SMART CITY WASTE MANAGEMENT SYSTEM USING IOT

Team Id: PNT2022TMID49101

Project Name: Smart Waste Management for Metropolitan Cities

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A. Dhivya

K. Dhana Lakshmi

R. Prabadevi

ABSTRACT

As the population of world is increasing day by day, the environment should be clean and hygienic for our better life leads. Waste management is one of the primary problem that the world faces irrespective of the case of developed or developing country. In most of the cities the overflowed garbage bins are creating an obnoxious smell and making an unhygienic environment. And this is leading to the rapid growth of bacteria and viruses which are causing different types of diseases. To overcome these situations efficient garbage collection systems are getting developed based on

IOT. In this paper, we inspire and propose an Internet of Things (IOT) using Garbage Monitoring And waste management system For Smart Cities. The main purpose of project is to develop the system which uses the information collected from sensors to manage the collected waste. In proposed system the each Smart City Waste Collection which are located in several areas of city are connected to Internet wirelessly, they equipped with sensors which collects the data about level of collected waste in Smart City Waste Collection. Then Smart City Waste Collection sends this information to central web portal using WIFI module. If the Waste Collector is filled up to its threshold value then the message is displayed on web portal and the responsible authority take proper action and it will shows the all information on to the Smart Bin Application on the users mobile phone.

Keywords:

Smart city, waste management, iot, ultrasonic sensor, node mcu ,android, etc

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Introduction:

Today waste is a problem on which huge sums of money is spent each year for its collection and segregation process. India particularly generates approximately 133 760 tons of MSW per day, of which approximately 91 152 tones is collected, and a huge sum of money is spent on

collection. World waste production is expected to be approximately 27 billion tons per year by 2050, one-third of which will come from Asia, with major contributions from China and India[1]. Waste generation in urban areas of India will be 0.7 kg per person per day in 2025, approximately four to six times higher than in 1999. Mostly Environmental pollution may be owing to the Municipal Solid Left- overs (MSL). A Proper maintenance becomes mandatory for an efficient and effective removal of the generated Municipal Solid Leftover. The key issue in the waste management is that the garbage bin at public places gets overflowed well in advance before the commencement of the next cleaning process. In present scenario of digitalizing world everything in our surroundings have been equipped with modern technology and internet to ease our work and gain more efficiency[2]. But the systems existing today for waste management are the same as they were before in most of the countries. Currently, for collection of waste in some countries, we have door to door collection systems that require a lot of efforts and money. A waste collector has to visit everybody's place, knocking the doors, and has to wait till each resident brings the waste to them . Moreover, residents have to be available inorder to get their waste collected at that particular time which brings in a major disadvantage of this system.[3] Also in some countries, systems do exist in which waste is collected from the trash bins of each colony, but this system also brings a disadvantage that many a times dustbins are overfilled and waste isn't collected from it. This also makes dustbins, a place facilitating bacterial growth, feeding animals and a breeding place for insects. Also at times it happens that dustbin collection is done in prior resulting in waste of fuel and increasing costs of waste collection. So, at each step a lot of fuel and money is invested unnecessary for the process.[4]

Literature Survey:

[1] Ashiya Malak, Pallavi Bhoyar, "Garbage Collection System Using IOT- A Review", 2017.

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 are planning to design "IOT Based Waste Management for Smart

Cities". 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 dust bin 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.

[2] Prof. Indu Anoop, Ayush Jain, "IOT based Smart Waste Management", 2017.
Many times, in our city we see that the garbage bins or dustbins placed at public places are overloaded. It creates unhygienic conditions for people as well as ugliness to that place leaving bad smell. To avoid such situations the proposed project will be implemented for efficient waste management using IOT. These dustbins are interfaced with Arduino based system having ultra- sonic wireless systems along with central system showing current status of garbage, on mobile web application with Android app by Wi-Fi. Hence the status will be updated on to the App. Major part of the proposed project de pends upon the working of the Wi-Fi module; essential for its implementation. The main aim of this project is to reduce human resources and efforts along with the enhancement of a smart city vision

[3] Raffaele Carli, Mariagrazia Dotoli "Measuring and Managing the Smart- ness of Cities: a Framework for Classifying Performance Indicators", 2013.
Due to the continuous increase of the world population living in cities, it is crucial to identify strategic plans and perform associated actions to make cities smarter, i.e., more operationally efficient, socially friendly, and environmentally sustainable, in a cost effective manner. To achieve these goals, emerging smart cities need to be optimally and intelligently measured, monitored, and managed. In this context the paper proposes the development of a framework for classifying performance indicators of a smart city. It is based on two dimensions: the degree of objectivity of observed variables and the level of technological advancement for data collection. The paper shows an application of the presented framework to the case of the Bari municipality (Italy).

[4]M. Fazio, M. Paone "Heterogeneous Sensors Become Homogeneous Things in

Smart Cities".Smart Cities offer a new approach for optimizing services, reducing costs, simplifying the management of Future Cities, enabling new services for citizens. In the Future Internet initiatives, Sensors Networks assume even more a crucial role, especially for making smarter cities. Sensors, becoming smart, will represent the peripheral elements of a complex future ICTworld. How- ever, due to the specific application field, smart sensors are very heterogeneous in

terms of communication technologies, sensing features and elaboration capabilities. To overcome issues due to the high heterogeneity in this paper we present a new architecture able to make a dual abstraction of complex sensing infrastructures along with data they collect. An important key of this work is to provide a service at worldwide level that is scalable and flexible. The architecture implementation is based on Sensor Web Enablement standard specifications and makes use of the Contiki Operating System for accomplishing the Internet of Things.

[5]Samir Atkar, Abhishek Aryan, "Garbage Collection System Using IOT", 2017.

The method of connecting the objects or things through wireless connectivity, Internet called Internet of Things. Nowadays a variety of tasks are based on IOT. Cities in the world are becoming smarter by implementing the things around using IOT. This is a new trend in technology. One of the objectives of smart cities is keeping the environment clean and neat. This aim is not fulfilled without the garbage bin management system. Hence the paper "IOT Based Intelligent Bin for Smart Cities" has been developed. Bin management is one of the major applications of IOT. Here sensors are connected to the all the bins at different areas. It senses the level of garbage in bin. When it reaches threshold a message is sent via GSM to the concerned person to clean it as soon as possible

Literature Survey Analysis:

The work done up to now is in some proposed systems, the proposed work is to detect the threshold values of dustbin and accordingly send a sms to driver, also some proposed systems are using android application to find nearby dustbins, but the limitations of these systems is such that there is no any means to inform the government about the dustbin status , so that government also should know the ground level status of this smart systems , also the tendency of people is such that they will require some motivation to use such systems, so we are providing one android based wallet system , also citizen will be provided with one smart card which when scanned ,one credit point will be updated to the wallet , its future scope or it depends on the government that what government will provide to the citizen with more credit points. But due to this wallet people will use the system frequently and

it can be spread on large scale by people itself which will help in making our city clean and healthy. Also we have developed a web based application for admin where admin can see the map and status of dustbins , those dustbins which are empty will appear in green color while those filled will appear red and partially filled will appear in yellow, so that government(admin) can also monitor that how our system works at ground level and can take necessary action. Also driver will have one android application to track the dustbinswhich are filled. So our proposed system will be definitely useful to make our city clean and healthy which will facilitates to promote common man to use the system and government to monitor the system.

Detailed Methodology:

The system will be developed using using python as a programming language. Front end will be HTML, CSS will be back end .Javascript is used for client side validation. Cloudant DB is used for project development.

System will consists of following modules:

Hardware

Module Android

ApplicationWeb

Application

Hardware consists of nodemcu, ultrasonic sensor, rfid reader, rfid tag. Ultrasonic sensor will tell us the information about the dust bin, either it is empty, half filled or full. This status will be sent to the java servlet via wireless LAN, the servlet will get this status and save into the database andaccordingly it will update the map of the web application. Also the responsibility of servlet is to send an SMS with the location of the dustbin to driver which is already updated at the time adding new dustbin by admin through web interface. Admin while adding new dustbin will add the location ie latitude and longitude of the dustbin, which will referred by the servlet. The android application will also connect to the server through WLAN using device ip address. In this way all the modulus will communicate each other through WLAN. In future if the web application is hosted , we can use WAN instead of LAN ie internet

Define the Problem Statements

Date	19 September 2022
Team ID	PNT2022TMID49101
Project Name	Project - Smart Waste Management System For Metropolitan Cities
Maximum Marks	2 Marks

Customer Problem Statement Template:

Create a problem statement to understand your customer's point of view. The Customer Problem Statement template helps you focus on what matters to create experiences people will love.

