|  |  |
| --- | --- |
| **Team ID** | **PNT2022TMID48693** |
| **Project Name** | **Smart Waste Management system for metropolitan cities** |
| **Team Leader** | **N.Pavithra** |
| **Team member 1** | **J.shabira taj** |
| **Team member 2** | **G.Sharmila Devi** |
| **Team member 3** | **M.Sumugapriya** |

**1.INTRODUCTION**

In public places and villages garbage accumulation is the serious problem now a days. The unhygienic condition leads to different diseases and spoil the environment. This can be solved by maintaining the smart dustbin in the surroundings. In this smart garbage management system is an improvement on the normal bin and it can check the garbage level over the dustbin by using ultrasonic sensor systems. Ultrasonic sensor is an instrument that measures the distance from an object. The automatic opening and closing of the bin can be done by sensor. The buzzer will be enabled when the bin is full. Then it will send alert message when the dustbin is full using GSM module and these GSM modules is connected to the circuit. So regular monitoring and intimating make the system useful in waste management. This leads to clean city for the better living. The mobile app is designed for every day update as graphical representation to ensure the greenish environment.

* **Project overview**

Waste management is all the activities and actions required to manage waste from its inception to its final disposal. This includes collection, transportation, treatment and disposal of waste together with monitoring and regulation. Waste collection methods vary widely among different countries and regions. Domestic waste collection services are often provided by local government authorities. Curbside collection is the most common method of disposal in most countries, in which waste is collected at regular intervals by specialised trucks. Waste collected is then transported to an appropriate disposal area.

Now days, cities with developing economies experience exhausted waste collection services, inadequately managed and uncontrolled dumpsites and the problems are worsening .

Waste collection method in such countries is an on-going challenge and many struggle due to weak institutions and rapid urbanization.

* **Purpose**

Environmental hygiene is very important for a healthy life. In our daily lives, waste containers should be stored without proper supervision until they overflow and fill up to leak and produce environmental pollutants that cause serious problems for human and environmental health. Is often. In smart cities, garbage containers need to be monitored and managed to ensure a healthy and smooth environment. In the field of technological progress, real-time monitoring and manipulation of waste treatment is a difficult topic that

**2.LITERATURE SURVEY**

* **Existing Problem**

Waste management has become an alarming challenge in local towns and cities across the world. Often the local area bins are overflowing and the municipalities are not aware of it. This affects the residents of that particular area in numerous ways starting from bad odour to unhygienic and unsafe surroundings. Poor waste management - ranging from non-existing collection systems to ineffective disposal -causes air pollution, water and soil contamination. Open and unsanitary areas contribute to contamination of drinking water and can cause infection and transmit diseases. Toxic components such as Persistent Organic Pollutants (POPs) pose particularly significant risks to human health and the environment as they accumulate through the food chain. Animals eating contaminated plants have higher doses of contaminants than if they were directly exposed. Precipitation or surface water seeping through waste will absorb hazardous components from landfills, agricultural areas, feedlots, etc. and carry them into surface and groundwater. Contaminated groundwater also poses a great health risk, as it is often used for drinking, bathing and recreation, as well as in agricultural and industrial activities. Landfills and waste transfer stations can attract various pests (insects, rodents, gulls, etc.) that look for food from

waste. These pests can spread diseases through viruses and bacteria (i.e., salmonella and e-coli), which are a risk to human health.

* **References**

**CROP YIELD ANALYSIS TITLE :**An Experimental Analysis of Crop Yield Prediction Using Modified Deep Learning Strategy.

**AUTHOR :P.Shyamala Bharathi, V.Amudha, G.Ramkumar**

**YEAR : 2022**

**ABSTRACT :**Agriculture is the most significant and important backbone to the country's economy and as compare to other countries Indian civilization depends this agricultural field a lot. Different climate conditions such as rainfall, temperature, humidity levels, pesticide problems and so on need to be monitored continuously to maintain the agricultural field in good manner. Now-a-days, there are lots of Artificial Intelligence assisted technologies are available to predict the climate conditions and report it properly to the respective user. In this paper, a novel deep learning strategy is designed to support agricultural field to predict the crop yield level in fine manner, in which the proposed learning scheme is called as Modified Deep Learning Strategy (MDLS). This MDLS is derived from the conventional learning schemes called K-Nearest Neighbor and the Decision Tree Algorithms. The proposed approach consider the parameters such as rainfall ratio, pesticide usage and the weather conditions like temperature level as the prediction constraints to analyze the crop yield nature. The resulting section shows the proper efficiency ratio of all the mentioned algorithms in clear manner with graphical representations. A novel crop yield prediction dataset is considered to estimate the prediction level of crops, in which it is obtained from the open source database called Kaggle. The performance evaluation of the proposed approach is portrayed in the resulting section as well as it is cross-validated with the conventional learning schemes called k-Nearest Neighbor and the Decision Tree algorithms to prove the efficiency of the proposed approach called Modified Deep Learning Strategy**.**

**TITLE : Crop Yield Prediction Using Machine Learning Algorithm.**

**AUTHOR :Ranjani J , V.K.G. Kalaiselvi , A.Sheela**

**YEAR : 2022**

**ABSTRACT :**Agriculture is the backbone of the Indian economy, with more than half of the country's people relying on it for subsistence. Crop production is predicted using machine learning techniques based on parameters such as rainfall, crop, and meteorological conditions. The most popular and powerful supervised machine learning algorithm, Random Forest, can do both classification and regression tasks. They are used in crop selection to reduce crop yield output losses, regardless of the distracting environment. Weather, climate, and other related environmental elements have posed a significant danger to agriculture's long-term viability. Machine learning (ML) is significant since it offers a decision-support tool for Crop Yield Prediction (CYP), which may help with decisions like which crops to cultivate and what to do during the crop's growing season. Crop yield estimation's major purpose is to boost agricultural crop production, and it does so using a variety of well-established models. Machine learning is increasingly widely used around the world due to its success in a range of disciplines such as forecasting, fault detection, pattern identification, and so on. A key agricultural concern is a yield prediction. Farmers will be able to determine the yield of their crop before growing on the agricultural field using the results of this study, allowing them to make informed decisions. To assist farmers in maximizing agricultural yield, timely instructions to forecast future crop output and analysis are required.

