A Minor Project Final Defence On

Garbage Tracking System

Submitted in Partial Fulfillment of the Requirements for the Degree of Bachelor of Engineering in Information Technology under Pokhara University Submitted by:

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Acknowledgement

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Abstract

The “Garbage Tracking System” is a Web Application, which is beneficial for the public to manage trash and live a thriving life. We, as common men, have been facing the problem of not knowing when the garbage collector will arrive. This web-based system helps the users to create their accounts and get to know when the garbage collector comes and they can also track the waste-collecting vehicle. The main objective of working on this project is to make people know about garbage carriers’ time. The whole community is supposed to be benefited from this web application. Moreover, the application is so user-friendly that any person can use it without any hindrance, irrespective of their educational qualifications.

For the project’s development, we used HTML, CSS, JavaScript, and mainly React.JS for the front end. React is used for designing the website, which makes the website attractive. JavaScript helps to create an object that goes to Django. Django is used as a bridge for the front end and database. For storing user details, we create the database and in the first stage, we have small data so we use the default database MYSQL. ESP32 or Arduino along with an ultrasonic sensor are used for notifications .

Keywords

Track, Garbage, Vehicle

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1 Introduction

As urban areas continue to grow and the population increases, waste management has become a pressing issue that demands immediate attention. Traditional waste management systems often face challenges such as inefficient collection routes, overflowing bins, and a deficiency of real-time monitoring. So we introduce the concept of a Garbage Tracking system that addresses these issues and promote a more sustainable and efficient waste management process.

Our project "Garbage Tracking System" is a real-life online platform that can be put on World Wide Web (WWW) to access it. This application is designed for users to track garbage-filled containers online and for the local people who will know the schedule of garbage carrier vehicles. We have three types of users first one is public, staff, and officer. We situate the sensor in the garbage container when the trash level crosses beyond the sensor we provide a red signal in the system otherwise a green signal is sent. This also provides the feature of notifying people when a garbage collector is scheduled to arrive in their locality.

Users are allow to inspect past schedules and they can speculate the time and date for the next garbage collection before they get a notification from the garbage collector. The map location provide the real location of the vehicle. Arduino and ESP 32 are used as IoT which is connected to the sensor which gathers data from the physical world.

Unmanaged garbage collection and unknown garbage collection are the main issues our project is intended to solve. This is a quite relatable problem-solving system in the case of garbage management. From our system, people are able to do things like track the vehicle and see the schedule, and get notified for garbage collection. This system also help the citizens to manage waste more responsibly and build a good culture.

2 Problem Statement

Have you ever faced a situation when you are a working professional or early morning college-going student and missed the garbage collecting vehicle? How awful you felt when the garbage piled up in your house's front yard?

How many times do we search the location of public dustbins and find nothing? How convenient would it be if we could track the garbage vehicle's location? It would be so helpful to manage the waste collection schedule, notify users and manage the staff's movement, and status of dustbins whether they're overflowing or not.

As an engineer, we have the responsibility of resolving the problem of the people. We see that garbage management faces the problem of managing waste in real-time scenarios. We perceive that many people don't know where the public dustbin is. Many people do not know when the garbage-collecting vehicle comes and go. We also face the problem of scheduling vehicles and usually miss the vehicle. The same problem people are facing. So they don't have any option so they throw and put the trash in the region from where they(garbage collector) collect it. Due to this the garbage comes out from the people's residents and collects the rest of the time in the region where the collector used to collect it. Animals like cows, dogs, and crows make the surroundings dirty when they get into it. These are the reason for creating problems in waste management. Many waste collection vehicles are unknown where to go to collect which route is worth so they can collect all garbage. Sometimes it takes a long, long month to collect someplace due to unknown routes and garbage containers.

The list of problem statements is given below:

- people miss the garbage collector vehicle due to an unknown vehicle schedule.
- People and garbage collector officers are unknown of public dustbins.
- Environment get dirty due to irresponsibility from people and related office worker.
- Newcomers as staff may be unknown of the clear route for garbage collection.
- It takes a long and long month to collect due to negligence.

3 Project Objectives

The objective of our project is to develop a web-based system that enable users to view the schedule of waste-collecting vehicles, and the status of public dustbins, and lessen the propensity to litter public places due to lack of efficient management. Our system targeted to effectively ease the hectic process of waste management. The main objectives which we aimed to achieve through the project are:

- To track the waste collector vehicle live.
- To provide schedule and notification of waste collector vehicles.
- To provide the status of the dustbin to the authorized organization.
- Don't let the public miss the garbage collector vehicles.

4 Significance of the study

Waste management is an important aspect of modern urban living. With the increasing amount of waste generated, cities are facing a challenge to manage waste efficiently. In recent years, several cities have implemented advanced waste management systems to optimize waste collection and disposal. These systems incorporate technology and offer an efficient solution for managing waste.

This system enhances the waste management system by tracing it. It allows for the accurate tracking and monitoring of waste materials throughout their life cycle, from generation to picking them up at the disposal site. Due to this, it provides strong data where the waste generation is at the peak level and relatable government offices will implement many measures to reduce the production of trash. It helps in optimizing the utility of resources for the betterment of society.

In the long term, the implementation of the Garbage Tracking System can have significant societal and environmental benefits. By optimizing waste management practices, it can contribute to a more sustainable future by reducing the environmental impact of waste, conserving resources, and promoting a circular economy.

The scalability and replicability of the Garbage Tracking System also hold great potential. It can be adapted and implemented in various cities and regions facing similar waste management challenges, contributing to a global movement towards efficient and sustainable waste management practices. In conclusion, the Garbage Tracking System plays a vital role in revolutionizing waste management by harnessing the power of technology and citizen engagement. Its implementation can lead to improved waste management practices, resource optimization, and a healthier living environment for communities. By addressing the challenges associated with waste management, this system paves the way for a more sustainable and thriving future."

5 Scope and Limitations

5.1 Scope

- It helps in Public engagement for well manage dustbins.
- Government can use this system for tracking which reduces unmanaged utilization of resources.
- Public observe the schedule and take garbage to the collecting site.
- It provides a tracking system so we can see the live effort and engagement of users.

5.2 Limitations

- It only track the waste-collecting vehicle.
- It track the vehicle through smartphone GPS for now.
- It hardly provide the accurate data.
- It occupied only a limited coverage area.

