4.1 FUNCTIONAL REQUIREMENT:**

Following are the functional requirements of the proposed solution.

|  |  |  |
| --- | --- | --- |
| **FR No.** | **Functional Requirement (Epic)** | **Sub Requirement (Story / Sub-Task)** |
| FR-1 | Detailed bin inventory. | All monitored bins and stands can be seen on the map, and you can visit them at any time via the Street View feature from Google.  Bins or stands are visible on the map as green, orange or red circles.  You can see bin details in the Dashboard – capacity, waste type, last measurement, GPS location and  collection schedule or pick recognition. |
| FR-2 | Real time bin monitoring. | The Dashboard displays real-time data on fill-levels of bins monitored by smart sensors.  In addition to the % of fill-level, based on the historical data, the tool predicts when the bin will become full, one of the functionalities that are not included even in the best waste management software..  Sensors recognize picks as well; so you can check when the bin was last collected.  With real-time data and predictions, you can eliminate the overflowing bins and stop collecting half-empty  ones. |
| FR-3 | Expensive bins. | We help you identify bins that drive up your collection costs. The tool calculates a rating for each bin in terms of collection costs.  The tool considers the average distance depo-bin- discharge in the area. The tool assigns bin a rating  (1-10) and calculates distance from depo-bin discharge. |
| FR-4 | Adjust bin distribution. | Ensure the most optimal distribution of bins. Identify areas with either dense or sparse bin distribution.  Make sure all trash types are represented within a stand.  Based on the historical data, you can adjust bin capacity  or location where necessary. |
| FR-5 | Eliminate unefficient picks. | Eliminate the collection of half-empty bins. The sensors recognize picks.  By using real-time data on fill-levels and pick recognition, we can show you how full the bins you  collect are. |

|  |  |  |
| --- | --- | --- |
|  |  | The report shows how full the bin was when picked. You immediately see any inefficient picks below 80%  full. |
| FR-6 | Plan waste collection routes. | The tool semi-automates waste collection route planning. Based on current bin fill-levels and predictions of reaching full capacity, you are ready to respond and schedule waste collection.  You can compare planned vs. executed routes to  identify any inconsistencies. |

**Non-functional Requirements:**

Following are the non-functional requirements of the proposed solution.

|  |  |  |
| --- | --- | --- |
| **FR No.** | **Non-Functional Requirement** | **Description** |
| NFR-1 | **Usability** | IoT device verifies that usability is a special and important perspective to analyze user requirements, which can further improve the design quality. In the design process with user experience as the core, the analysis of users’ product usability can indeed help designers better understand users’ potential needs  in waste management, behavior and experience. |
| NFR-2 | **Security** | Use a reusable bottles Use reusable grocery bags  Purchase wisely and recycle  Avoid single use food and drink containers. |
| NFR-3 | **Reliability** | Smart waste management is also about creating better working conditions for waste collectors and drivers. Instead of driving the same collection routes and servicing empty bins, waste collectors will spend their time more efficiently, taking care of bins that  need servicing. |
| NFR-4 | **Performance** | The Smart Sensors use ultrasound technology to measure the fill levels (along with other data) in bins several times a day. Using a variety of IoT networks ( (NB-IoT,GPRS), the sensors send the data to  Sensoneo’s Smart Waste Management Software System, a powerful cloud-based platform, for data- driven daily operations, available also as a waste management app.  Customers are hence provided data-driven decision making, and optimization of waste collection routes, frequencies, and vehicle loads resulting in route  reduction by at least 30%. |
| NFR-5 | **Availability** | By developing & deploying resilient hardware and beautiful software we empower cities, businesses,  and countries to manage waste smarter. |
| NFR-6 | **Scalability** | Using smart waste bins reduce the number of bins  inside town , cities coz we able to monitor the |

**5. PROJECT DESIGN:**

**5.1 DATA FLOW DIAGRAM:**

**Data flow diagram**

• A data flow diagram system is implemented throughout the city.This is a centrally controlled system which finds locations of several waste bins.

• System is implemented throughout the city. This is a centrally controlled system which finds locations of several waste bins.

• These sensors constitute a smart waste bin system to send information like level of smart waste bin and locations of the smart wastebins. the flow of collected data is shown.

• Send waste collector at that location Store data band analysis found to be above than a prescribed danger level, an alert system is generated and the subsequent message is circulated and broadcasted to all the concerned cities.

• The implementation of the model consisting of sensors.

• Predominantly composition of Information and Communication Technologies (ICT) and the Internet of Things (IoT) is an innovative city environment.

• It develops, deploys, and promotes sustainable development to address growing urbanization challenges in smart applications such as computational power, communication bandwidth, and others.

• ICT is an intelligent network of connected objects and machines; it has an essential role in communicating the data to the cloud with various wireless technology such as Wi-Fi, Bluetooth, Global Position System (GPS), and Cellular Communication environment .