**TITLE : Design And Implementation Of Crop Yield Prediction Model In Agriculture.**

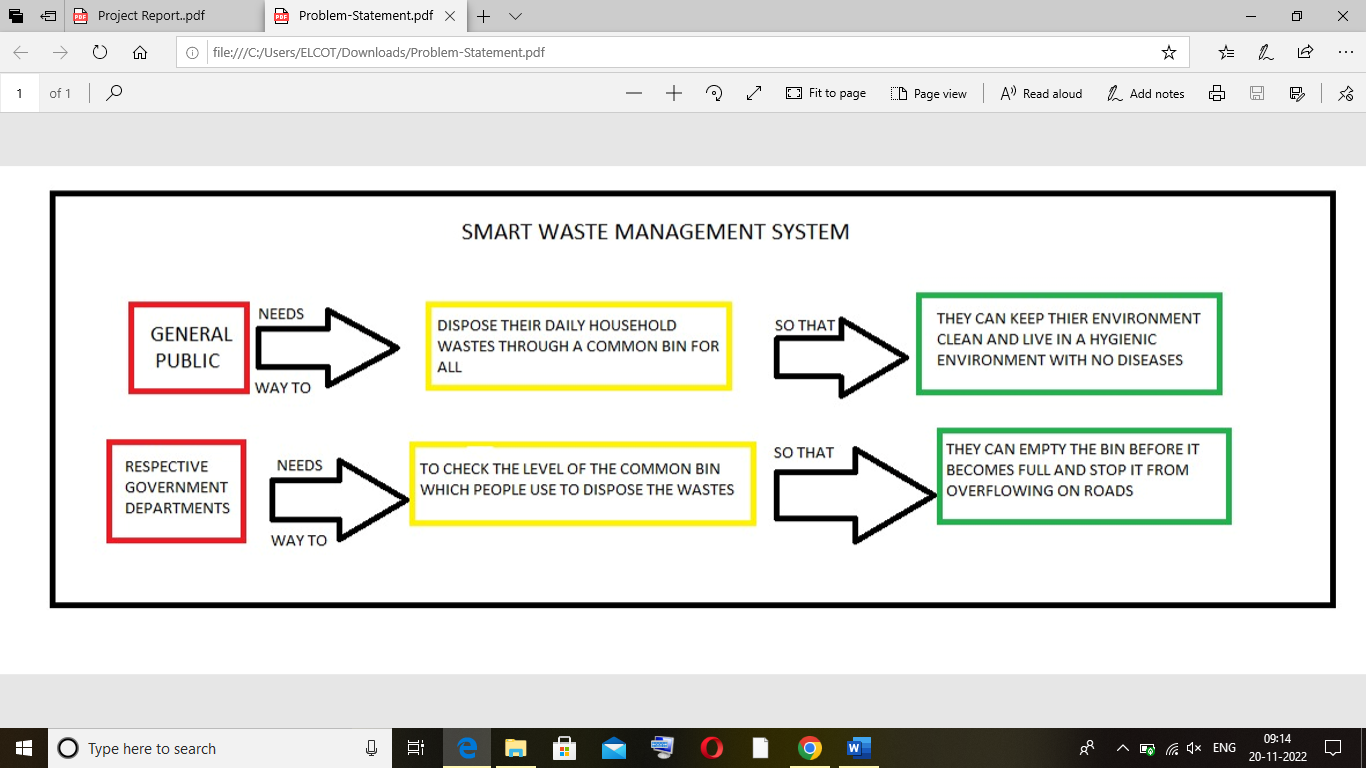
**AUTHOR : Sangeetha , Shruthi G**

**YEAR : 2020**

**ABSTRACT :**Agriculture is the best utility region especially inside the developing worldwide areas like India. Usage of records age in agriculture can substitute the circumstance of decision making and Farmers can yield in higher manner. About portion of the number of inhabitants in India relies upon on farming for its occupation however its commitment towards the GDP of India is just 14 percent. One suitable explanation behind this is the deficiency of adequate decision making by farmers on yield prediction. There isn't any framework in location to suggest farmer what plants to grow. The proposed machine learning approach aims at predicting the best yielded crop for a particular region by analyzing various atmospheric factors like rainfall, temperature, humidity etc., and land factors like soil pH, soil type including past records of crops grown. Finally our system is expected to predict the best yield based on dataset we have collected.

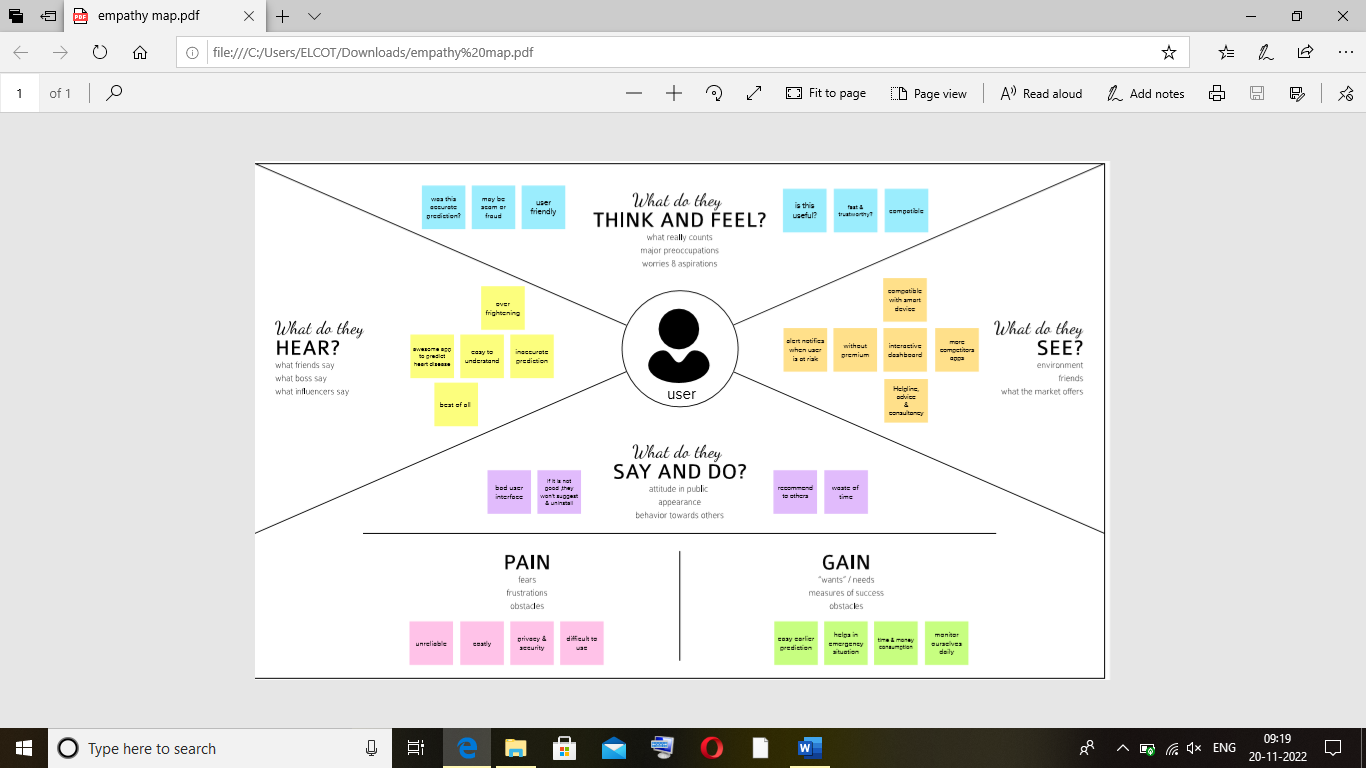
* **Problem Statement**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Problem Statement (PS) | I am (customer) | I am trying to | But | Because | Which makes me feel |
| **Ps1** | Council | Monitor the waste in my city | I have not much effective system for monitoring | Because of high cost | Unhygienic |
| **Ps2** | Council | Manage the waste in my city | I have not much effective system for managing | Because of more time consuming | Unsafe |

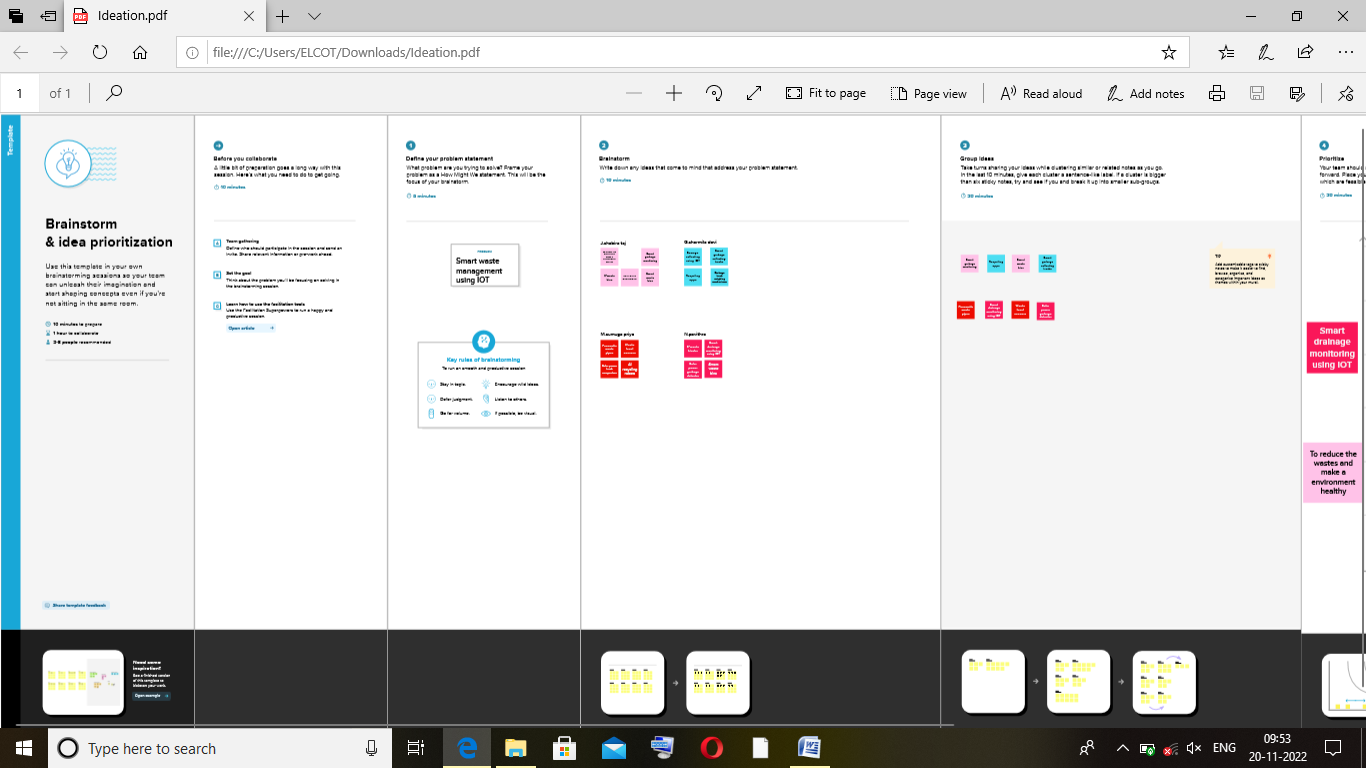
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**3.IDEATION AND PROPOSE SOLUTION**