6 Literature Review

Waste management is an important aspect of modern urban living. With the increasing amount of waste generated, cities are facing a challenge to manage waste efficiently. In recent years, several cities have implemented advanced waste management systems to optimize waste collection and disposal. These systems incorporate technology and offer an efficient solution for managing waste. One such system includes user, staff, and officer components. The system uses sensors to detect when waste containers are full and need to be emptied. The admin component of the system monitors and manages the entire system, providing detailed reports on its status. The user component allows residents to track their waste collection schedules and receive notifications when collections are due. The staff component enables efficient deployment of resources, ensuring waste collection staff is deployed to areas with the highest volume of waste. Finally, the officer component provides oversight and enforcement of waste management regulations.

The use of public waste containers and bins around Kathmandu metropolitan city is also limited.[1] Smart waste management (SWM) involves for example collection and analysis of data from sensors on smart garbage bins (SGBs), management of waste trucks and urban infrastructure; planning and optimization of waste truck routes etc[2] IoT-based garbage monitoring system which checks the level of garbage in bins and sends that information to authorized workers through SMS. The information contains a garbage level and the bin's Google map link. Using the garbage bin link, the worker reaches the garbage bin when it is full and saves time which is unnecessarily used to go through for garbage bin even if it is not full.[3]

Safai Mitra is a similar kind of waste management system being used in India.

Behzad Esmaeiliana, Ben Wangb, Kemper Lewisc, Fabio Duarte, Carlo Rattif, and Sara Behdad provide a comprehensive review of the literature on smart waste management systems and their implications for smart city research.[4]

Overall, the waste management system is an innovative and effective solution for managing waste in urban areas. By implementing this system, cities can improve the efficiency and effectiveness of their waste management systems, ensuring a cleaner and healthier environment for residents.

7 Proposed Methodology

We worked on the following methodologies for the application of knowledge, skills, tools, and techniques to a wide range of activities and designs in order to meet the requirements of our project. The Process was repeat until we made our project a work product. The methodology we used is incremental methodology

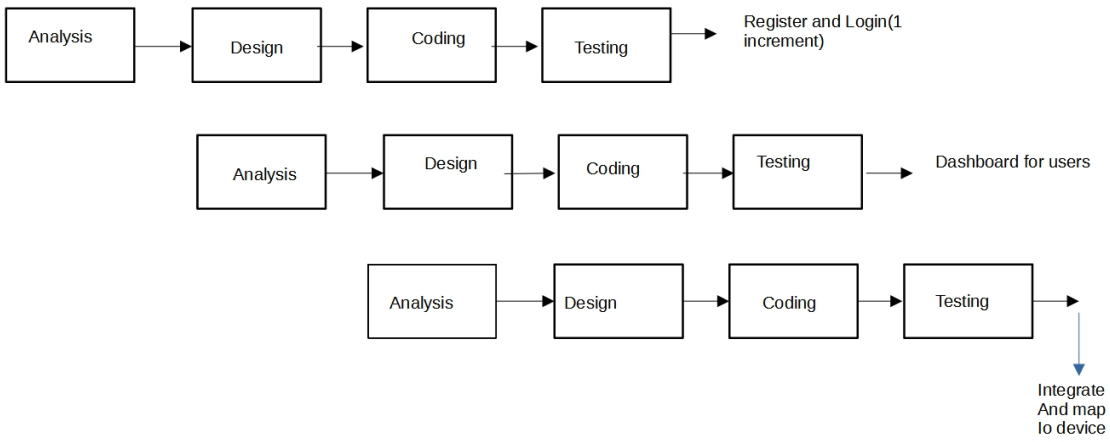

Figure 1: Incremental Software Development model

Analysis: In Analysis mode, We do an analysis of users' requirements and analysis of how compatible software is for development.

Design: We will design the system after analysis. In this, we develop different modules for the system. We make the design of what data types are going to use in the system

Coding: Coding is the section where we start to implement our design in real-life applications using different programming languages

Testing:

Testing is done at last after coding the design. We will use black box testing and white box testing for the convenience of the customer after we deploy it among the people.

7.1 Software Specification

HTML:

It is the standard markup language used to create web Pages.HTML is written in the form of HTML elements consisting of tags enclosed in angle brackets (e.g.)tags most commonly come in pairs like $< h1 > and < /h1 >$.

CASCADING STYLE SHEETS (CSS):

It is a style sheet language used for describing the look and formatting of a document written in markup language. While most often used to style web pages and interfaces written in HTML. The language can be applied to any kind of XML document. CSS is a cornerstone specification of the web and almost all web pages use CSS style sheets to describe their presentation.

MYSQL:

MySQL is developed, distributed, and supported by Oracle Corporation. MySQL is a database system used on the web it runs on a server. MySQL is ideal for both small and large applications. It is very fast, reliable, and easy to use. It supports standard SQL. MySQL can be compiled on a number of platforms. The data in MySQL is stored in tables. A table is a collection of related data, and it consists of columns and rows. Databases are useful when storing information categorically.

JavaScript:

JavaScript is a dynamic computer programming language. It is lightweight and most commonly used as a part of web pages, whose implementations allow client-side script to interact with the user and make dynamic pages. It is an interpreted programming language with object-oriented capabilities.

Django:

Django is a Python framework that makes it easier to create websites using Python. Django takes care of the difficult stuff so that you can concentrate on building your web applications.
Django emphasizes reusability of components, also referred to as DRY (Don't Repeat Yourself), and comes with ready-to-use features like login system, database connection, and CRUD operations (Create Read Update Delete).

IoT:

- **Esp32:** The ESP32 is a powerful and versatile micro controller board that has gained significant popularity due to its capabilities and features. It is based on the Xtensa LX6 processor and is equipped with Wi-Fi and Bluetooth connectivity, making it suitable for various Internet of Things (IoT) applications. The ESP32 offers a wide range of input/output pins, analog-to-digital converters, and communication interfaces, providing flexibility for connecting and controlling other devices and sensors. It can be programmed using the Arduino IDE or other compatible development environments.

Figure 2: ESP32 diagram

- **HC-SR04:**This is the HC-SR04 ultrasonic distance sensor. This economical sensor provides 2cm to 400cm of non-contact measurement functionality with a ranging accuracy that can reach up to 3mm. Each HC-SR04 module includes an ultrasonic transmitter, a receiver and a control circuit.