A well-articulated customer problem statement allows you and your team to find the ideal solution for the challenges your customers face. Throughout the process, you'll also be able to
Empathize with your customers, which helps you better understand how they perceive your product or service

I am	Describe customer With 3-4 key Charactertics – Who are they?	customer
I'm trying to	Let there outcome Or "job" they come about. what are the trying to achieve?	Overflow with trash or recycling and before infestation becomes an issue
But	Describe what problem or barriers in the way – what bothers them most? Environmental	Environmental concerns ,poverty reduction and employment generation
Because	Enter the "root cause" of why the problem or barrier exists – what needs to be solved?	One of the ways to put that plan into action is through the 3 smart ideas of waste management – Reduce, Reuse, Recycle.
Which makes me feel	Describe the emotions from the customer's point of view – how does it impact them emotionally?	Recyclables and distributed through put the city and collection of recyclables and other materials is me feel

Example:

Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel

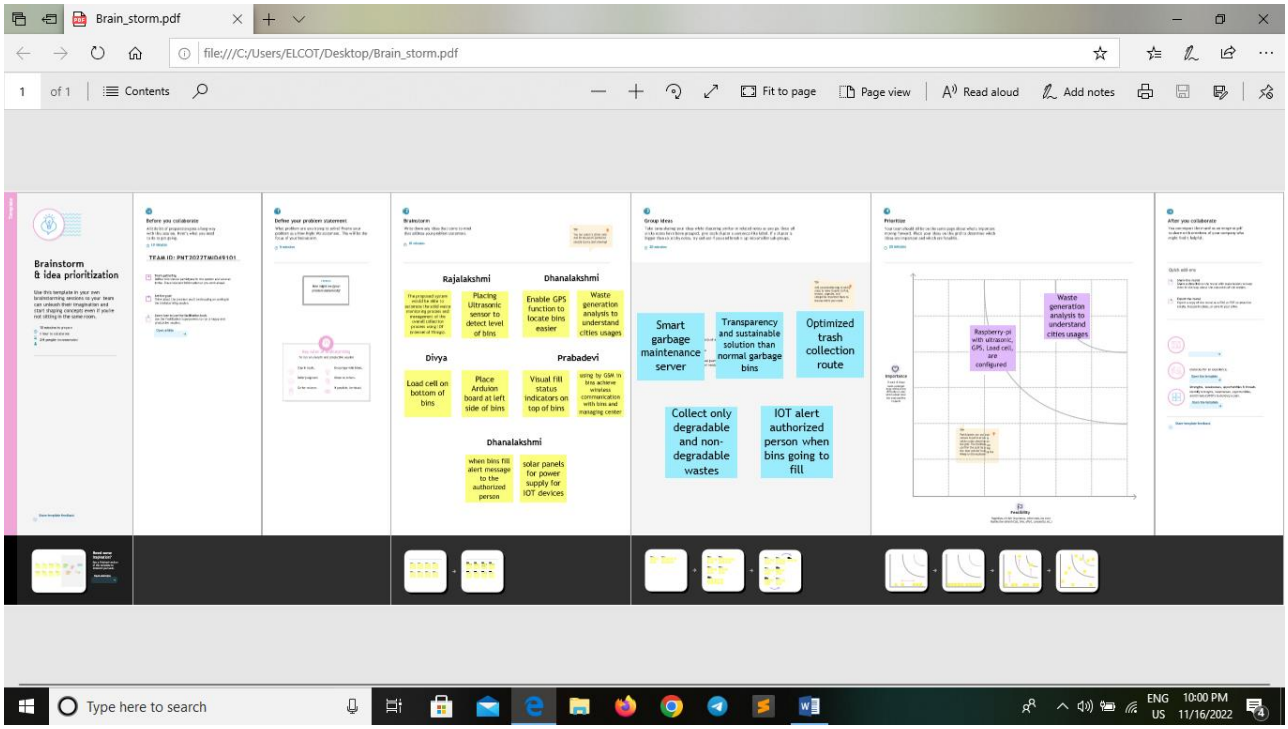
PS-1	customer	Overflow with trash or recycling and before infestation becomes an issue	Environment concerns ,poverty reduction and employment generation	One of the ways to put that plan into action is through the 3 smart ideas of waste management – Reduce, Reuse, Recycle	Recyclabels and distributed through put the city and collection of recyclables and other materials is complicate

Proposed Solution:

Empathy Map Canvas:

Smart waste management system for metropolitan cities using IOT

Ideation & Brain Stroming:



Proposed Solution:

Date	24 September 2022
Team ID	PNT2022TMID49101
Project Name	Smart Waste Management System For Metropolitan Cities
Maximum Marks	2 Marks

Proposed Solution Template:

Project team shall fill the following information in proposed solution template.

S. No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	This project deals with the problem of waste management in smart cities, where the garbage collection system is not optimized. This project enables the organizations to meet their needs of smart garbage management systems. This system allows the authorized person to know the fill level of each garbage bin in a locality or city at all times, to give a cost-effective and Time saving route to the truck drivers.
2.	Idea / Solution description	The key research objectives are as follows: • The proposed system would be able to automate the solid waste monitoring process and management of the overall collection process using IOT (Internet of Things). • The Proposed system consists of main subsystems namely Smart Trash System (STS) and Smart Monitoring and Controlling Hut(SMCH). • In the proposed system, whenever the waste bin gets filled this is acknowledged by placing the circuit at the waste bin, which transmits it to the receiver at the desired place in the area or spot.

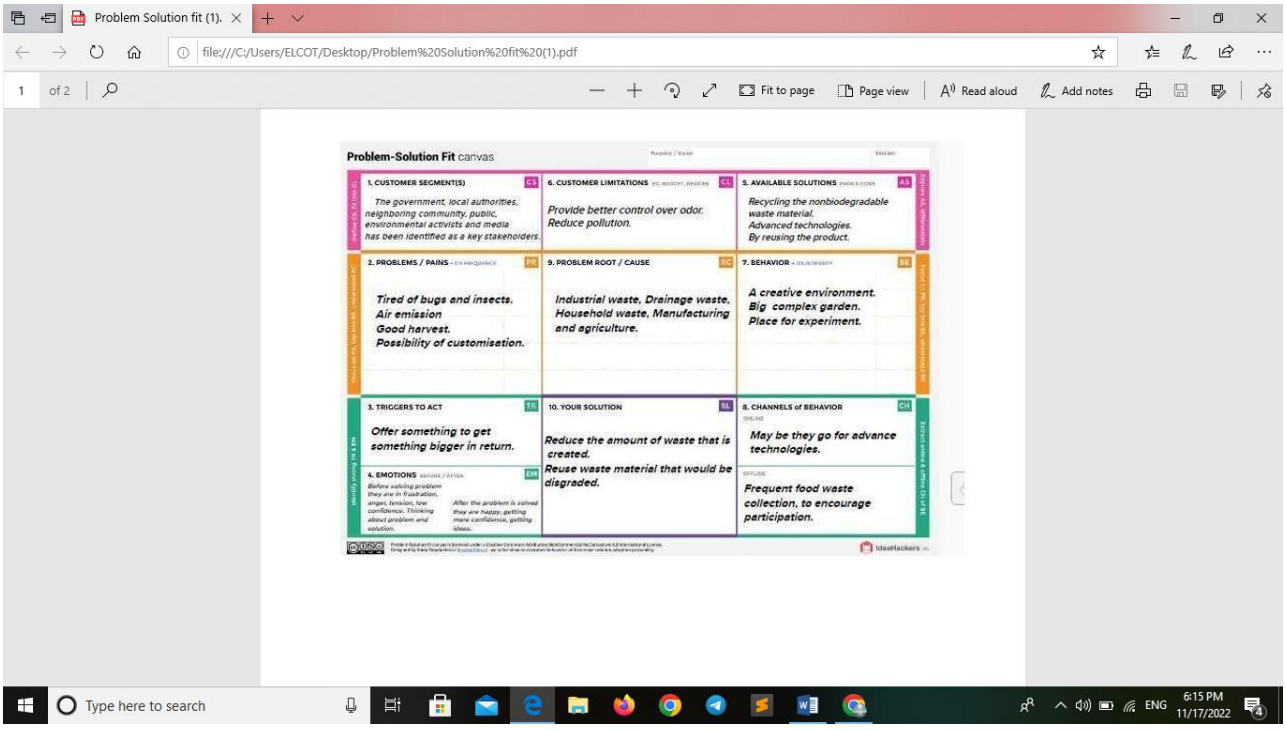
		• In the proposed system, the received signal indicates the waste bin status at the monitoring and controlling system**.**
3.	Novelty / Uniqueness	We are going to establish SWM in our college but the real hard thing is that janitor (cleaner) don't know to operate these thing practically so here our team planned to build a wrist band to them, that indicate via light blinking when the dustbin fill and this is Uniqueness we made here beside from project constrain.
4.	Social Impact / Customer Satisfaction	From the public perception as worst impacts of present solid waste disposal practices are seen direct social impacts such as neigh bour hood of landfills to communities, breeding of pests and loss in property values.

5.	Business Model (Revenue Model)	Waste Management organizes its operations into two reportable business segments: Solid Waste, comprising the Company's waste collection, transfer, recycling and resource recovery, and disposal services, which are operated and managed locally by the Company's various subsidiaries, which focus on distinct geographic areas; and Corporate and Other, comprising the Company's other activities, including its development and operation of landfill gas-to- energy facilities in the INDIA, and its recycling brokerage services, as well as various corporate functions.
6.	Scalability of the Solution	In this regard, smart city design has been increasingly studied and discussed around the world to solve this problem. Following this approach, this paper presented an

		efficient IoT- based and real-time waste management model for improving the living environment in cities, focused on a citizen perspective. The proposed system uses sensor and communication technologies where waste data is collected from the smart bin, in real-time, and then transmitted to an online platform where citizens can access and check the availability of the compartments scattered around a city.