* **Empathy map canvas**

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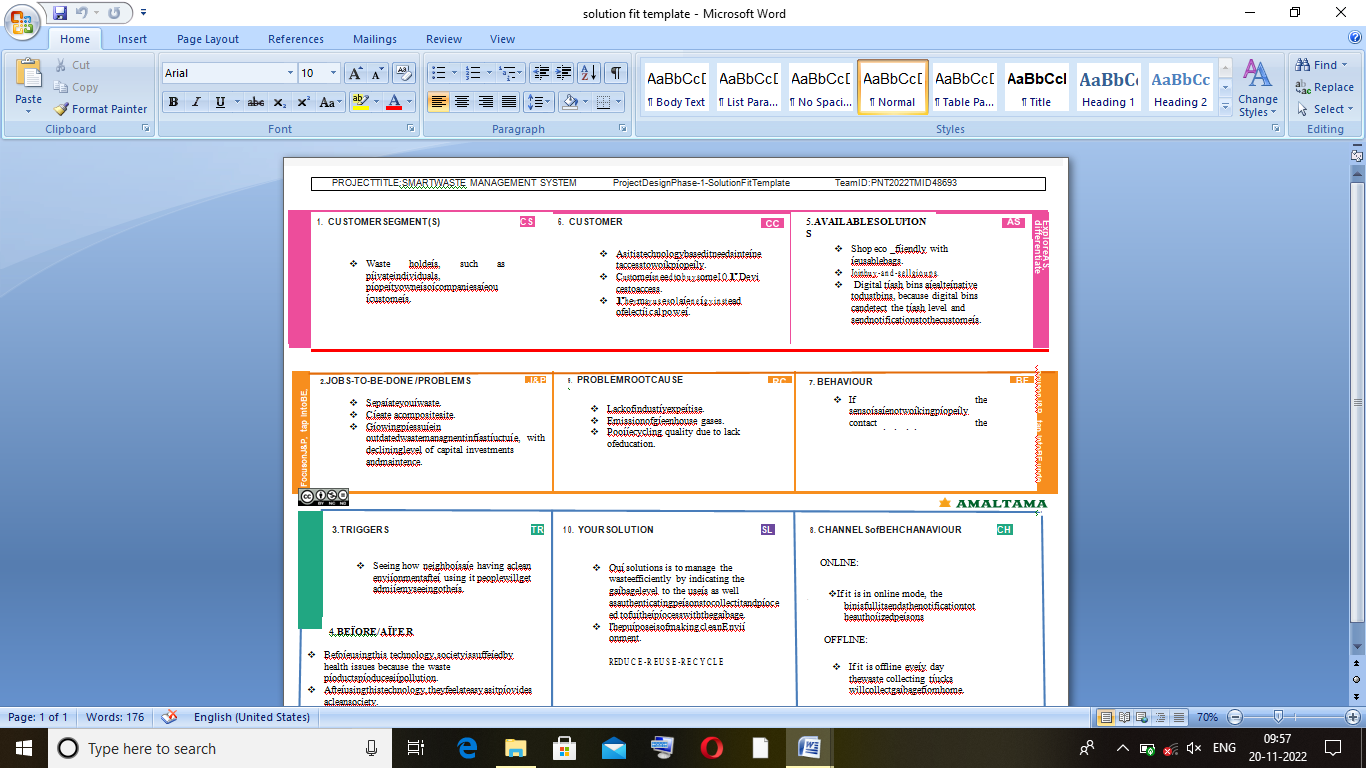
* **Ideation and Brainstorming**

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* Project Design Phase Proposed Solution Template

|  |  |  |
| --- | --- | --- |
| **SI.NO** | **Parameter** | **Description** |
| **1** | Problem Statement (Problem to be solved) | The process in current city setting solves the waste problem partially while it creates other problems such as, Some trash bins are over filled while others are under filled by the trash collection time ,overfilled trash bins create unhygienic conditions ,un optimized truck routes resulting 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. |
| **2** | Idea/Solution description | In this system, a 24×7 monitoring system is designed for monitoring dumpsters .Here as mart and organized system is designed for selective clearing .The ultrasonic sensor is used for measuring the level of waste in the dumpster .DC motor powered platform is used for segregating wet and dry waste. IR sensor and moisture sensor used for separating wet and dry waste .If either of the containers is full then an alert message is sent from the dumpster .In turn, employees can clear the corresponding dumpster .All these sensors are connected to an Arduino Uno board .It can be used for controlling all mechanical set up based on current conditions |
| **3** | Novelty/Uniqueness | 1.Identifypotentialstreams  2.reatewastemanagement-focusedcommunityoutreachplane |
| **4** | Social Impact/ Customer Satisfaction | 1.Neighbourhoodoflandfillsto  2.communities,breedingofpestsandlossinpropertyvalues  3.TheIOTsolutionusethedataandselectoptimum routes for waste collection trucks |
| **5** | Business Model(Revenue Model) | 1.It generates revenue through the provision of various waste management and disposal services .  2.Recycling solutions to residential ,commercial ,industrial and municipal clients. |

* **Problem Solution Fit**

****

**4. REQUIREMENT ANALYSIS**

* **Functional Requirement**

|  |  |  |
| --- | --- | --- |
| **Functional Requirements. NO** | **Functional Requirement(Epic)** | **Sub Requirement(Story/Sub-Task)** |
| **1** | Detailed bin inventory | All monitored bin sand stands can be see non the map, and you can visit them at any time via the Street View feature from Google.  Bin sort stands are visible on the map as green , or an ordered circles.  You can see bin details in the Dashboard – capacity ,waste type ,last measurement, GPS location and  Collection schedule or pick cognition. |
| **2** | Real time bin monitoring | The Dash board displays real-time data on fill-level so 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 |
| **3** | Expensive bins | We help you identify bins that drive up your collectioncosts.Thetoolcalculatesaratingforeachbinintermsofcollectioncosts.  The tool considers the average distanced stop -bin-discharge in the area. The tool assigns bin a rating  (1-10)and calculates distance from depend – bin discharge |
| **4** | Adjust bin distribution | Ensure the most optimal distribution of bins. Identify areas with either sense or sparse bin distribution.  Make sure all trash types are represented with in a stand.  Based on the historical data , you can adjust bin capacity  Or location where necessary. |
| **5** | Eliminate un efficient picks | Eliminate the collection of half-empty bins .These or recognize picks.  By using real-time data on fill-levels and pick recognition , we can show you how full he bins you  collect are |

* **Non Functional Requirements**

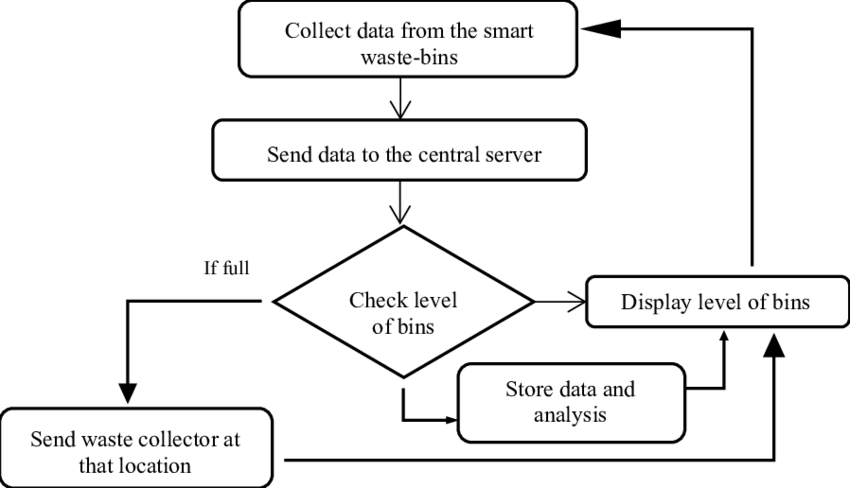
|  |  |  |
| --- | --- | --- |
| **Functional Requirement. NO** | **Non-Functional Requirement** | **Description** |
| **1** | Usability | Usability is a unique and significant perspective to examine user needs, which may further enhance the design quality, according to Iot devices. Analysing how well people interact with a product may help designers better understand customers' prospective demands for waste management, behaviour, and experience in the design process when user experience is at the Centre. |
| 2 | Security | Utilize recyclable bottles. Utilize reusable shopping bags. Spend responsibly and recycle Eat and drink in limited-use containers. |
| **3** | Reliability | Creating improved working conditions for garbage collectors and drivers is another aspect of smart waste management. Waste collectors will use their time more effectively by attending to bins that require service rather than travelling the same collection routes and servicing empty bins. |
| **4** | Performance | The Smart Sensors assess the fill levels in bins (along with other data) numerous times each day using ultrasonic technology. The sensors feed data to Senone’s Smart Waste Management Software System, a robust cloud-based platform with datadriven daily operations and a waste management app, using a variety of IoT networks (NB- IoT , GPRS). As a consequence, customers receive data-driven decision making services, and garbage collection routes, frequency, and truck loads are optimized, resulting in at least a 30% decrease in route length. |