  There are only four pins that you need to worry about on the HC-SR04: VCC (Power), Trig (Trigger), Echo (Receive), and GND (Ground). You will find this sensor very easy to set up and use for your next range-finding project!

  This sensor has additional control circuitry that can prevent inconsistent ”bouncy” data depending on the application.

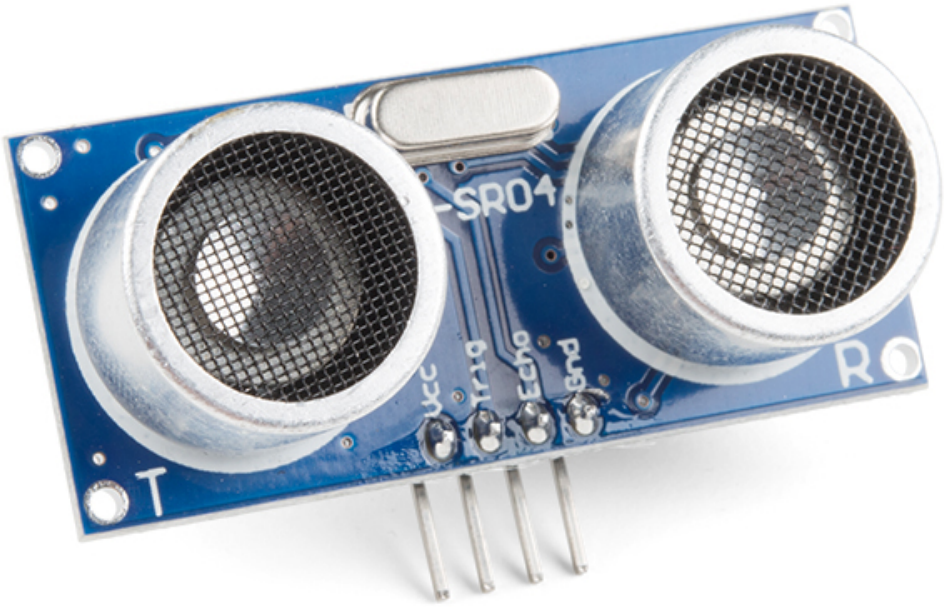

Figure 3: ultrasonic diagram

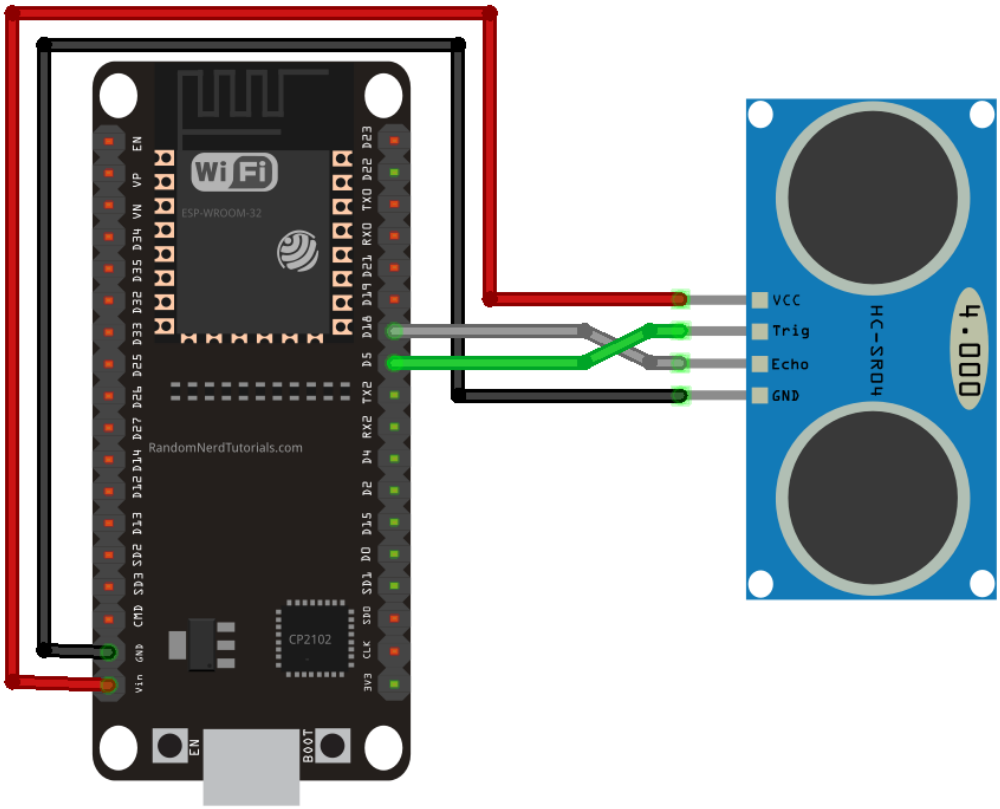

Figure 4: ultrasonic and ESP32 diagram

7.2 Use-case diagram

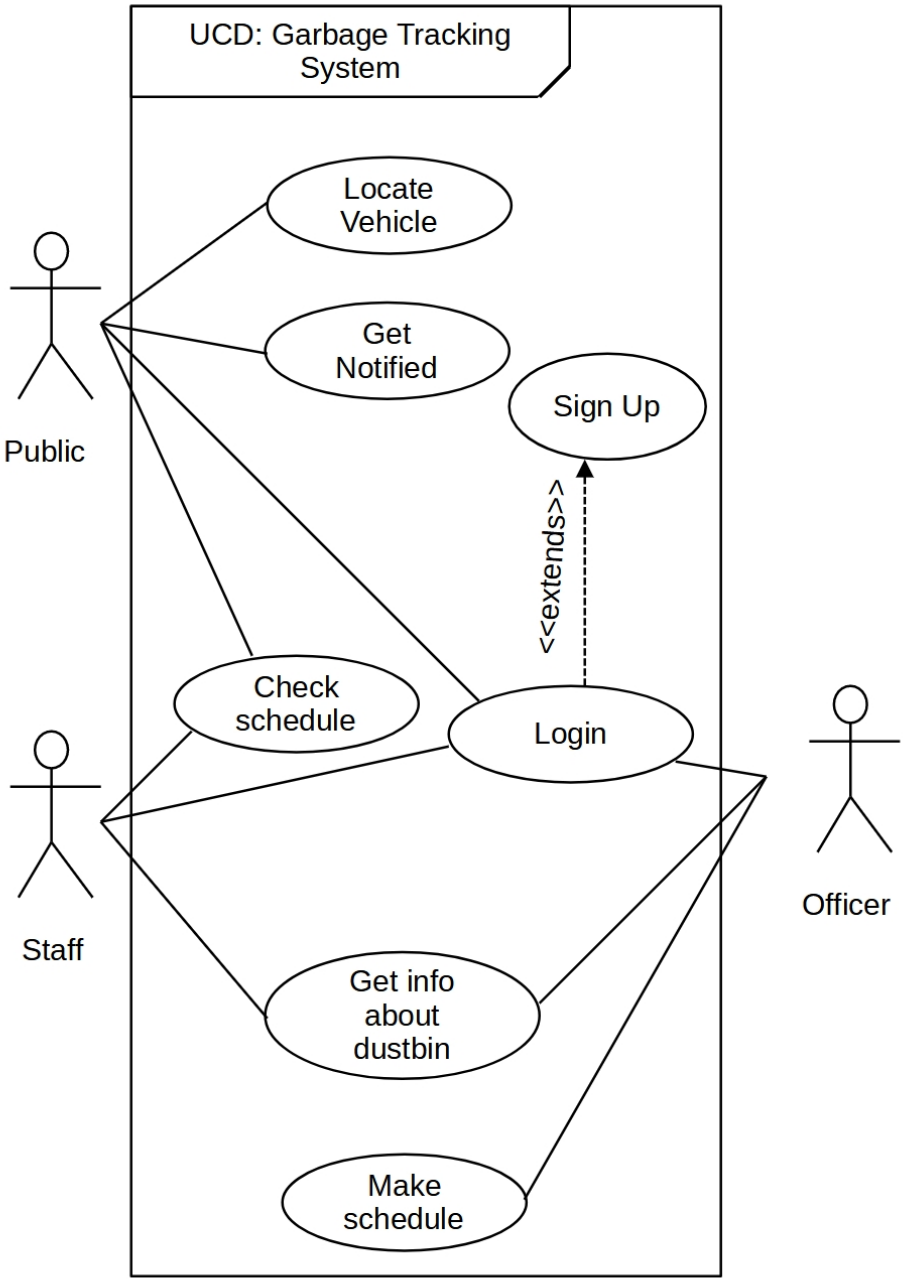

Figure 5: Use case diagram

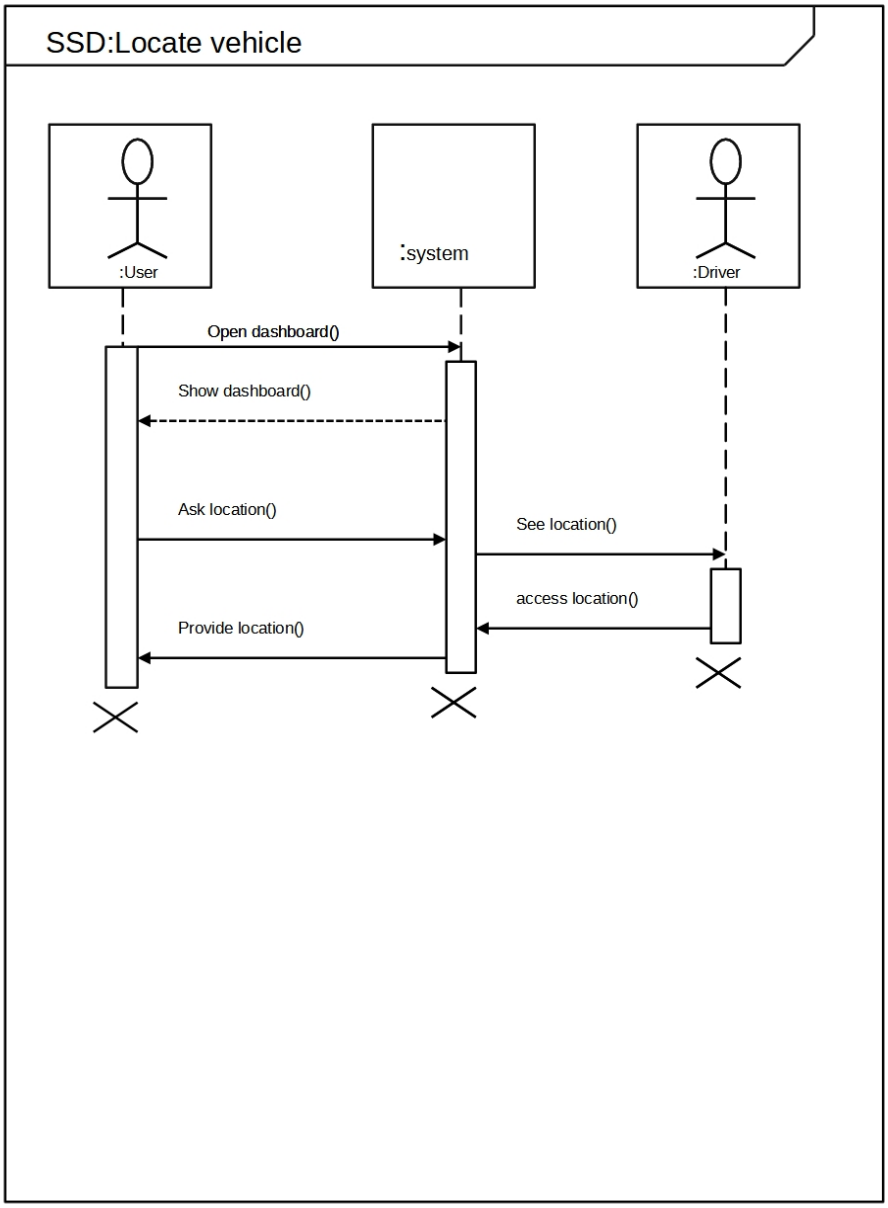

Figure 6: ssd for case locate vehicle

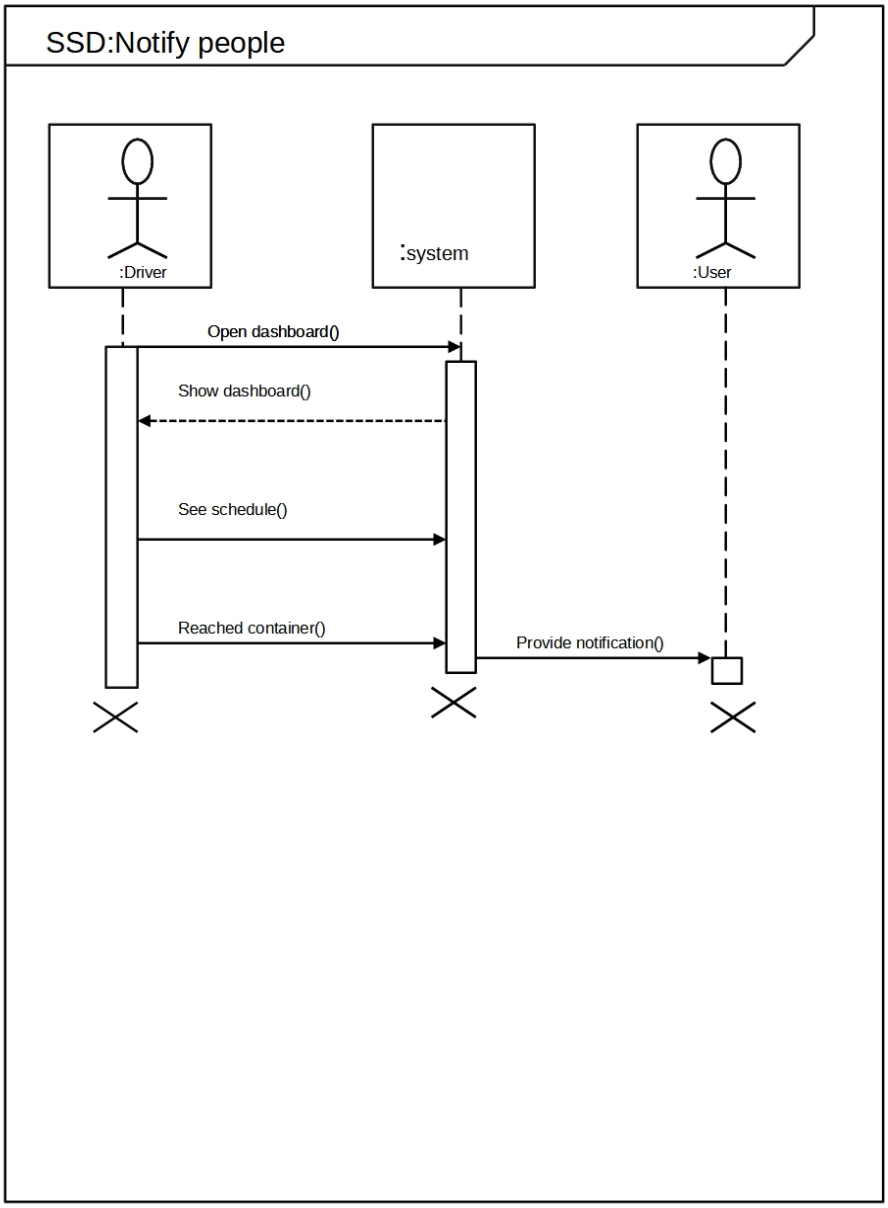

Figure 7: ssd for case notify people

The method we used in our use case format is the casual method. In this method, we introduce both the main success scenario and the alternate scenario.

Main success scenario:

In our system, the first customer gets notified of the scheduled notifications scheduled by the officer. Customers locate real-time and place garbage carrier vehicles. First, they need to login into the system for that they need to sign up first. The officer also first login the system. Officers are allowed to make schedules for carrier vehicles. Officers also get info about dustbins which are linked to our system. Staff are allowed to check the schedule and get info about dustbins.

Alternate Scenario:

1. If waste collection is missed due to unforeseen circumstances, residents can't report it for rescheduling.

2. In the event of a system outage or error, waste collection staff can't manually record collection and disposal data

3. Incorrect Segregation:

4. If waste is improperly segregated by residents, our system can't detect the waste types: decaying and non-decaying.

Locate Vehicle:

Main Success scenario:

Customers open our system and see the exact location of the garbage carrier vehicle.

Alternate scenario:

If the system doesn't show real-time location. If the mobile set which we use to locate the vehicle location is left behind.

Get Notified:

Main success scenario:

The sensor provides info on dustbin status and the system provides notification to the users.

Alternate scenario:

If the sensor gets damaged by waste on it?

Check scheduling:

Main success scenario:

Staff opens our system after login and checks the status of the schedule.

Alternate scenario:

If scheduling is done wrongly,rescheduling can’t be done?

Make schedule:

Main success scenario:

The officer make schedule using its login credentials.They can edit or can add information about schedule of next service or destinations.

Alternate scenario:

If the Officer can update same early previous destinations?

Get info about dustbin:

Main success scenario:

When user like staff and officer open our system they can find the dustbin info and its status.

Alternate scenario:

What if same previous data is shown at the time of inspection?

7.3 ER diagram

ER Diagram is also known as an entity relationship diagram, which is used to show the relationship between multiple entities and their attribute. The following figure describes the ER relationship of our project.