Problem Fit Solution:

Date	01 November 2022
Team ID	PNT2022TMID49101
Project Name	Smart Waste Management System For Metropolitan Cities



Requirement Analysis:

Date	16 October 2022
Team ID	PNT2022TMID49101
Project Name	Project - Smart Waste Management System For Metropolitan Cities
Maximum Marks	4 Marks

Functional Requirements:

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 de p o- bin- discharge in the area. The tool assigns bin a rating (1-10) and calculates distance from de p o-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 un efficient 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 Pre dictions 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 garbage 24/7 more cost effect and scalability when we moves to smarter.

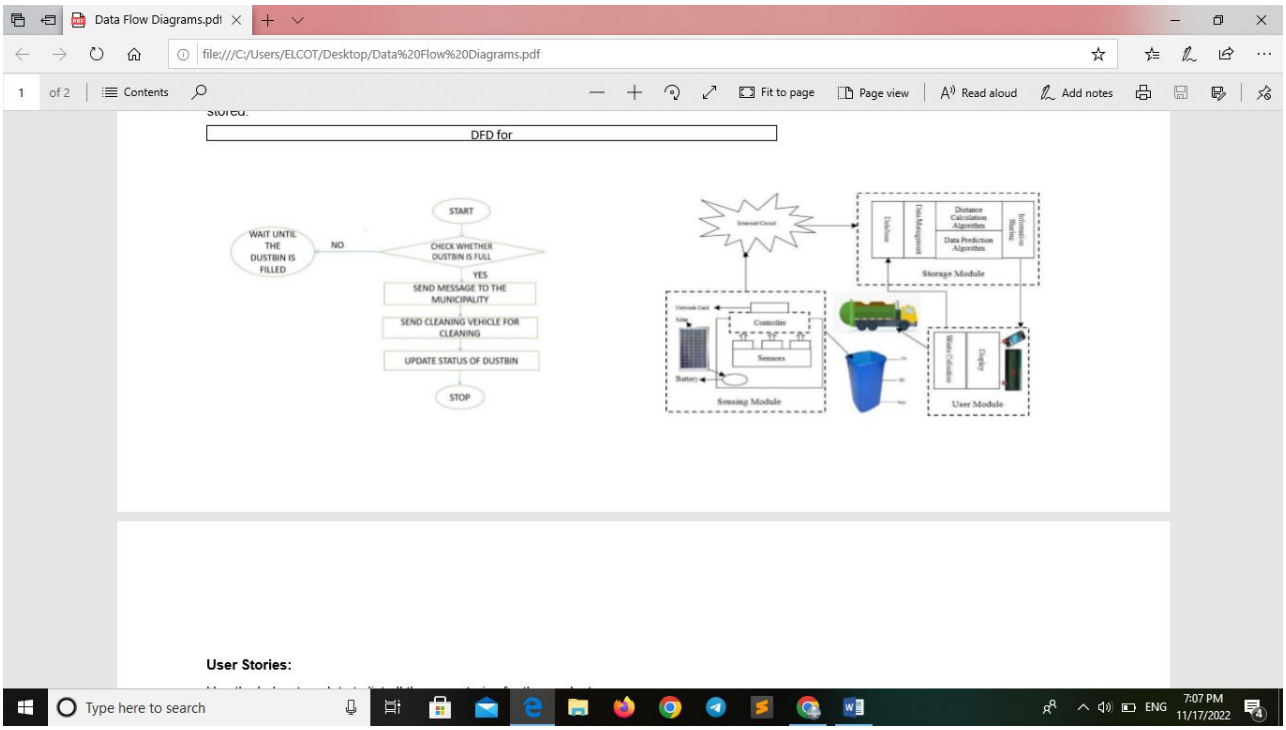
PROJECT DESIGN

Data flow diagrams:

DATE	01 November 2022
TEAM ID	PNT2022TMID49101
PROJECT NAME	SMART WASTE MANAGEMENT FOR METROPOLITAN CITIES
MAXIMUM MARKS	4 Marks

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.



Solution Architecture:

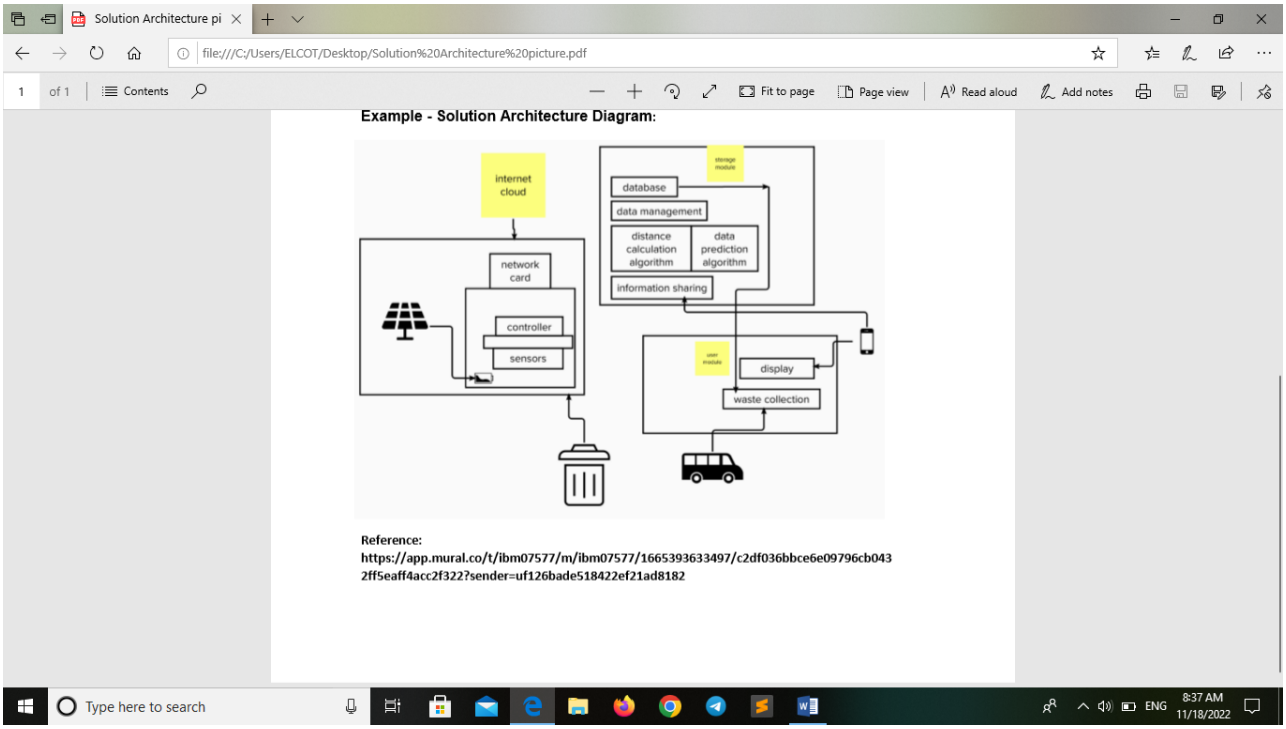
Date	19 September 2022
Team Id	PNT2022TMID49101
Project Name	Smart Waste management for Metropolitan Cities
Maximum Marks	4 Marks

Solution Architecture:

Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to:

 Find the best tech solution to solve existing business problems.
 Describe the structure, characteristics, behavior, and other aspects of the software to project stakeholders.
 Define features, development phases, and solution requirements.
 Provide specifications according to which the solution is defined, managed, and delivered.

Example - Solution Architecture Diagram:



Reference:

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Technology Stack (Architecture & Stack)

Date	31 October 2022
Team id	PNT2022TMID49101
Project Name	Smart Waste Management for Metropolitan Cities
Maximum Marks	4 Marks

Technical Architecture:

The Deliverable shall include the architectural diagram as below and the information as per the table1 & table 2

Guidelines:

1. Our proposed model provide real time monitoring to the garbage bins placed in various locations.
2. The garbage bins are build with a sensor module(Ultrasonic sensor) which continuosly monitors the garbage bin.
3. Any moment the garbage level passes over the critical level (i.e 80%), the system generates a notification to the monitoring panel (admin panel /garbage cleaning team) and so the cleaning team collects the garbage from the identified garbage bin.