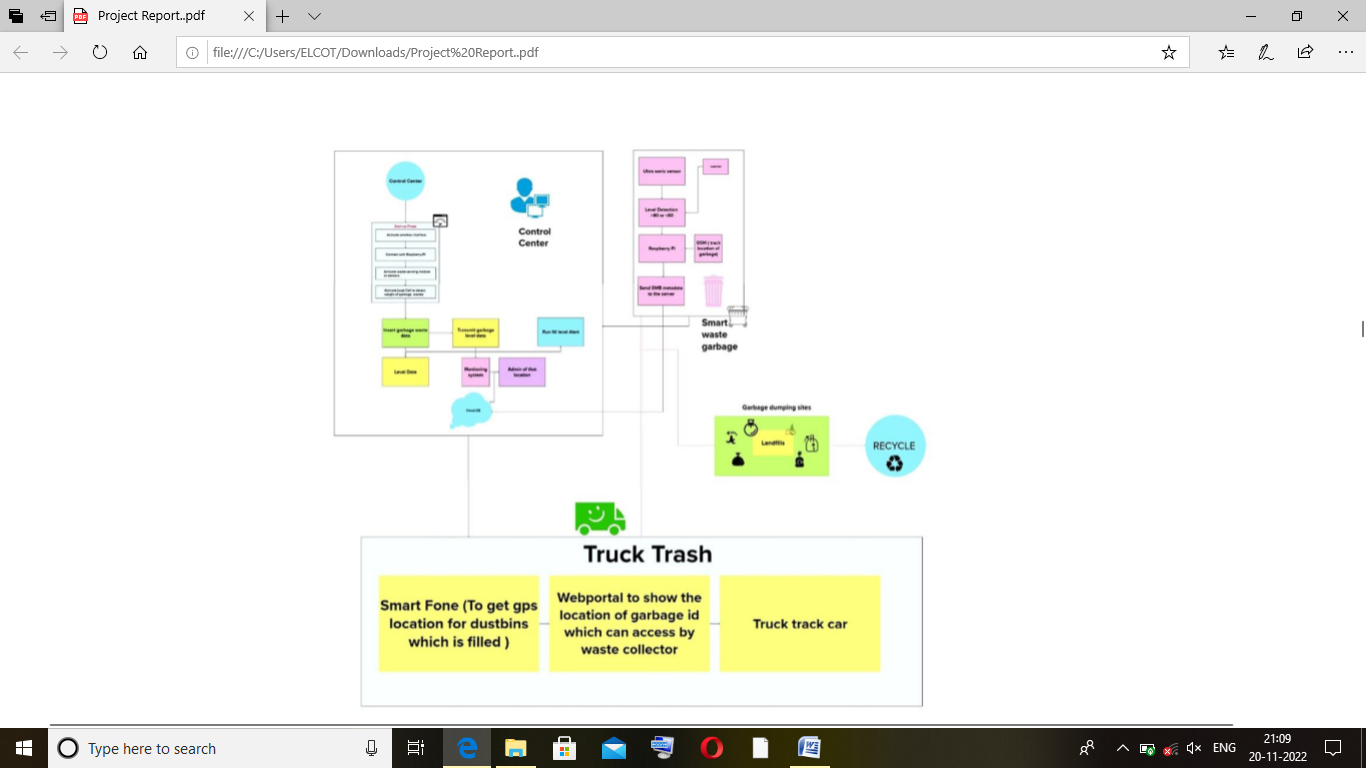
**5. PROJECT DESIGN**

* **Data Flow Diagram**

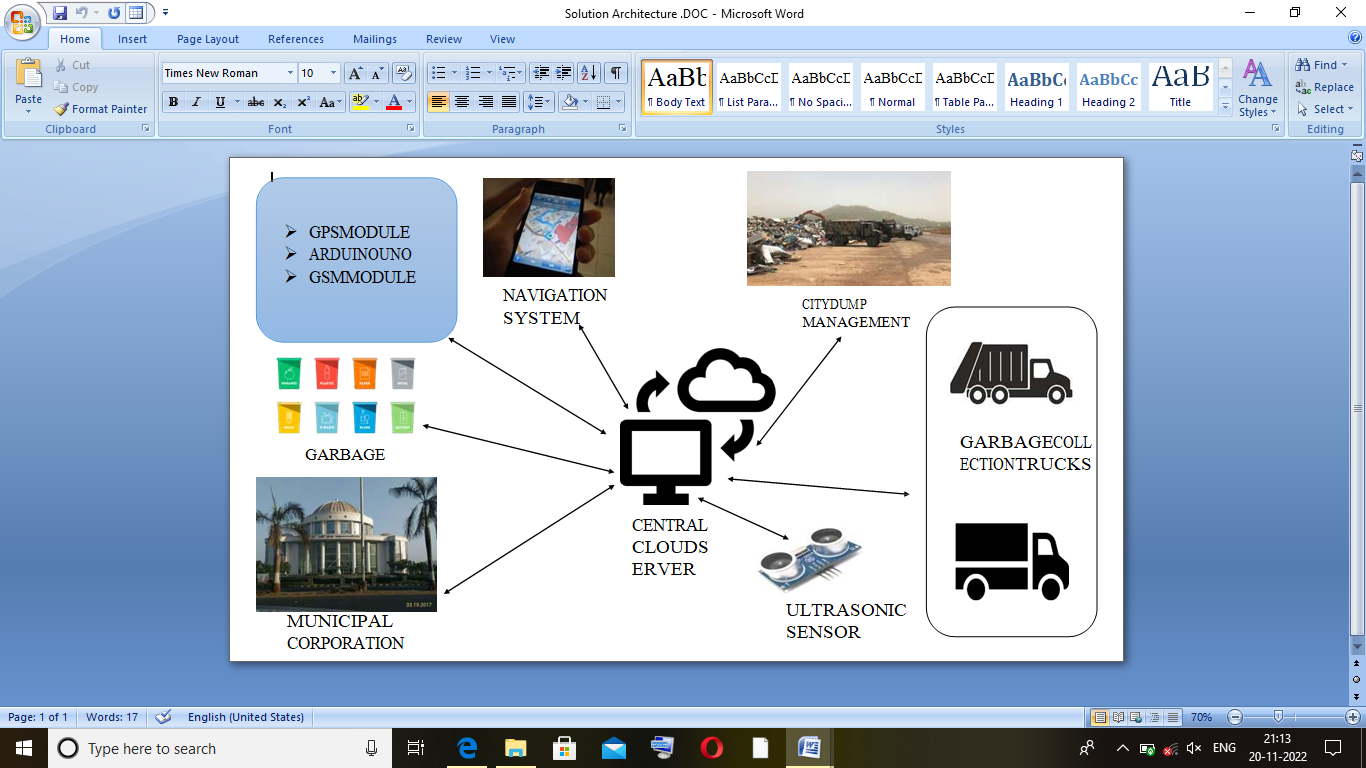
A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.

1. The first test conducted is the situation where the garbage bin is empty or its garbage level is very low
2. Then, the bin is filled with more garbage until its level has surpassed the first threshold value, which is set to 80% then the first warning SMS is being sent, as depicted
3. The first notification SMS sent by the system, once the waste reaches the level of 85% full
4. The second notification SMS sent by the system, indicating that bin is at least 95% full and the garbage needs to be collected immediately

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* **Solution & Technical Architecture**

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* **User Stories**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **User Type** | **Functional Requirement (Epic)** | **User Story Number** | **(User Story / Task)** | **Acceptance criteria** | **Priority** | **Release** | |
| Admin(who manages server) | Web server login | USN-1 | As a admin, I can able to track the truck driver name, id, contact number, location, and also the location of the dustbin | I can Manage and direct workers through web server | High | Sprint1 |
| Co-Admin | Login | USN-2 | As a co-admin I’ll monitor the workers, whether the work has been done properly, checking the availability of workers and also monitor the waste collected by the truck driver within the scheduled time | I can monitor the garbage bin activity | High | Sprint1 |
| Customer (Web user) | User | USN-3 | As a user , I can able to raise queries to higher authorities about the maintenance and disposal of waste | I can raise queries | Medium | Sprint2 |
| Customer Care Executive | Worker | USN-4 | As a customer care executive I will try to rectify the queries from customers by contacting co-admin. In case of emergency situation query can be reported to Admin.  I | I can attend calls and respond people and solve their problems | High | Sprint1 |
| Truck driver | Worker | USN-5 | The truck driver is a worker who has been assigned to collect the garbage and he have to report to admin about when and where and also the timings , the garbage has been picked up according the daily schedule | I will do the work properly and report the data at the scheduled time | High | Sprint1 |