**6. PROJECT PLANNING & SCHEDULING**

**6.1 SPRINT PLANNING &ESTIMATION:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sprint** | **Functional Requirement (Epic)** | **Task** | **Story Points** | **Priority** | **Team Members** |
| Sprint-1 | Registration | As a team lead , I can enrolled for the project byentering my email, password and within that I can enter my team members name and their email. | 2 | High | Veerasivaji K |
| Sprint-1 |  | As a team lead , I will receive confirmation email once , I have enrolled for the project with team id and along with team members name. | 2 | High | Balamurugan A |
| Sprint-2 | Login | As a team member, I can login to the IBM portal by entering email & password | 1 | Medium | Santhoshini A |
| Sprint-2 |  | As a team member, I can login to the IBM portal by entering email & password | 1 | Medium | Vinothini G |
| Sprint-2 |  | As a team member, I can login to the IBM portal by entering email & | 1 | Medium | Veerasivaji K |

**6. PROJECT PLANNING & SCHEDULING**

**6.1 SPRINT PLANNING &ESTIMATION:**



**7.CODING AND SOLUTIONING:**

Import requests importjson importibmiotf.application importibmiotf.device import timeimport random import sys # watson device details organization "4yi0vc" devicType = "BIN1" deviceId = "BIN1ID" authMethod= "token" authToken="123456789" #generate random values for randomo variables (temperature&humidity) def myCommandCallback(cmd): global a print("command recieved:%s" %cmd.data['command']) control=cmd.data['command'] print(control) try: deviceOptions={"org": organization, "type": devicType,"id": deviceId,"authmethod":authMethod,"authtoken":authToken} deviceCli = ibmiotf.device.Client(deviceOptions) except Exception as e: print("caught exception connecting device %s" %str(e)) sys.exit() #connect and send a datapoint "temp" with value integer value into the cloud as a type of event for every 10 seconds deviceCli.connect() while True: distance= random.randint(10,70) loadcell= random.randint(5,15) data= {'dist':distance,'load':loadcell} if loadcell < 13 and loadcell > 15: load = "90 %" elif loadcell < 8 and loadcell > 12: load = "60 %" elif loadcell < 4 and loadcell > 7: load = "40 %" else: load = "0 %" if distance < 15: dist = 'Risk warning:' 'Dumpster poundage getting high, Time to collect :) 90 %' elif distance < 40 and distance >16: dist = 'Risk warning:' 'dumpster is above 60%' elif distance < 60 and distance > 41: dist = 'Risk warning:' '40 %' else: dist = 'Risk warning:' '17 %' if load == "90 %" or distance == "90 %": warn = 'alert :' ' Dumpster poundage getting high, Time to collect :)' distance == "60 %": elif load == "60 %" or warn = 'alert :' 'dumpster is above 60%' else : warn = 'alert :' 'No need to collect right now ' def myOnPublishCallback(lat=10.678991,long=78.177731): print("Gandigramam, Karur") print("published distance = %s " %distance,"loadcell:%s " %loadcell,"lon = %s " %long,"lat = %s" %lat) print(load) print(dist) print(warn) time.sleep(10) success=deviceCli.publishEvent ("IoTSensor","json",warn,qos=0,on\_publish= myOnPublishCallback) success=deviceCli.publishEvent ("IoTSensor","json",data,qos=0,on\_publish= myOnPublishCallback) if not success: print("not connected to ibmiot") time.sleep(30) deviceCli.commandCallback=myCommandCallback #disconnect the device deviceCli.disconnect.

**8.CONCLUSION:**

The Garbage level detection in bins are used to get the weight of the garbage in the bin. This system Alerts the authorized person to empty the bin whenever the bins are full. Garbage level of the bins can be monitored through a web App. We can view the location of every bin in the web application by sending GPS location from the device.

10.FUTURE SCOPE

Analytics and Reporting Solutions provide Advanced Analytics and help in managing data generated by the sensors. It is expected to hold the largest share of the Smart Waste Management System Market by solution. The solution includes components such as advanced analytics, data management, and dashboards & platforms. The huge flow of data and the need for environment protection are the major driving forces for the growth of analytics and reporting solutions in the Smart Waste Management System Market.

**9.SOURCE CODE:**

#include <WiFi.h>

#include <PubSubClient.h>

WiFiClient wifiClient;

String data3; #define ORG "4yi0vc"

#define DEVICE\_TYPE "nodeMcu"

#define DEVICE\_ID "Assignment4" #define TOKEN "123456789"

#define speed 0.034

#define led 14

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

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

char topic[] = "iot-2/cmd/home/fmt/String";

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

char token[] TOKEN;

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

client(server, 1883, wifiClient); void publishData();

const int trigpin-5; const int echopin=18;

String command;

String data=""; long duration;

float dist;

void setup()

Serial.begin(115200);

pinMode(led, OUTPUT); pinMode(trigpin, OUTPUT);

pinMode(echopin, INPUT);

wifiConnect(); mqttConnect(); }

void loop() { bool isNearby = dist< 100; digitalWrite(led, isNearby);

publishData(); delay(500);

if (Iclient.loop()) { mqttConnect();

}

void wifiConnect() {

Serial.print("Connecting to "); Serial.print("Wifi"); WiFi.begin("Wokwi-GUEST", "", 6);

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

delay(500); Serial.print(".");

import random

while(True):

 q=random.randint(10,999)  p=random.randint(10,999)  print("current temperature:",q)  print("current humidity:",p,"%")  j=37

 a=35

 if q>j and p<a:

 print("Sound alarm")

 else:

 print("Sound off")

 break

import time

import RPi.GPIO as GPIO

GPIO.setmode(GPIO.BOARD)

GPIO.setup(11, GPIO.OUT)

while True:

GPIO.output(11,True)

time.sleep(5)

GPIO.output(11,False)

time.sleep(5)

from gpiozero import Button, TrafficLights, Buzzer

buzzer = Buzzer(15)

button = Button(21)

lights = TrafficLights(25, 8, 7)

while True:

           button.wait\_for\_press()

           buzzer.on()

           light.green.on()

           sleep(5)

           lights.amber.on()

           sleep(5)

           lights.red.on()

           sleep(5)

           lights.off()

           buzzer.off()