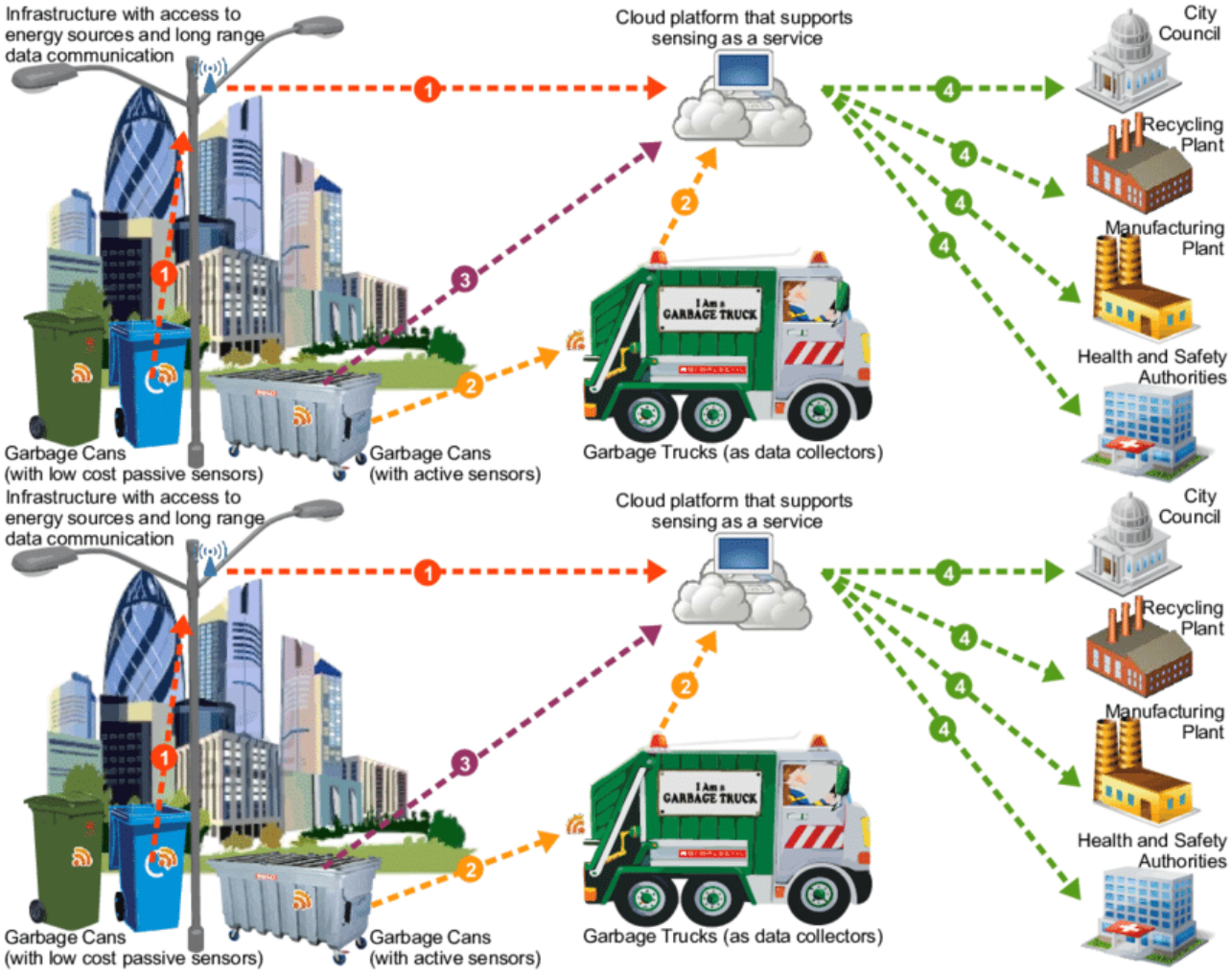


Table -1 : Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	How user interacts with application e.g. Web UI, Mobile App, Chat bot etc.	HTML, CSS, JavaScript / Angular Js / React Js etc.
2.	Application Logic-1	Logic for a process in the application	Java / Python
3.	Application Logic-2	Logic for a process in the application	IBM Watson STT service
4.	Application Logic-3	Logic for a process in the application	IBM Watson Assistant
5.	Database	Data Type, Configurations etc.	MySQL, No SQL, etc.
6.	Cloud Database	Database Service on Cloud	IBM DB2, IBM cloudant etc.
7.	File Storage	File storage requirements	IBM Block Storage or Other Storage Service or Local File system
8.	External API-1	Purpose of External API used in the application	IBM Weather API, etc.
9.	External API-2	Purpose of External API used in the application	Aaadhar API, etc.
10.	Machine Learning Model	Purpose of Machine Learning Model	Object Recognition Model, etc.

11.	Infrastructure (Server / Cloud)	Application Deployment on Local System / Cloud Local Server Configuration: Cloud Server Configuration:	Local, Cloud Foundry, Kubernetes, etc.

Table-2: Application Characteristics:

S. No	Characteristics	Description	Technology
1.	Open-Source Frameworks	List the open-source frameworks used	Technology of Open source framework
2.	Security Implementations	List all the security / access controls implemented, use of firewalls etc.	e.g. SHA-256, Encryptions, IAM Controls, OWASP etc
3.	Scalable Architecture	Justify the scalability of architecture (3 – tier, Micro-services)	Technology used
4.	Availability	Justify the availability of application (e.g. use of load balancers, distributed servers etc.)	Technology used
5.	Performance	Design consideration for the performance of the application (number of requests per sec, use of Cache, use of CDN's) etc	Technology used

User Stories:

Use the below template to list all the user stories for the product.

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Authorised Person(Manages	Login	USN-1	As authorised	I can access web page	Medium	Sprint-2

web app)			person, I gave user id and password for every workers and manage them	/dashboard		
Admin	Login	USN-2	As a admin, I will manage garbage level monitor. When garbage gets filling alert, I will post location and garbage Id to trash truck.	I can manage garbage monitoring.	High	Sprint-1
Truck Driver	Login	USN-3	As a driver, I'll follow the route sent by user to reach the filled garbage location.	I can drive to reach the garbage filled route in dynamic route given**.**	Medium	Sprint-2
Garbage Collector	Login	USN-4	As a garbage collector, I'll collect all the garbage from garbage bin and load it to the truck and send them to landfill.	I can collect garbage and pulled to truck.	Medium	Sprint-2
Municipality	Login	USN-5	As a municipality, I'll check the process are happening in discipline	I can manage all the process going good**.**	High	Sprint-1

			manner without any issues.			

PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation:

PHASE	TITLE	DESCRIPTION
Ideation Phase	Literature Survey & Information Gathering	Literature survey on the Ideation Phase selected 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 Nonfunctional 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.

6.2 Sprint Delivery Schedule:

Sprint	Functional Requirement (Epic)	Task	Story Point-s	Priority	Team Members
Sprint-1	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	Raja Lakshmi
Sprint-1		As a team lead, I will receive confirmation email once, I have enrolled for the	2	High	Dhivya

		project with team id and along with team members name.			
Sprint-2	Login	As a team member, I can login to the IBM portal by entering email & password	1	Medium	Dhana Lakshmi
Sprint- 2		As a team member, I can login to the IBM portal by entering email & password	1	Medium	Prabadevi
Sprint- 2		As a team member, I can login to the IBM portal by entering email & password	1	Medium	Raja Lakshmi
Sprint- 2		As a team member, I can login to the IBM portal by entering email & password	1	Medium	Dhana Lakshmi

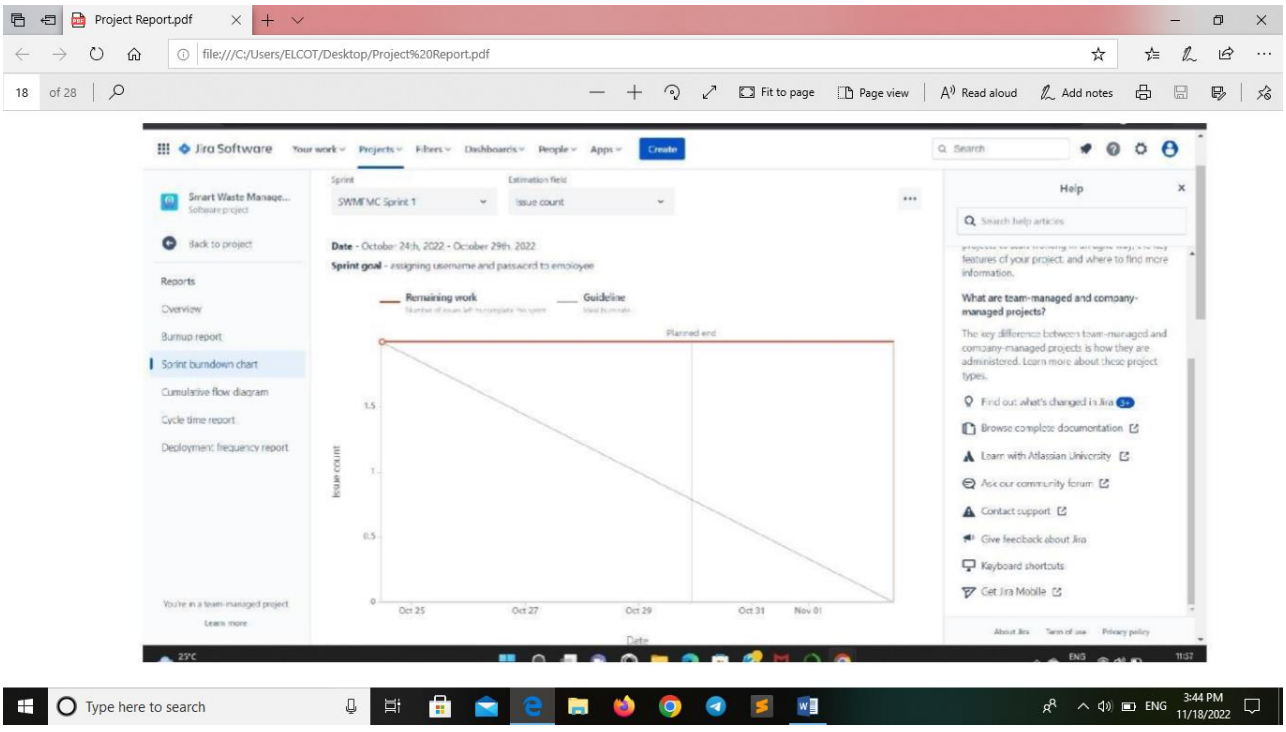
Project Tracker, Velocity & Burn down Chart:

Sprint	**Total Story Points**	**Duration**	**Sprint Start Date(Planned)**	**Sprint End Date (Planned)**	**Story Points Completed (Planned End Date)**	**Sprint Release Date (Actual)**
Sprint-1	20	6 Days	22 Oct 2022	27 Oct 2022	20	06 Nov 2022
Sprint-2	20	6 Days	31 Oct 2022	5 Nov	30	07 Nov 2022

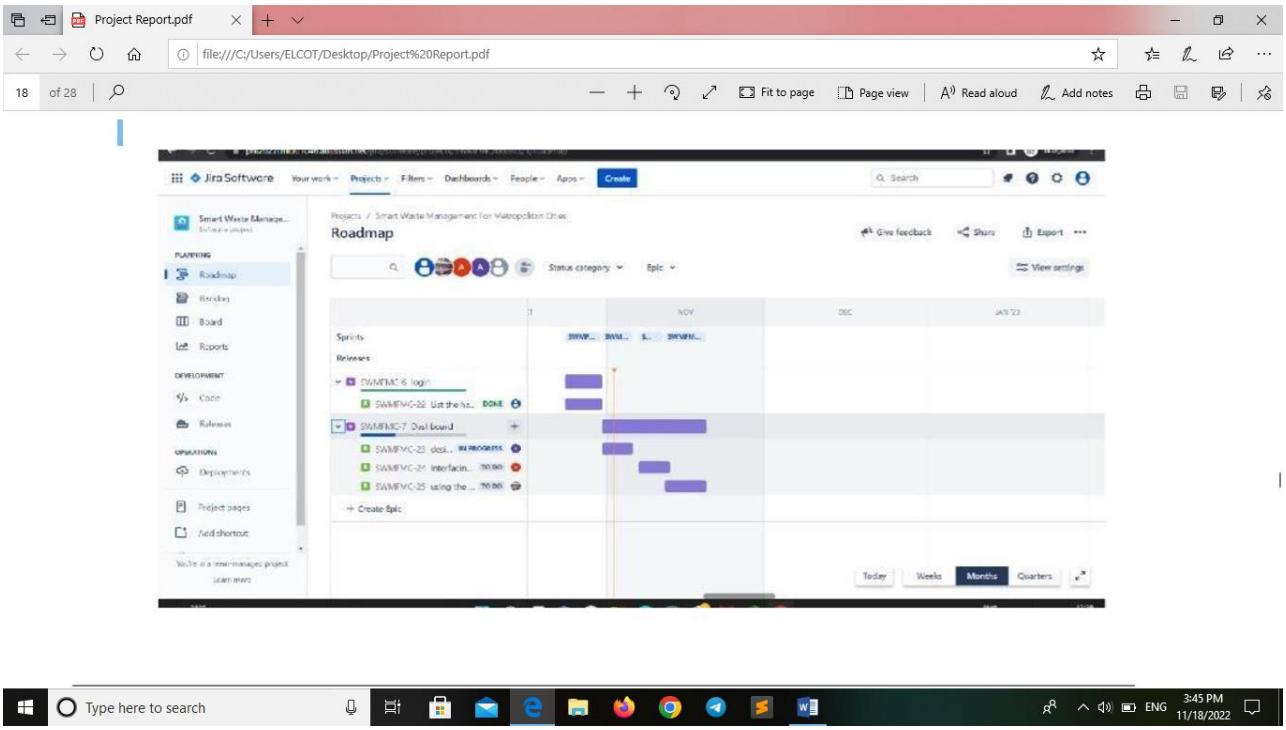
				2022		
Sprint-3	20	6 Days	7 Nov 2022	12 Nov 2022	49	08 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	50	09 Nov 2022

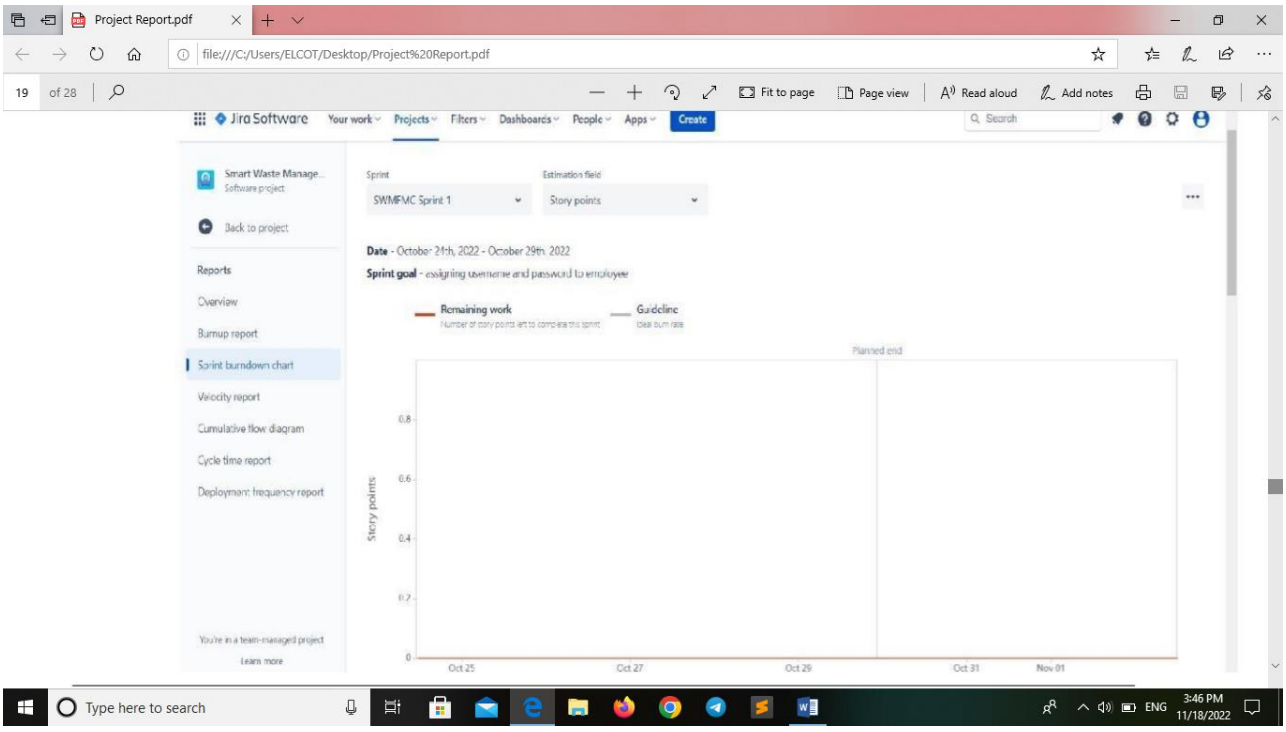
6.3 Reports from JIRA:

Burnout:



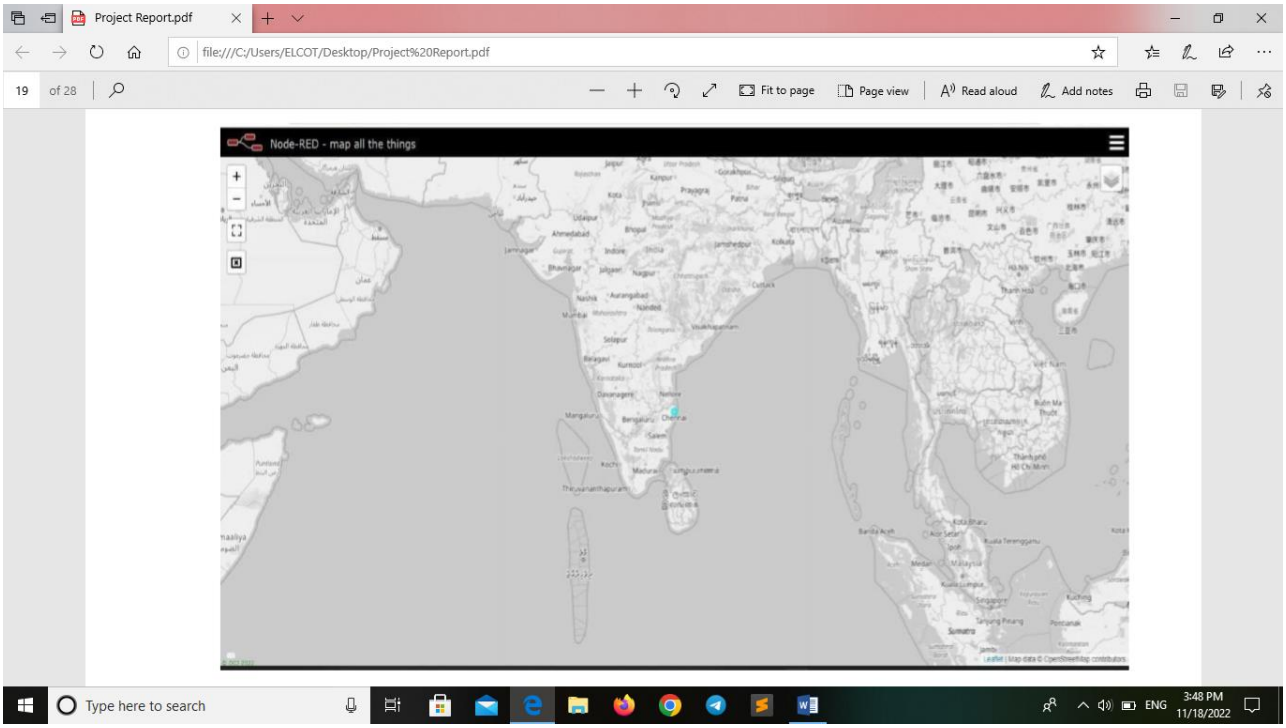
Road map:



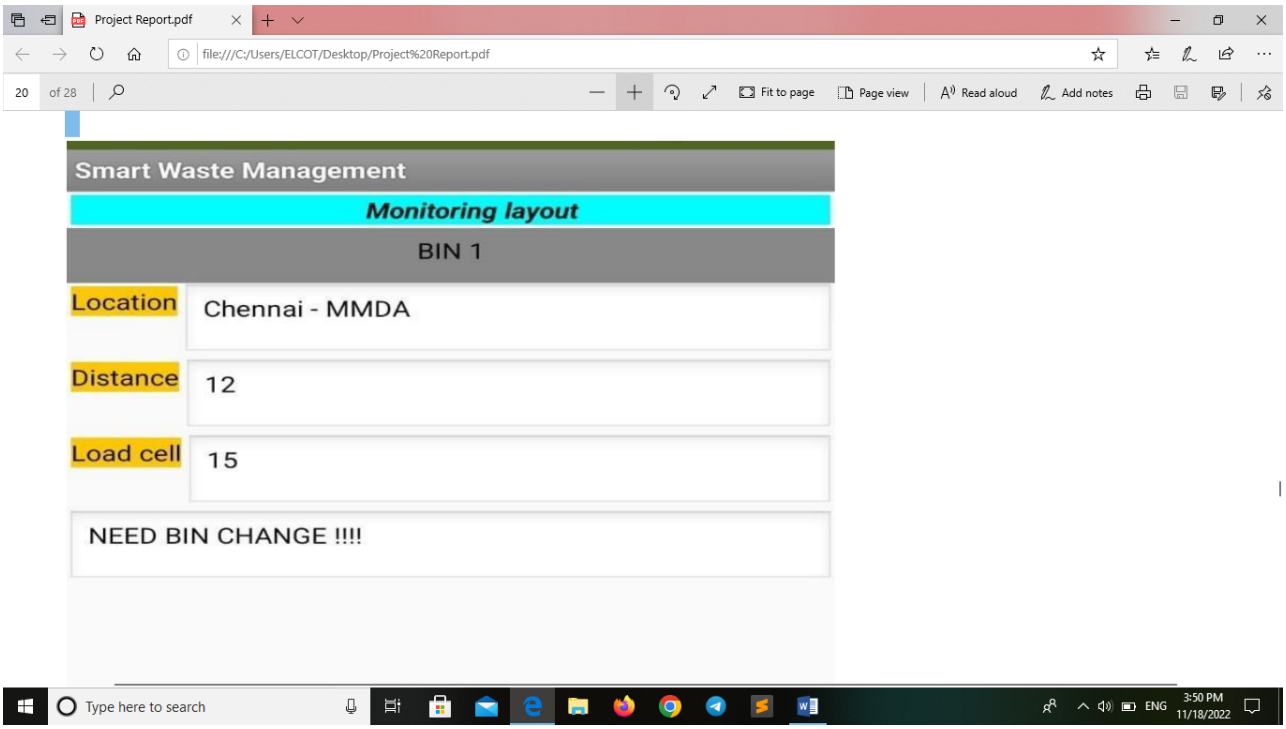


7. CODING & SOLUTIONING

7.1 Feature 1- LOCATION TRACKER:



7.2 Feature 2- LIVE UPDATE ON COLLECTED DATA:



8. Testing:

8.1 Test cases:

TEST CASE ID	FEATURE TYPE	COMPONENT	TEST SCENARIO	PRE REQUISITE	STEPS TO EXEC UTE	TEST DATA	EXPECTED RESUL T	ACTUAL RESUL T	STATUS	COMMENTS	TC FOR AUTOMATION(Y/N)	BUG ID	EXECUTED BY
LOGIN PAGE_TC_001	FUNCTIONAL	HOME PAGE	VERIFY THE USER IS ABLE TO SEE THE LOGIN/SIG N UP WEN USER CLICK ON MY ACCOUNT BUTTON		1.ENT ER URL AND CLICK GO 2.VER IFY LOGIN/SIGN UP	https://169.51.204.219.30106	L0gin page is visible	Working as expected	PASS	Successful			RAJA LAKSHMI
LOGIN PAGE_TC_002	UI	HOME PAGE	VERIFY THE USER IS ABLE TO		1.ENT ER URL AND CLI	https://169.51.20	Application should	Working as expect	PASS	Successfull			DHIVYA

			SEE THE LOGIN/SIG N UP WEN USER CLICK ON MY ACCOUNT BUTTON		CK GO 2.VERIFY LOGIN/SIGN UP Elem e nts a.ID text b o x passw ord text box c..login button D.new user Ealrady have an accou nt	4.219.3 0 10 6	show below UI element	ed					
LOGIN PAGE_TC_003	FUNCTIONAL	LOGIN PAGE	VERIFY THE USER ISABL		1.enter url and click go 2.cli	Id: 1111 passwor	User should naviga	Working as expect	PASS	Success full			PRABA DEVI

			E TO SEE THE LOG IN/S I G N UP WE N USE R CLI CK ON MY ACC OU NT BUT TON		ck on my acco unt 3.Ent er valid ID 4.Ent er valid pass word 5.cli ck on login	d:5 67 8	te yo ur ho me pag e.	ed					
LOGI N	FUNC TI ONA	LO GI N	VERI FY		1.ent er url	Id: 11 11	Co nfir m	Wo rki ng	P A S S	Suc c essf ul			RAJAL AKSH MI
PAG E_T C_ 004	L	PA GE	THE USE R IS ABL E TO SEE THE LOG IN/S IG N UP WE N		and click go 2.cli ck on my acco unt 3.Ent er valid ID 4.Ent	pas s wo r d:5 6 78	ati on me ssa ge sen t	gas exp ect ed		ful			DHIVY A

			USER CLICK ON MY ACCOUNT BUTTON		er valid password 5.click on login butvton								
LOGIN PAGE_TC_005	UI	LOGIN PAGE	VERIFY THE USER IS ABLE TO SEE THE LOG IN/SIG NUP WEN USER CLICK ON MY ACCOUNT BUTTON		1.enter url and click go 2.click on my account 3.Enter valid ID 4.Enter valid password 5.click on login button	Id: 1111 password:5678	Confirmation message sent	Working as expected	PASS	Successful			DHANALAKSHMI
LOG	FUN	LO	VER		VER	Id:	Cu	Wo	P	Suc			PRABA

IN PAG E_T C_ 006	CTIO NA L	GI N PA GE FO R AD MI N	IFY THE USE R IS ABL E TO SEE THE LOG IN/S IG N UP WE N USE R CLI CK ON MY ACC OU NT BUT TON		IFY THE USE R IS ABL E TO SEE THE LOG IN/S IG N UP WE N USE R CLI CK ON MY ACC OU NT BUT TON	1 11 1 pas s wo r d:5 6 78	sto m er dat aba s e is visi ble	rki ng as exp ect e d	A S S	cess ful			DEVI

8.2 User acceptance Testing:

1. **Purpose of Document**

The purpose of this document is to briefly explain the test coverage and open issues of the [Product Name] project at the time of the release to User Acceptance Testing (UAT).

2. **Defect Analysis**

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	2	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	7

1. **Test Case Analysis:**

This report shows the number of test cases that have passed, failed, and untested

Section	Total Cases	Not Tested	Pass	Fail
Print Engine	7	0	0	7
Client Application	51	0	0	51
Security	2	0	0	2

Outsource Shipping	3	0	0	3
Exception Reporting	9	0	0	9
Final Report Output	4	0	0	4
Version Control	2	0	0	2

9. RESULTS:

9.1 Performance Metrics:

10. ADVANTAGES & DISADVANTAGES

ADVANTAGES:

- Reduction in Collection Cost
- No Missed Pickups
- Reduced Overflows
- Waste Generation Analysis
- CO2 Emission Reduction

DISADVANTAGES:

- System requires a greater number of waste bins for separate waste collection as per population in the city.

- This results into high initial cost due to expensive smart dustbins compare to other methods. Sensor nodes used in the dustbins have limited memory size.

11. CONCLUSION:

A Smart Waste Management system that is more effective than the one in use now is achievable by using sensors to monitor the filling of bins. Our conception of a "smart waste management system" focuses on monitoring waste management, offering

intelligent technology for waste systems, eliminating human intervention, minimizing human time and effort, and producing a healthy and trash-free environment. The suggested approach can be implemented in smart cities where residents have busy schedules that provide little time for garbage management. If desired, the bins might be put into place in a metropolis where a sizable container would be able to hold enough solid trash for a single unit. The price might be high.