**6.PROJECT PLANNING & SCHEDULE**

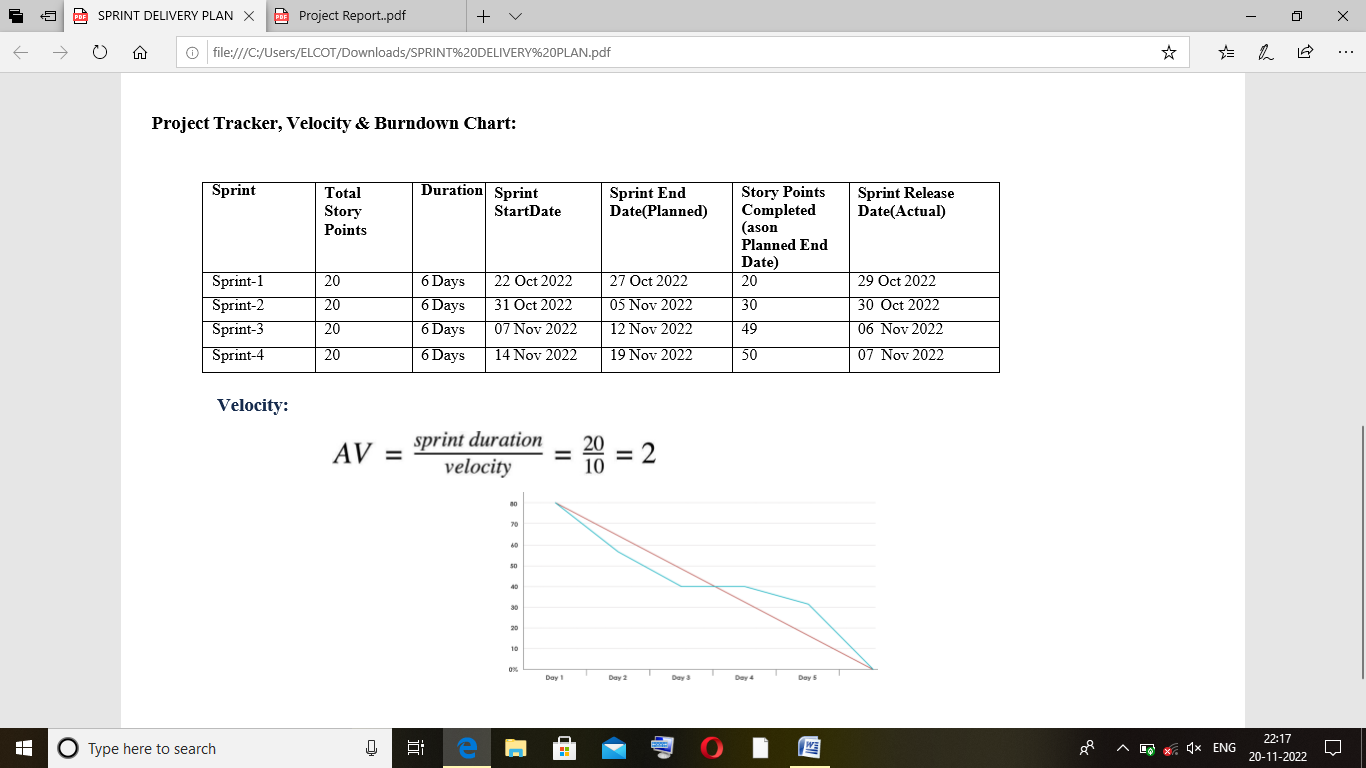
|  |  |  |
| --- | --- | --- |
| **PHASE** | **TITLE** | DESCRIPTION |
| Ideation Phase | Literature survey & Information Gathering | Literature survey on the selected project & gathering information by referring the, technical papers, research publications etc. |
|  | Prepare Empathy Map | Prepare Empathy Map Canvas to capture the user Pains & Gains, Prepare list of problem statements |
|  | Ideation | List the by organizing the brainstorming session and prioritize the top 3 ideas based on the feasibility & importance |
| Phase-1 | Proposed Solution | Prepare the proposed solution document, which includes the novelty, feasibility of idea, business model, social impact, scalability of solution, etc. |
|  | Problem Solution Fit | Prepare problem - solution fit document |
|  | solution Architecture | Prepare solution architecture document |
| Phase-2 | Customer Journey | Prepare the customer journey maps to understand the user interactions & experiences with the application (entry to exit). |

|  |  |  |
| --- | --- | --- |
|  | Functional Requirement | Prepare the functional and Non functional requirement document. |
|  | Data Flow Diagrams | Draw the data flow diagrams and submit for review. |
|  | Technology Architecture | Prepare the technology architecture diagram. |
| Project planning phase | Prepare Milestone & Activity List | Prepare the milestones & activity list of the project |
| Project development phase | Project Development - Delivery of Sprint-1, 2, 3 & 4 | Develop & submit the developed code by testing it. |

* **Sprint Delivery Schedule**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sprint** | **Functional Requirement (Epic)** | **Task** | **Story Point** | **Priority** | **Team Members** |
| Sprint1 | Registration | As a team lead , I can enrolled for the project by entering my email, password and within that I can enter my team members name and their email | 2 | High | N.Pavithra |
| Sprint2 |  | 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 | M.Sumugapriya |
| Sprint3 | Login | As a team member, I can login to the IBM portal by entering email & password | 2 | High | G.Sharmila Devi |
| Sprint4 |  | As a team member, I can login to the IBM portal by entering email & password | 2 | High | J.shabirataj |

* **Report From JIRA**

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**7. CODING & SOLUTION**

**PYTHON SCRIPT:**

import time import

sys

import ibmiotf. application

import ibmiotf .device import

random

#Provide your IBM Watson Device Credentials

organization = "fp3a19” device Type = "sample"

deviceId = "123" authMethod = "token" authToken = "Abcdefgh"

# Initialize GPIO

def myCommandcallback (cmd) : print ("Command received: %s"

% cmd.data[ 'command' ]) status=cmd.data['command'] if

status=="1ighton" : print ("led is on") else :

print ("led is off")

# print(cmd)

try: deviceoptions = {"org": organization, "type": deviceType,"id"

: deviceId,"auth-method":authMethod,"auth-token":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 “hello”• with value “world”• into the cloud as

an event of type “greeting”• 10 times deviceCli.connect ()

while True:

#Get Sensor Data from DET11 temp=random.randint

(0,100)

Humid=random. randint (0, 100)