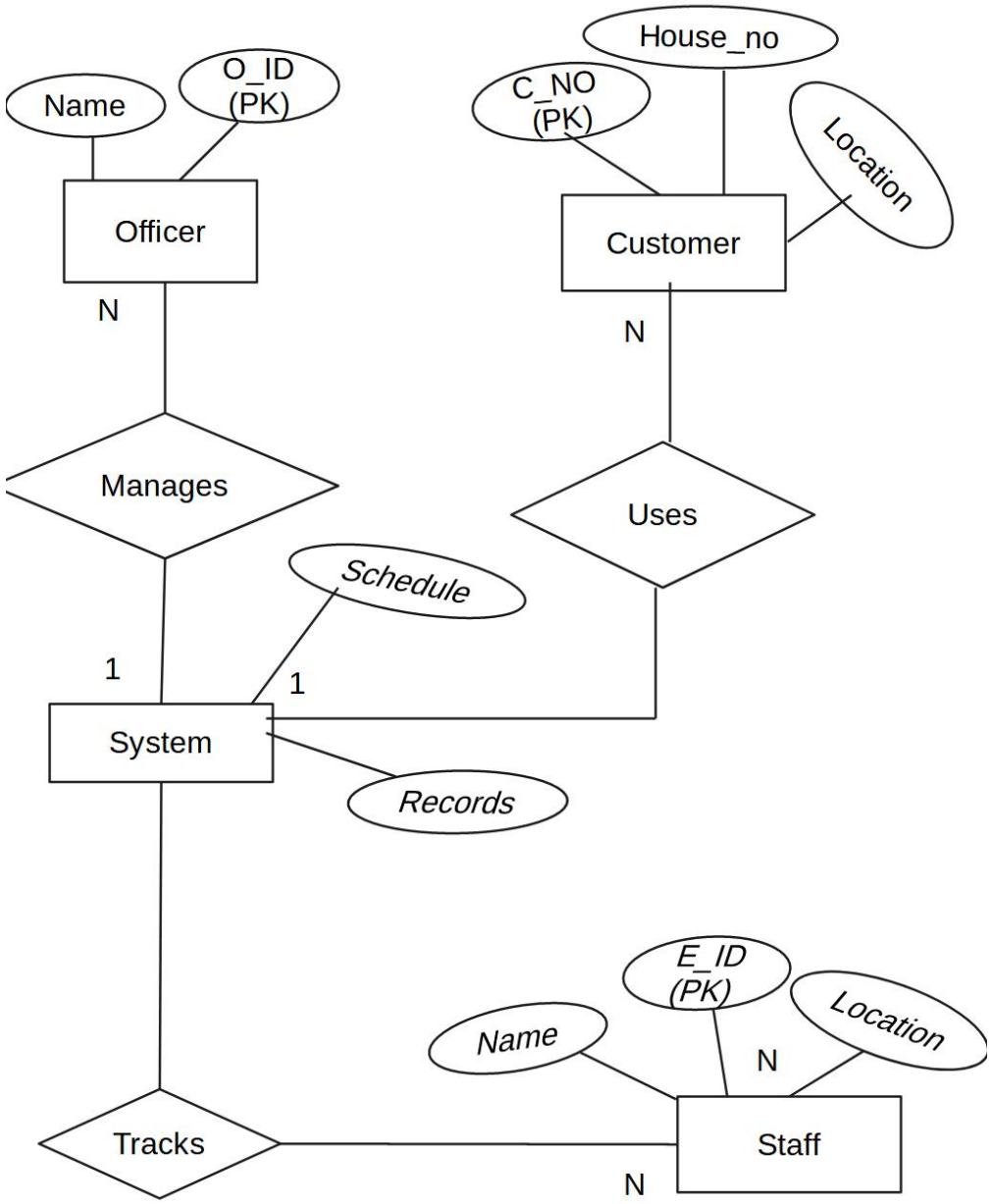

Figure 8: ER diagram

In our system, we have three entities Public, Customer, and Staff. The customer uses System. Customer contains C_No,House_NO,Location.Officer contains Name, O_ID.
The staff contains Name, E_ID, and Location. The officer manages the system. Staff tracks trash bins using the system.

7.4 Task done

In this Garbage Management System we did as our plan.The task we did at a given interval of time till final defense are:

- We selected our front-end and back-end coding language.
- We developed our login and sign up page.
- We developed our dashboard.
- we have connected ESP-32 and Ultrasonic Sensor to the back-end.
- We have our database connected with sign-up and sign in.
- Rest API is developed.
- API endpoints has used for interaction with db.
- Open street map is successfully integrated.
- Mail sending to the user has completed.
- Officer are allowed to change the schedule.
- Individuals will receive real-time notifications alerting them to the imminent arrival of their designated vehicle.

7.5 Proposed Validation Scheme

Reliability, effectiveness, and accuracy should be secure, and for that proper validation should be in practice. We used the following validation

7.5.1 Data Validation

We used data validation for the validation scheme. It ensures data is accurate, complete, and consistent. It involves checking data for errors, inconsistencies, or anomalies to ensure its reliability

and usability. By validating data, organizations will maintain data integrity, improve data quality, and prevent errors or issues that may arise from using incorrect or incomplete data.

7.5.2 Field Testing

Field testing is typically conducted to evaluate how a product or system performs in real-world scenarios, verify its functionality, identify potential issues or limitations, and gather user feedback. This provides an opportunity to evaluate the product's performance under different conditions, such as different weather conditions, geographic locations, user behavior, or usage patterns.

7.5.3 Performance Evaluation

In the context of waste tracking systems, performance evaluation refers to the process of evaluating and measuring the system's effectiveness, efficiency, and overall performance.
This include evaluating the Accuracy, Reliability, Reporting and analytics, User Experience, and Data Integration of the waste tracking system to ensure that it is working as intended and meeting its objectives.

7.5.4 User Feedback and Satisfaction

A user satisfaction verification scheme in a waste tracking system refers to the process or methodology implemented to assess and verify the satisfaction levels of users or customers of the system. This includes collecting feedback, evaluating user experiences, and measuring overall satisfaction with the waste tracking system.
Surveys and Feedback Collection, Continuous Improvement and Iteration, Review, and Analysis are the validation scheme that we are going to use during the underdevelopment phase of the system.

8 Conclusion

This section, we present the key findings obtained from the development and testing of the garbage tracking system. The system has designed to track and monitor the movement of garbage in real-time, aiming to improve waste management and optimize collection processes.

- Through the integration of GPS technology and IoT sensors, we were able to accurately determine the location of the bins and monitor their movement in real time.
- The garbage tracking system also incorporated sensors to monitor the fill levels of garbage bins.

8.1 Discussion

The results obtained from our garbage tracking system have several implications for waste management practices and overall efficiency. The discussion section focuses on interpreting these findings and their potential impact. Here are some key points for discussion:

- By optimizing collection routes and avoiding unnecessary pickups, the system reduces fuel consumption, vehicle wear and tear, and labor costs. This not only saves resources but also contributes to a more environmentally sustainable waste management approach.
- By predicting the optimal collection time based on bin capacity, waste management personnel can ensure timely pickups, reducing the chances of bins reaching their maximum capacity and causing littering or environmental hazards. This improves overall cleanliness and hygiene in the community.

9 Further Works

The task that will be increment at the time of iteration and incremental phase are:

- We use detector for classifying types of garbage in dust-bin.
- we will provide shortest distance from destination to dustbin.
- we will use GPS in vehicle for accurate tracking.
- We will make them convenient by develop its App.
- Will use messaging system rather than email.