12. FUTURE SCOPE:

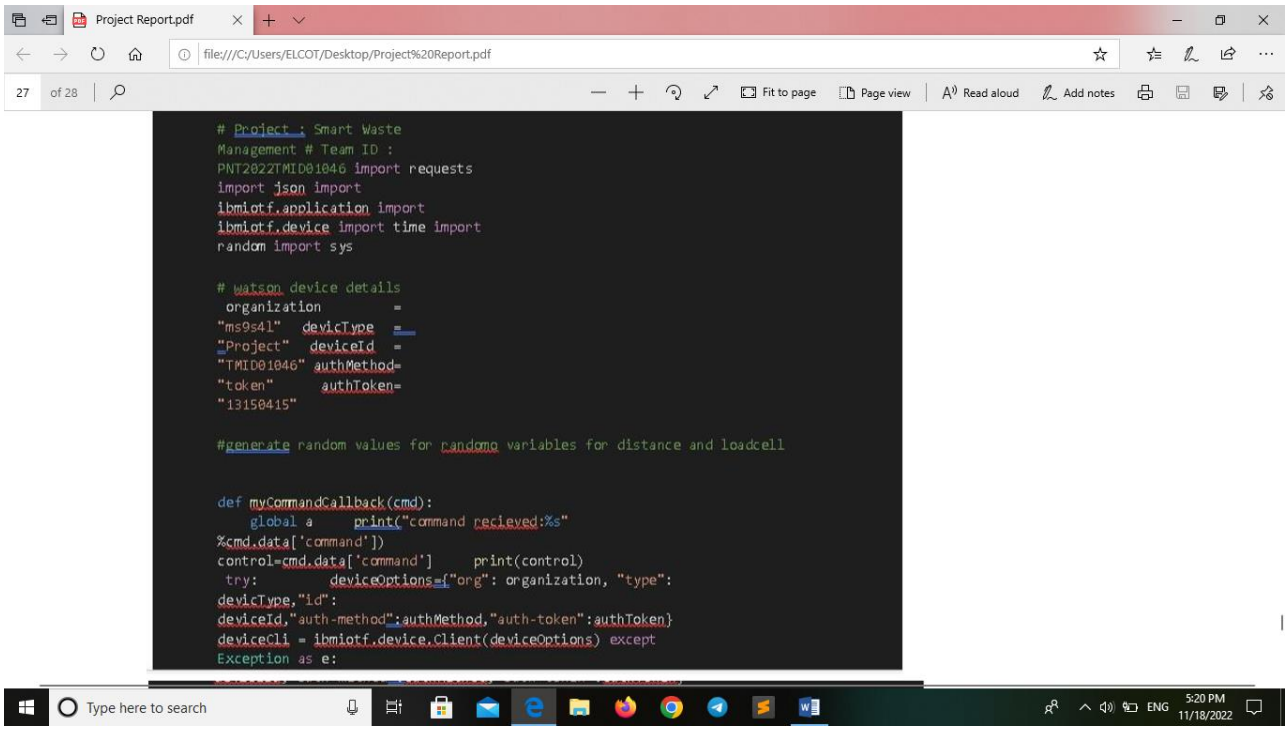
There are several future works and improvements for the proposed system, including the following:

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:


Project Report.pdf
file:///C:/Users/ELCOT/Desktop/Project%20Report.pdf
27 of 28
Fit to page
Page view
Read aloud
Add notes
Project : Smart Waste
Management # Team ID :
PNT2022TMID01046 import requests
import json import
ibmiotf.application import
ibmiotf.device import time import
random import sys
watson device details
organization =
"ms9s4l" deviceType =
"Project" deviceId =
"TMID01046" authMethod=
"token" authToken=
"13150415"
#generate random values for randomo variables for distance and loadcell
def myCommandCallback(cmd):
global a print("command recieved:%s"
%cmd.data['command'])
control=cmd.data['command'] print(control)
try: deviceOptions={"org": organization, "type":
deviceType,"id":
deviceId,"auth-method":authMethod,"auth-token":authToken}
deviceCli = ibmiotf.device.Client(deviceOptions) except
Exception as e:
Type here to search
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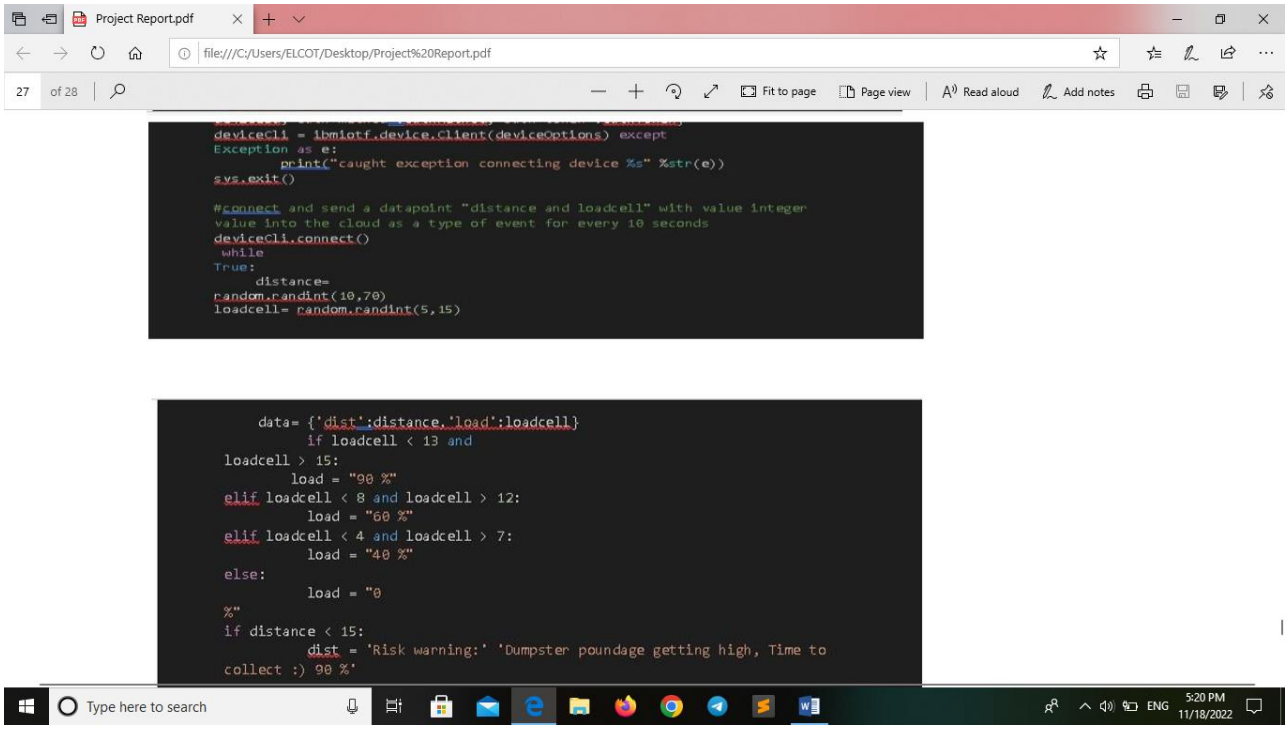
11/18/2022