data = { 'temp': temp, 'Humid': Humid }

#print data def myonPublishCallback () : print ("Published Temperature

= %s C" % temp, "Humidity = %s

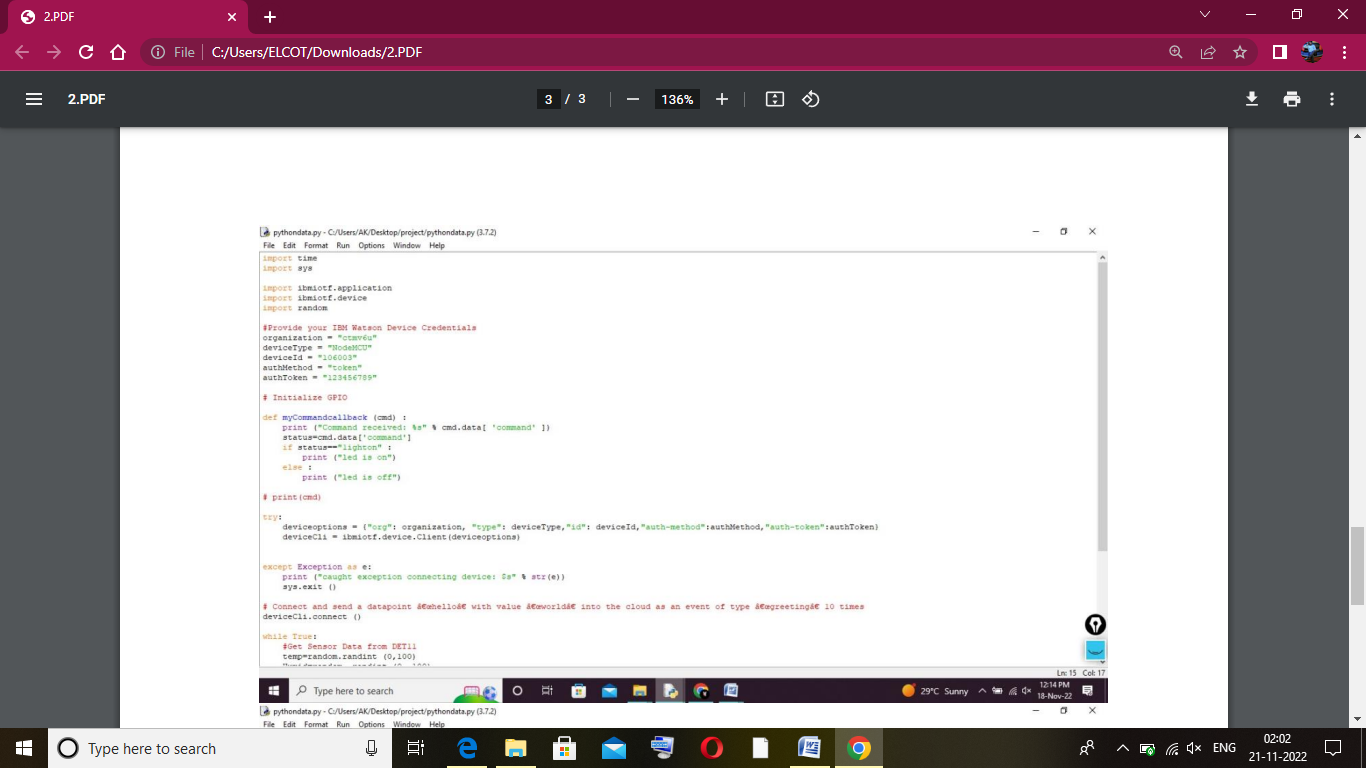
%%"% Humid, "to IBM Watson") success =

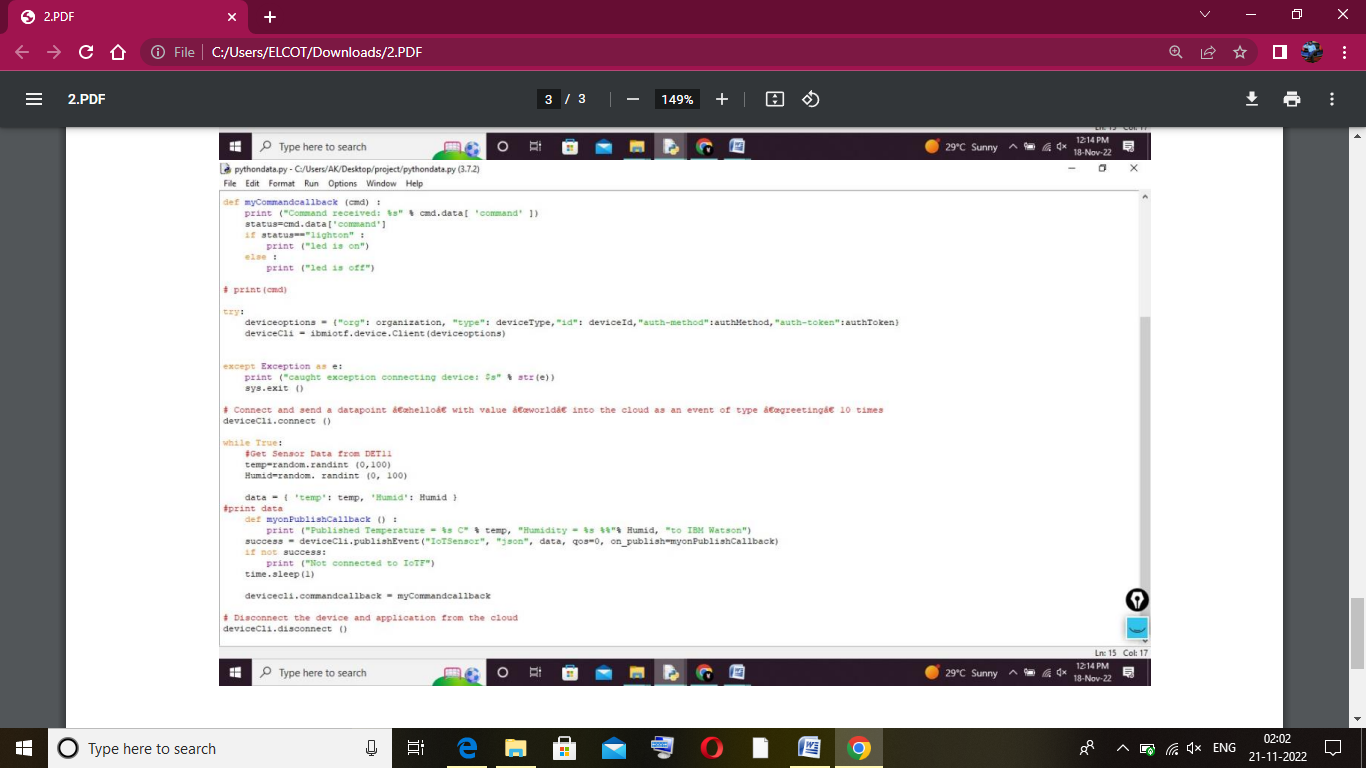
deviceCli. publishEvent("IoT Sensor", "json", data, qos=0,

on\_publish=my on Publish Callback) if not success: print ("Not connected

to IoTF") time .sleep(1)

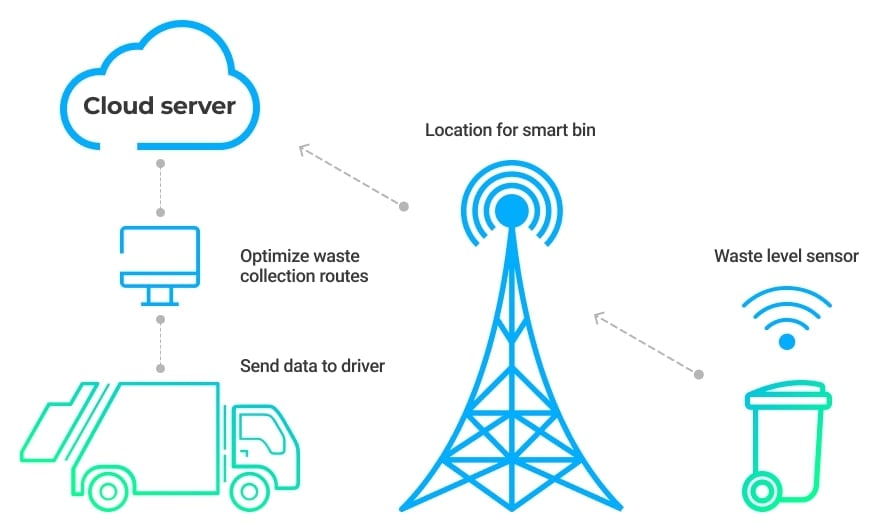
devicecil .command callback = my Command callback SCREENSHOTS :

****

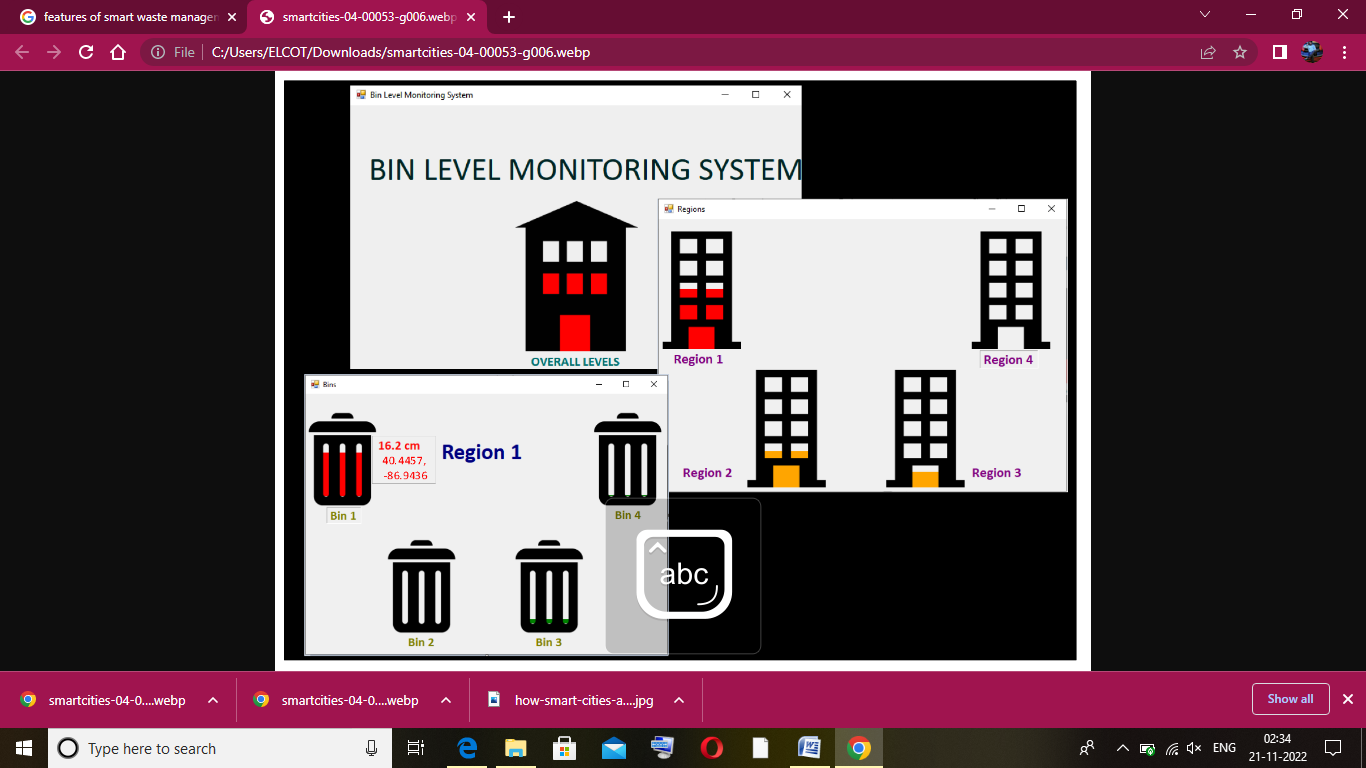
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**Disconnect the device and application from the cloud devicecli. Disconnect().**