10 Outputs

- Trace the waste in an elite way.
- Individuals received real-time notifications alerting them to the imminent arrival of their designated vehicle.
- helped in garbage management organization to manage trash.
- It notify the public if the vehicle is nearby.

11 Project Task and schedule

The Project Schedule is designed as per the requirements and constraints involved. This project is completed in about 6 months. Requirement analysis and System design is given major emphasis. Research and database management done at first. Debugging and testing was done until the completion of the project.

The table shown below shows project scheduling for completing different aspects of the project.

Task and Time Schedule:

No.	Task	Approximation time (day)
1.	Requirement analysis and specification	28
2.	Design	35
3.	Development	60
4.	Testing	37
5.	Deployment	16
6.	Documentation	90

11.1 Gantt Chart:

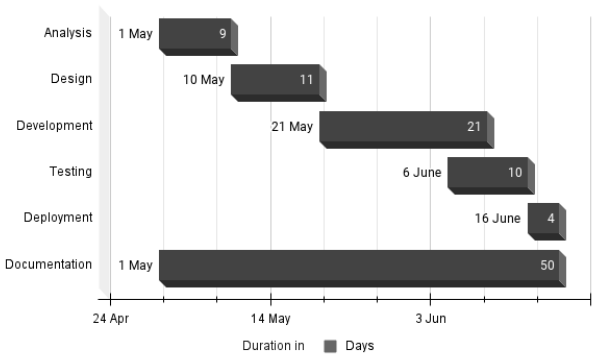

Figure 9: Gantt chart for increment one

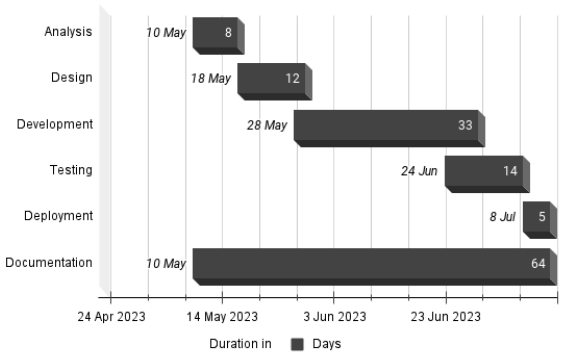

Figure 10: Gantt chart for increment two

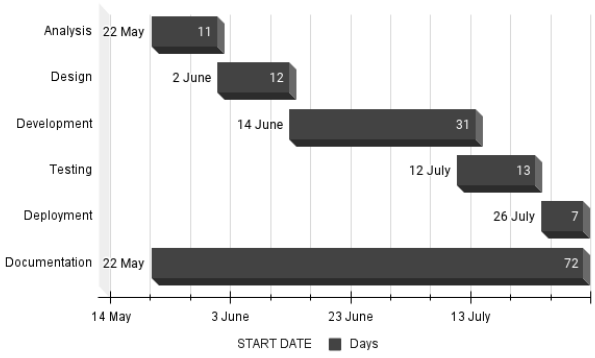

Figure 11: Gantt chart for increment three

11.2 Team members and their roles

Name	Roles
Binay Rijal	Project Manager
Suman Sharma	Front end Developer
Smreeta Shrestha	Back end Developer
Yubraj Adhikari	System Analyst

