

GUJARAT TECHNOLOGICAL UNIVERSITY

(GTU)



GIDC Degree Engineering College, Navsari

Affiliated with GTU



A
Report
On

Road Safety

Under subject of
DESIGN ENGINEERING – 2B
B. E. III, Semester – VI
(Computer Engineering Department)

Submitted by
Group: 683141

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Academic year
(2024-2025)



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CERTIFICATE

Date:

*This is to certify that the **DESIGN ENGINEERING-2B PROJECT** entitled “Road Safety” has been carried out by Saiyad Ayanuddin Vahiruddin (231103107007), Dhruti Rajeshkumar Desai (231103107002), Dixi Rohitbhai Patel (231103107004) students of BE III, Semester VI under my guidance in partial fulfilment of the degree of Bachelor of Engineering in Computer Engineering (6th Semester) of Gujarat Technological University, Ahmedabad during the academic year 2024-25.*

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ABSTRACT

The Road Safety Application is a mobile-based solution designed to enhance the safety of people on the road. The app supports two types of users: regular users and administrators. Users can report nearby road hazards such as speed breakers, accidents, and potholes. When a user submits a report, the mobile device automatically detects their current location (latitude and longitude) using GPS and sends it to the admin for review.

The app integrates Leaflet Maps, allowing users to set their source and destination and view their real-time location. A key feature is the Speed Breaker Marking System, where users can mark new speed breakers. These requests are sent to the admin, and the marker is only displayed on the map after admin approval.

The app provides real-time alerts/notifications to users when they approach a marked speed breaker, helping them stay cautious and avoid potential accidents. A web-based dashboard is also available for the admin to view, approve, or reject incoming reports.

Chapter 1: Introduction to concept/ idea

1.1 Introduction

Saiyad Ayanuddin Vahiruddin

Dhruti Rajeshkumar Desai

Dixi Rohitbhai Patel

We are students of GIDC Degree Engineering College of Computer Engineering of 3rd year. We all are interested doing paperwork, making website & find solution of problem. We like to innovate something new which will make people's life easier. We are working very hard for make our project best. We all are very hard working and work in unity.

Name of Guide: PROF. BRIJESHU. PATEL

Our guide is very helping person. He help in make our project best, as possible as he can. Any time, he responds positively and clear our all doubts related to our project topic. He provides all guidelines that we need in our project. He done his job very sincerely and done it as his responsibility. Also he is very hard working.

Design Thinking

"Innovation & Design Thinking" will allow students to develop basic skills in creative problem solving, innovation, and human-centered "design thinking." Innovation has become increasingly important because of the rapid evolution in products and business models and the ever more complicated world in which businesses and organizations operate. The course focuses on the manager's or leader's role as an innovator and facilitator of innovation by others.

As future managers, these skills also include the ability to identify innovative individuals, form innovative teams, and build innovative cultures within organizations. The course takes the view that innovative problem solving and design thinking can be learned through repeated practice. Students will engage in exercises, projects, and reflections to explore various methods and approaches to innovative problem solving and design thinking. The course will introduce a variety of tools and techniques ("props") that, with repeated use, will help students think more expansively, creatively, and effectively through all phases of an innovation project.

1.2 Objective

- Improve road safety
- Enhance driver's awareness
- Reduced road accidents
- Speed control

1.3 Purpose

- The main purpose of this project is to prevent accidents by alerting real time notifications for speed breaker.

2.1 AEIOU Summary Canvas

Environment:

- Noisy
- Construction
- Rainy
- Muddy
- Pollution
- Traffic
- Summer
- Foggy

Interactions:

- Driver to Passenger
- Driver to other Drivers
- Driver to Traffic police
- Passenger to Driver
- Passenger to Street vendors

Activities:

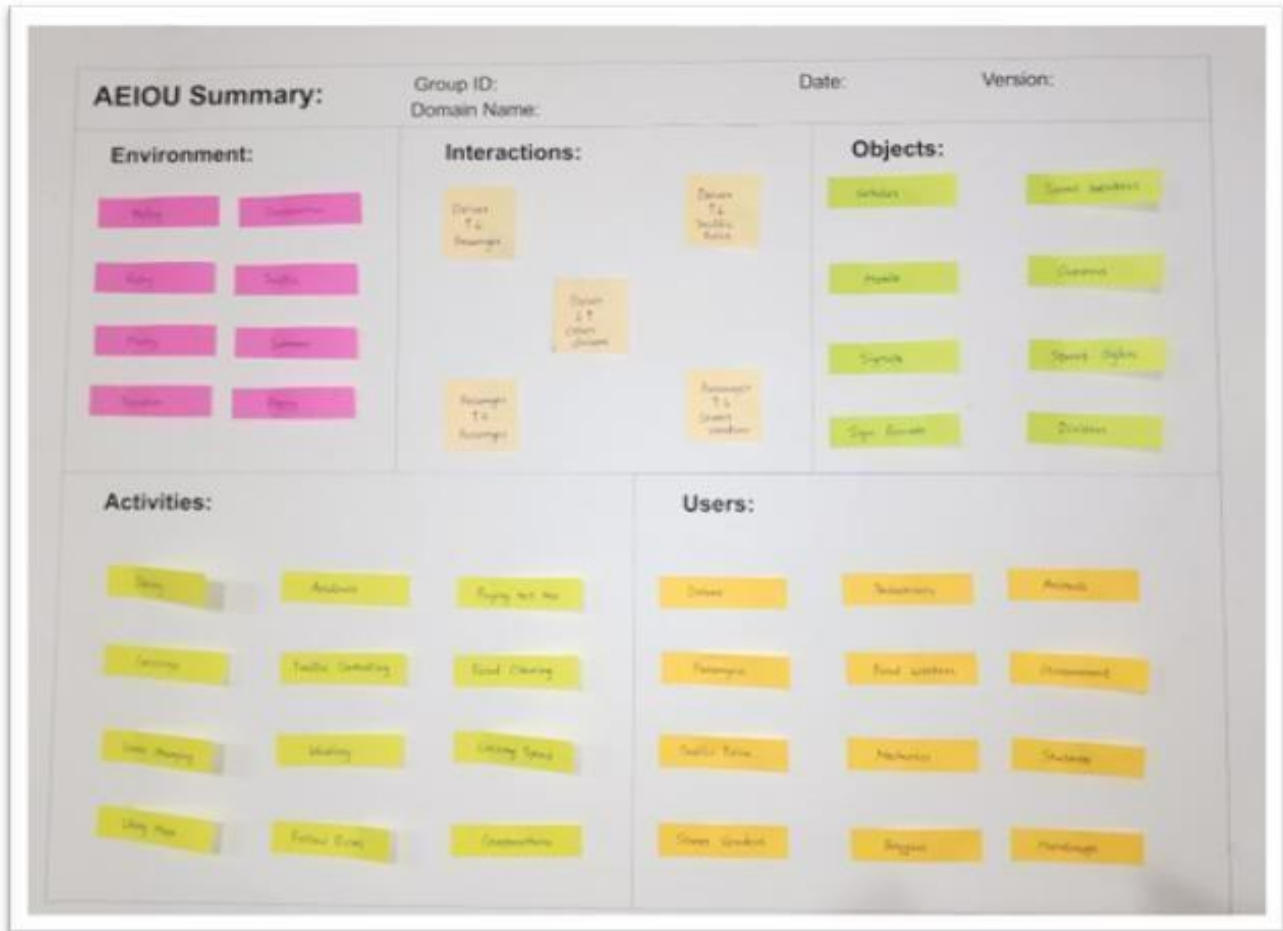
- Driving
- Crossings
- Lane changing
- Using maps
- Accidents
- Traffic controlling
- Waiting
- Following rules
- Paying tolls
- Road cleaning
- Limiting speed
- Constructions

Objects:

- Vehicles
- Speed breakers
- Mobile
- Cameras
- Signals
- Street lights
- Sign Boards
- Divider

Users:

- Driver
- Pedestrians
- Animals
- Passengers
- Road workers
- Government
- Traffic police
- Mechanics
- Students
- Street vendors
- Beggar



(Fig 2.1: AEIOU Canvas)

2.2 Mind Mapping Canvas

User:

- Drivers
- Passengers
- Street vendors
- Beggars
- Traffic police
- Road workers
- Mechanics
- Pedestrians