* **Feature1:LOCATION TRACKER**

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* **Feature2:BIN LEVEL MONITORING SYSTEM**

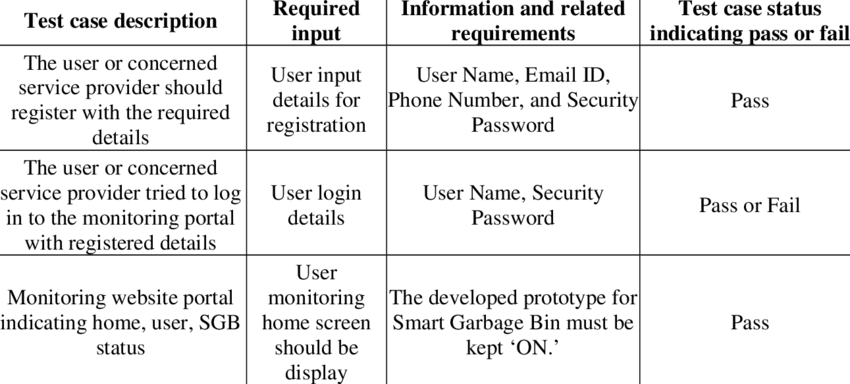
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* **Application**

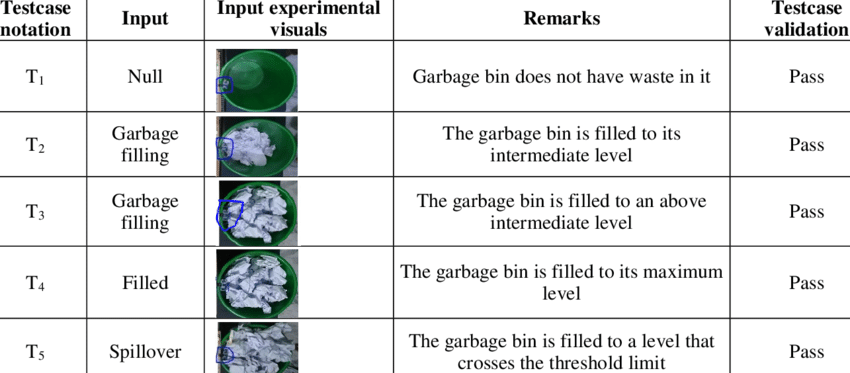
The project design is a part of the implication that can be used to improve the waste management of a locality. All the technical aspects have been thoroughly designed keeping all the constraints in mind. The project resolves around whether the project will be able to meet the future needs of the users. This project-based on IoT gives users the freedom of changing hardware as well as software specifications as per the arising need. IoT based projects are already designed while keeping future demands in mind and in a rising economy like India where the concept of smart cities is new the demand for our project will keep on increasing. This project here is a model of the large scale application which spans pan India in different smart cities. The implementation of this project has been divided into various phases. Starting from the metropolitan cities and moving towards the concept of smart cities, it will also cover small towns and tier III cities in later phases. At present, we are here to display the live working of the model and give an idea about the actual implications. For any society to flourish, it is manifestly important that they remain fair and orderly. Deciding how best to ensure this, in light of the huge growth in both the uptake and complexity of technology that has occurred in the last decade, and which can be expected to continue in the next, this here is one of the products that can be used to contribute to the better management of waste and increase the efficiency of resources.

**8. TESTING**

* **Test Cases**

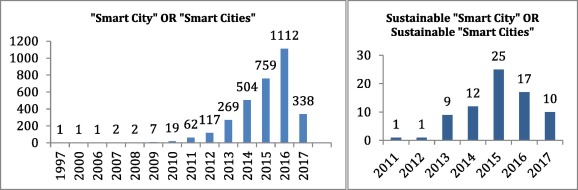
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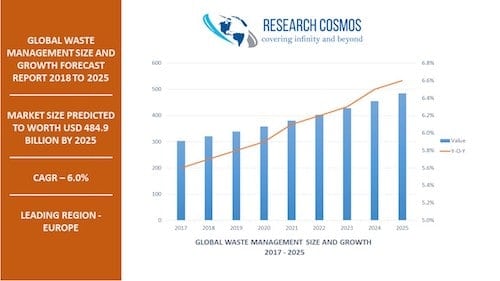
* **User Acceptance Testing**

**  
9.RESULTS: 6 Major Benefits of IOT Waste Management For Smart Cities**



* **Time-Saving**
* **Cost-Saving**
* **Transparency**
* **Sustainability**
* **Improving Efficiency**
* **Meet The Increasing Demand For Sustainable Solution**
* **PERFORMANCE METRICS**

****

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**10**.**Advantages**

* **Practice is highly lucrative**
* **Keeps the environment clean and fresh**
* **Saves the Earth and conserves energy**
* **Reduces environmental pollution**

**Disadvantages**

* **Process is not always cost-effective**
* **The resultant product has a short life**
* **Needs More Global Buy-In**
* **The sites are often dangerous**

**11.CONCLUSION**

Solid waste management is faced with a number of issues which include lack of

throughput, inadequate solid waste data, efficiency problem, delays in collection and

resistance to new technologies. Presently, waste management is a major problem for

authorities who are responsible for such task because it’s a costly service and it huge-

ly impacts the environment as a whole. This study introduced a smart waste monitor-

ing system that uses several sensors and communication technologies to achieve the

set task. The proposed system was achieved through the development of theoretical

models, layout and decision-making algorithms in the course of the project.

There is an enormous amount of room for the development of this project in order

for it to meet commercial standards. One of my many recommendations would be that

of the addition of other sensors e.g. accelerometer. The accelerometer will make the

system save more energy by turning on the system to measure the bin level only when

the lid is opened to dispose waste. The system would then update its current state on

ThingSpeak and turn off, preventing unnecessary measurement when the bin’s level

has not been altered due to dormancy.

Another recommendation is the use of solar panel for power generation making its power supply autonomous.

**12.FEATURE SCOPE**

1. Change the system of user authentication and atomic lock of bins, which would aid in protecting the bin from damage or theft.

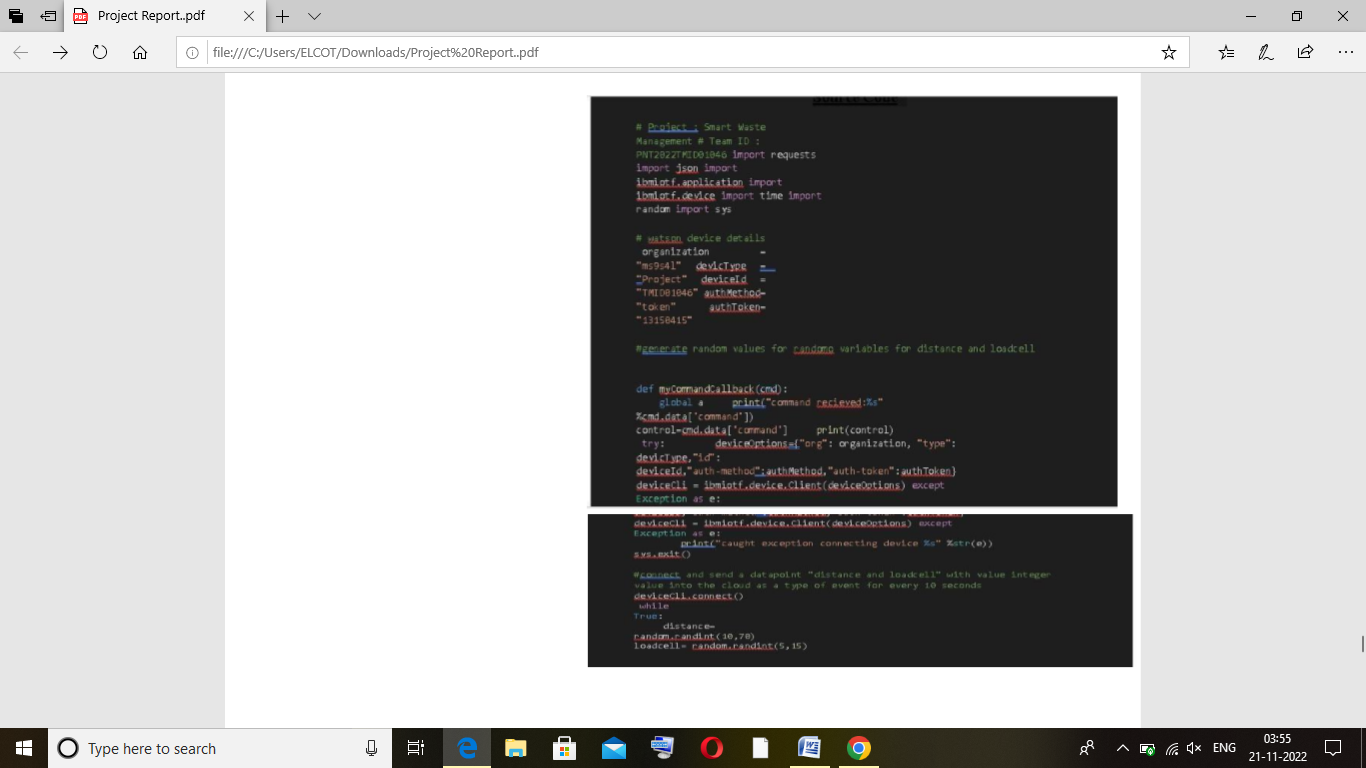
2. The concept of green points would encourage the involvement of residents or end users, making the idea successful and aiding in the achievement of collaborative waste management efforts, thus fulfilling the idea of Swachh Bharath.