Project Report.pdf
file:///C:/Users/ELCOT/Desktop/Project%20Report.pdf
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Fit to page
Page view
Read aloud
Add notes
deviceCli = ibmiotf.device.Client(deviceOptions) except
Exception as e:
print("caught exception connecting device %s" %str(e))
sys.exit()
#connect and send a datapoint "distance and loadcell" 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 %'
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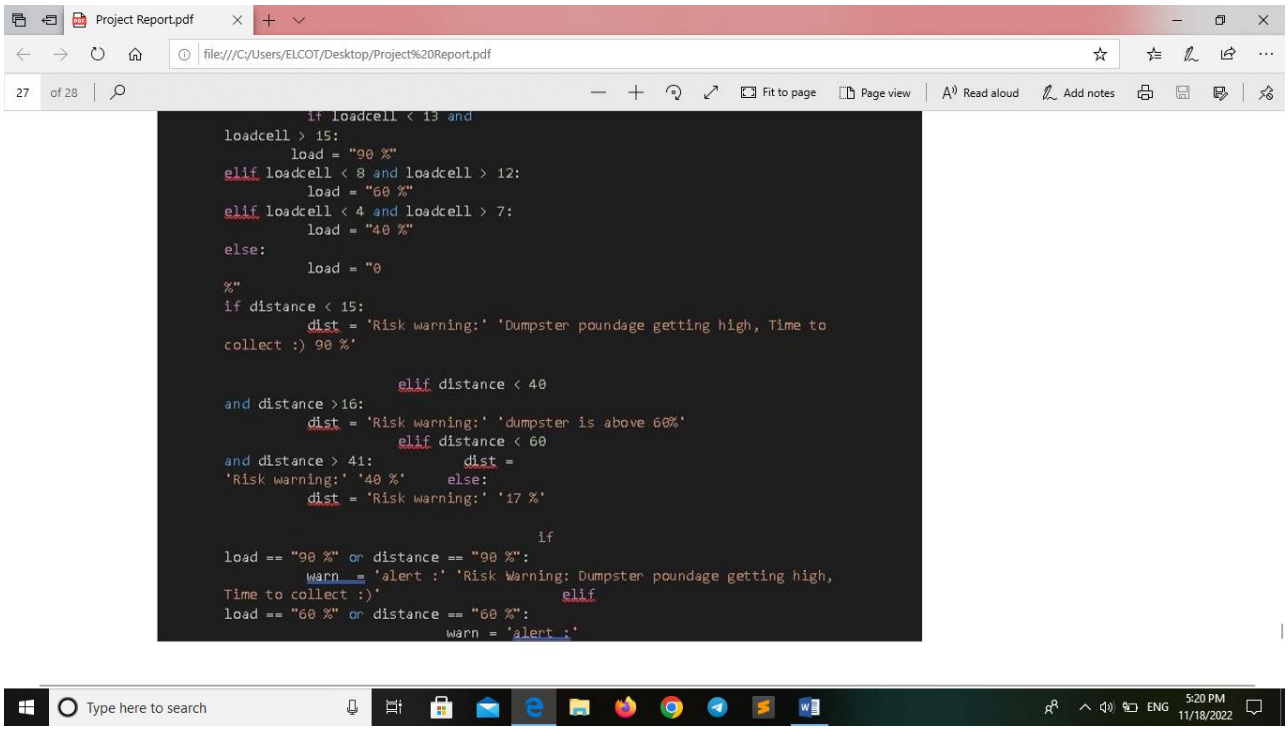
Project Report.pdf
file:///C:/Users/ELCOT/Desktop/Project%20Report.pdf
27 of 28
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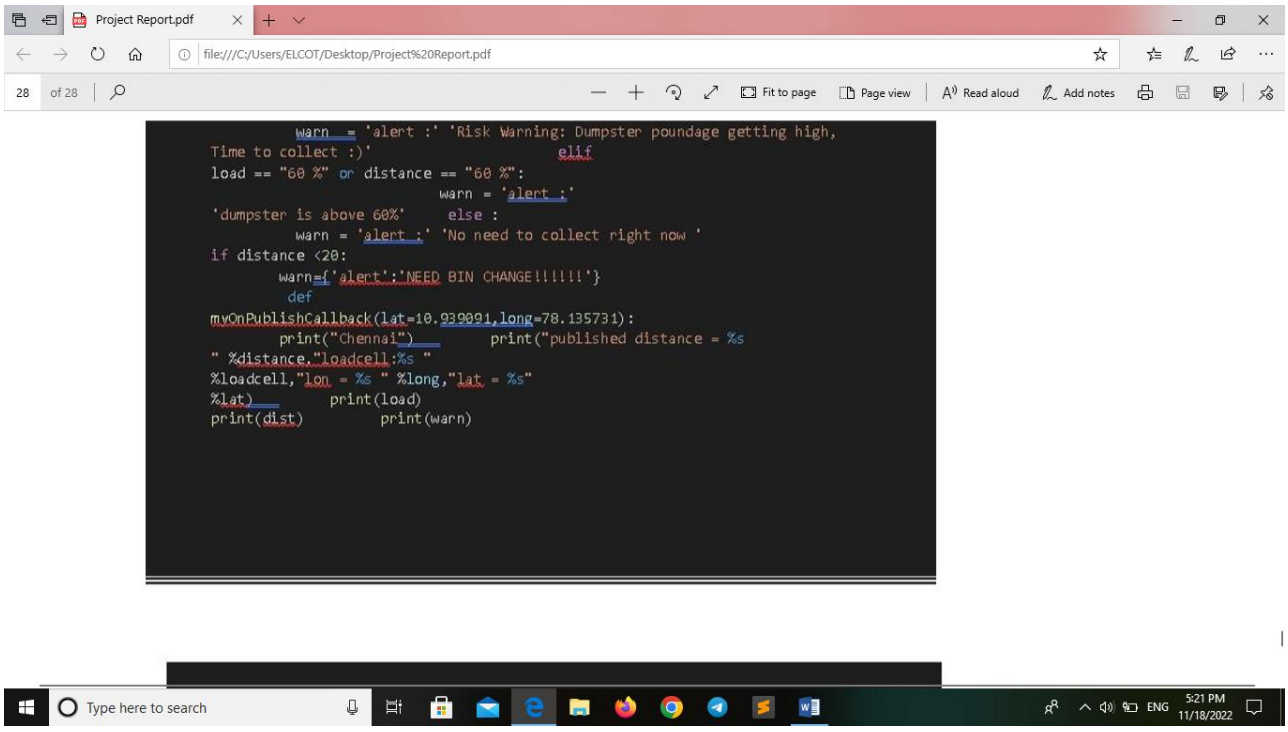
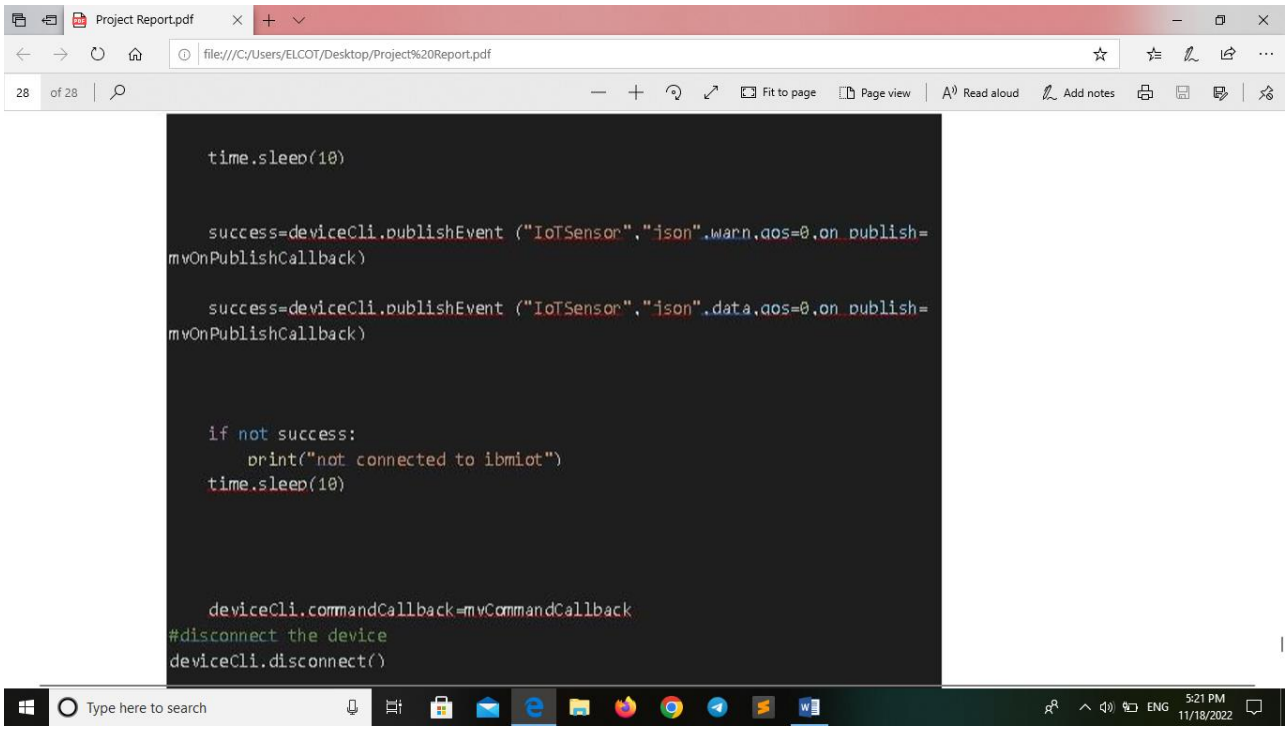
if loadcell < 13 and
loadcell > 15:
load = "90 %"
elif loadcell < 8 and loadcell > 12:
load = "60 %"
elif loadcell < 4 and loadcell > 7:
load = "40 %"
else:
load = "0
%"
if distance < 15:
dist = 'Risk warning:' 'Dumpster poundage getting high, Time to
collect :) 90 %'
elif distance < 40
and distance >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 :' 'Risk Warning: Dumpster poundage getting high,
Time to collect :)'
elif
load == "60 %" or distance == "60 %":
warn = 'alert :'
Type here to search
ENG
5:20 PM
11/18/2022


Project Report.pdf
file:///C:/Users/ELCOT/Desktop/Project%20Report.pdf
28 of 28
Fit to page
Page view
Read aloud
Add notes
warn = 'alert :' 'Risk Warning: Dumpster poundage getting high,
Time to collect :)'
elif
load == "60 %" or distance == "60 %":
warn = 'alert :'
'dumpster is above 60%'
else :
warn = 'alert :' 'No need to collect right now '
if distance <20:
warn={'alert':'NEED BIN CHANGE!!!!!!'}
def
myOnPublishCallback(lat=10.939091,long=78.135731):
print("Chennai")
print("published distance = %s
" %distance,"loadcell:%s "
%loadcell,"lon = %s " %long,"lat = %s"
%lat)
print(load)
print(dist)
print(warn)
Type here to search
ENG
5:21 PM
11/18/2022



Git hub Link:

https://github.com/IBM-EPBL/IBM-Project-41375-1660641591