12 References

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13 Appendix

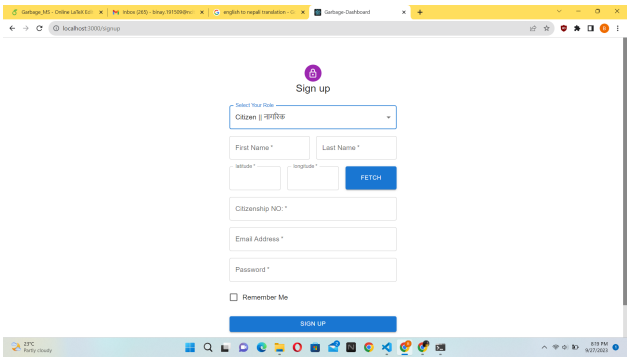


Figure 12: signup page

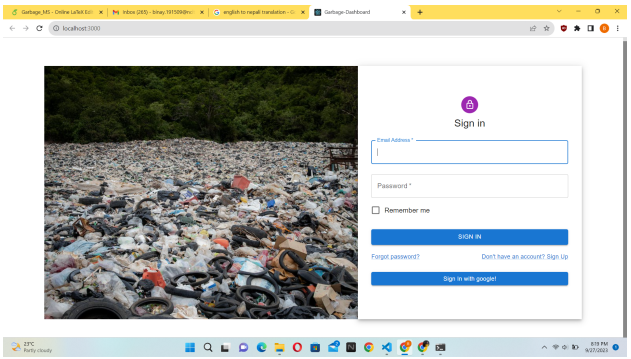


Figure 13: signin page

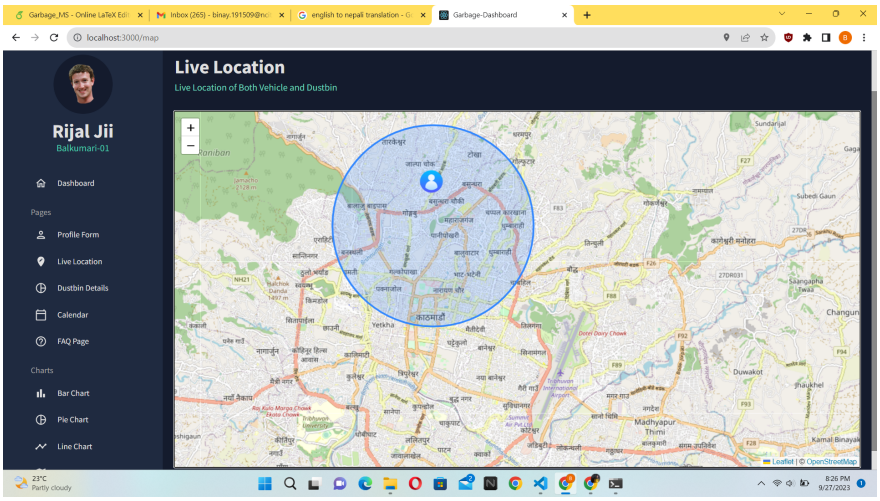


Figure 14: map page

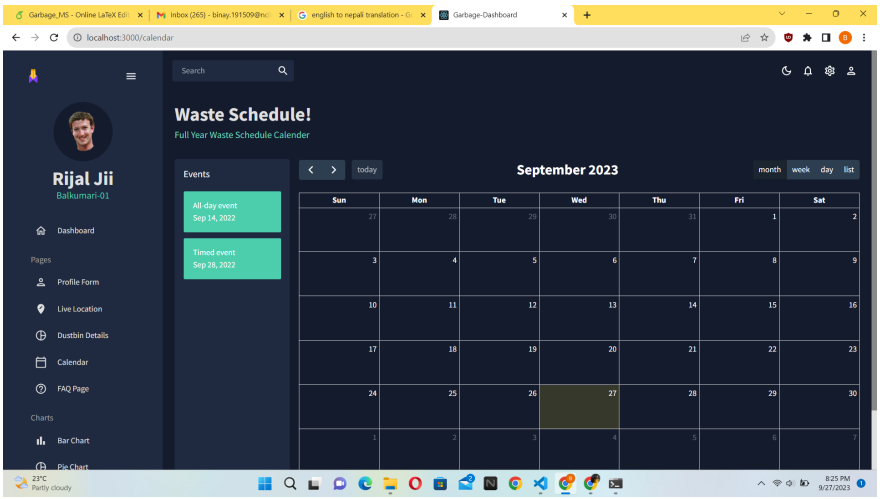
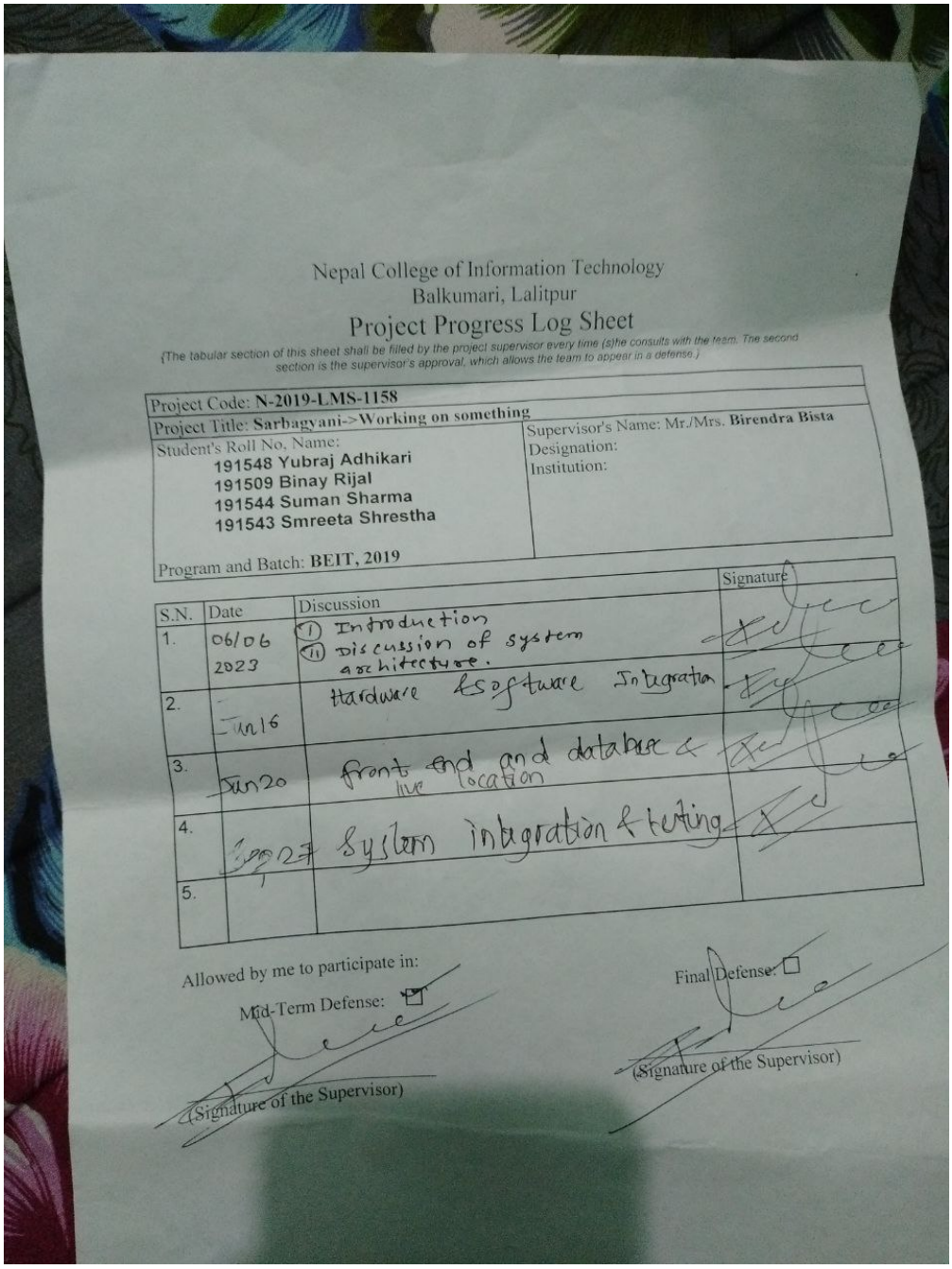


Figure 15: calendar page

Figure 16: calendar page



Nepal College of Information Technology
Balkumari, Lalitpur

Project Progress Log Sheet

(The tabular section of this sheet shall be filled by the project supervisor every time (s)he consults with the team. The second section is the supervisor's approval, which allows the team to appear in a defense.)

Project Code: **N-2019-LMS-1158**

Project Title: **Sarbagyani->Working on something**

Student's Roll No, Name:
191548 Yubraj Adhikari
191509 Binay Rijal
191544 Suman Sharma
191543 Smreeta Shrestha

Supervisor's Name: Mr./Mrs. **Birendra Bista**
Designation:
Institution:

Program and Batch: **BEIT, 2019**

S.N.	Date	Discussion	Signature
1.	06/06 2023	(i) Introduction (ii) discussion of system architecture.	
2.	Jun16	Hardware & software Integration	
3.	Jun20	front end and database & live location	
4.	Jun27	System integration & testing	
5.			

Allowed by me to participate in:

Mid-Term Defense: ☑

(Signature of the Supervisor)

Final Defense: ☐

(Signature of the Supervisor)

Figure 17: progress report