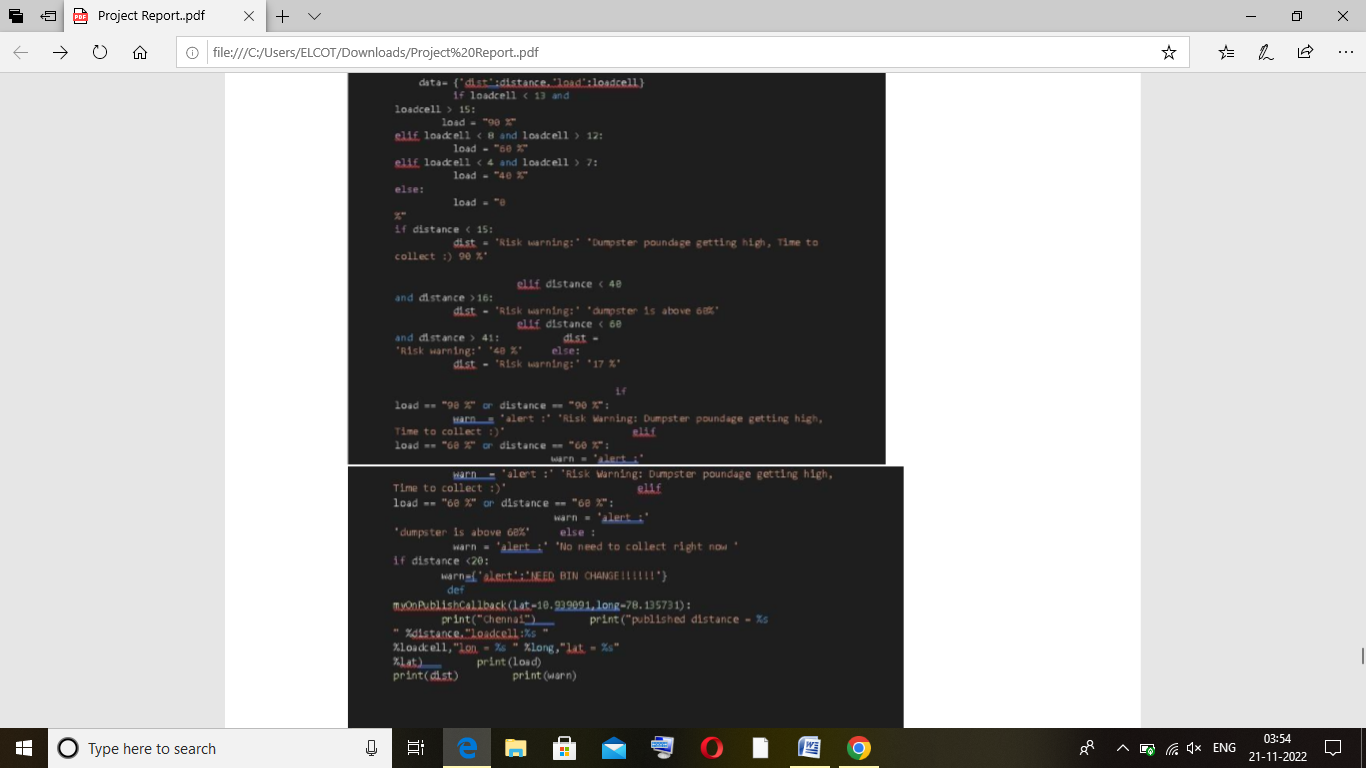
3. Having case study or data analytics on the type and times waste is collected on different days or seasons, making bin filling predictable and removing the reliance on electronic components, and fixing the coordinates.

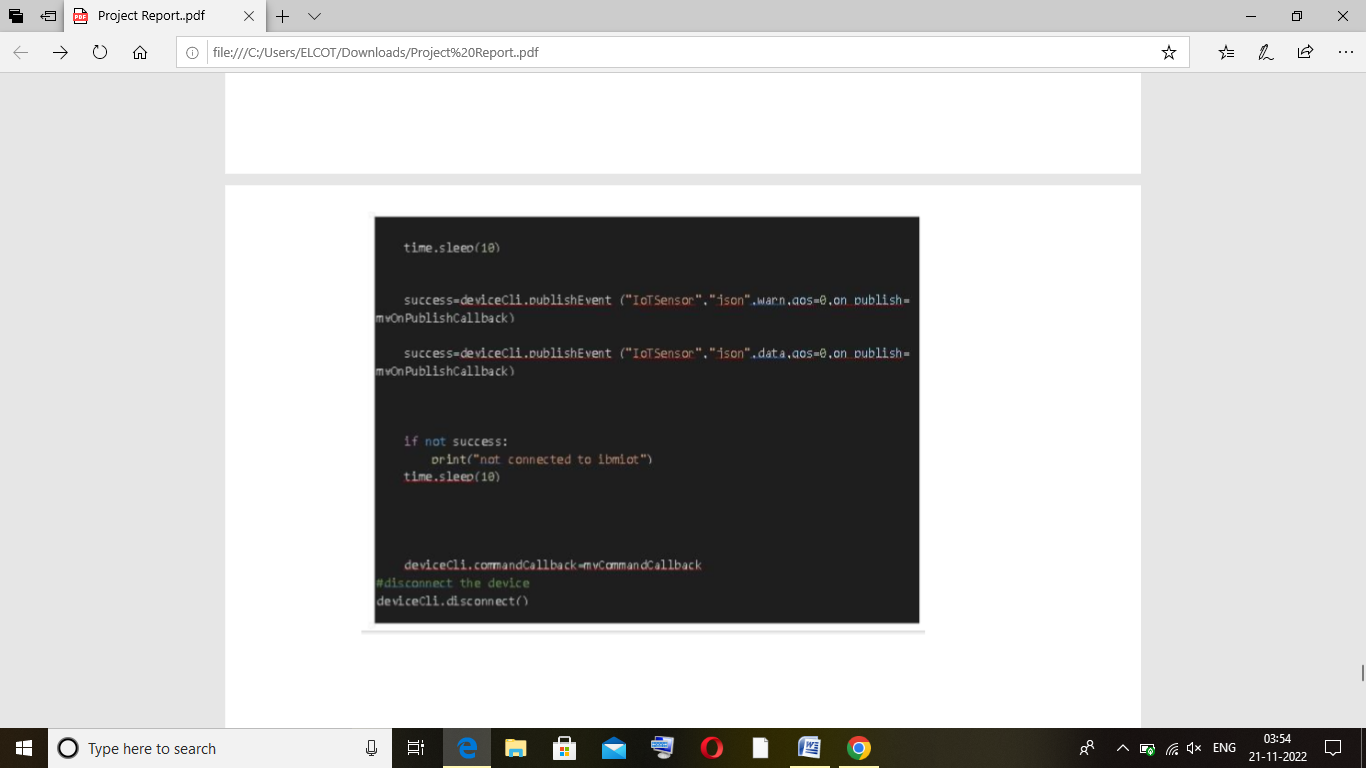
4. Improving the Server's and Android's graphical interfaces

**13.APPENDIX**

* **Source Code**



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* **GitHub Project Demo Link**

**https://github.com/IBM-EPBL/IBM-Project-42311-1660658946.git**