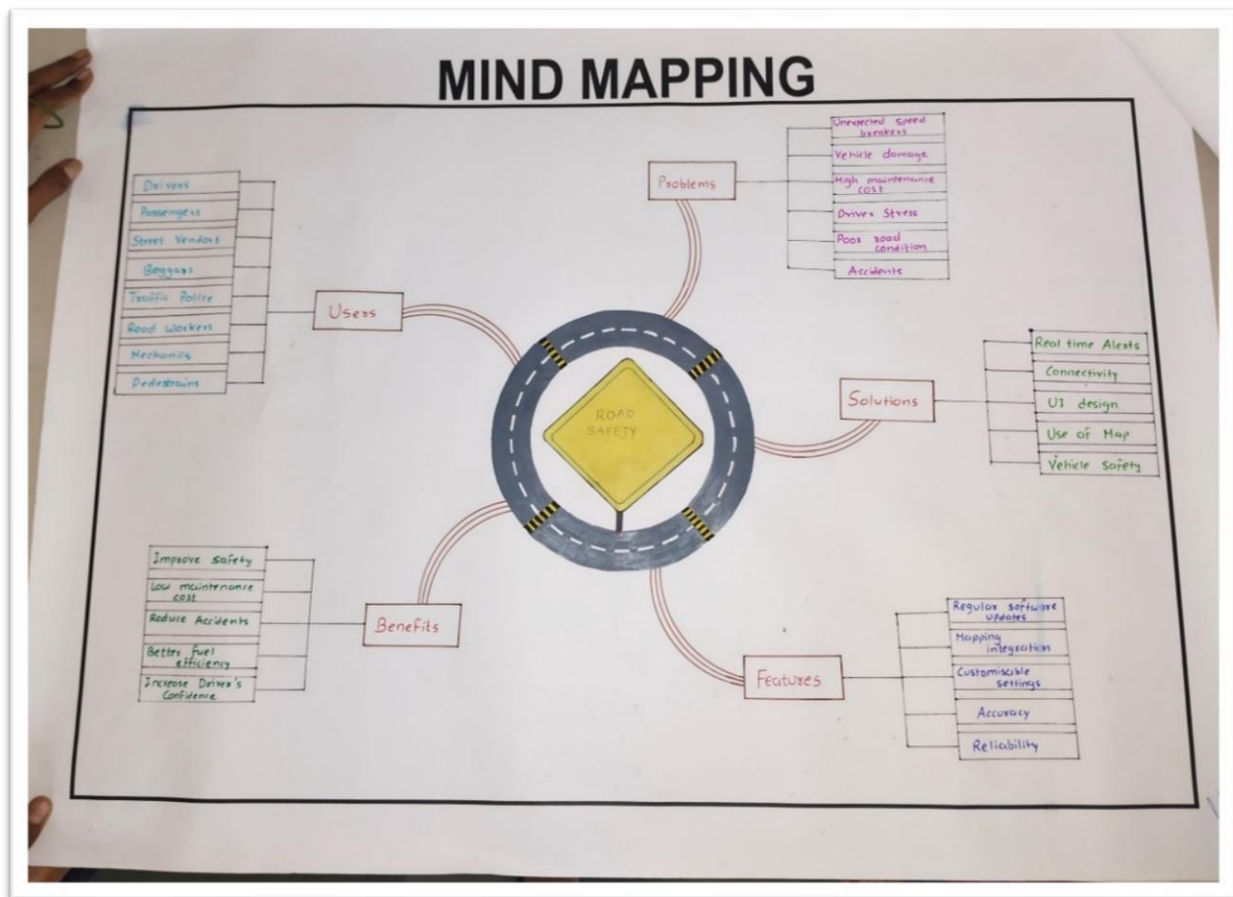
Solutions:

- Real-time alerts
- Connectivity
- UI design
- Use of maps
- Vehicle safety

Benefits:

- Improved safety
- Low maintenance cost
- Reduced accidents
- Better fuel efficiency
- Increased driver's confidence

(Fig 2.2: Mind Map)



2.3 Empathy Canvas Users

Users are the people who belong to the domain that we have selected and they are the ones who face problems in that domain. The users that we have included are:

- Driver
- Pedestrians
- Traffic police
- Passengers
- Road workers

Stakeholders

Stakeholders are the people who are directly or indirectly affected by the domain, problem and the solution of the problem. They are the ones who get profit or loss from the domain.

- Vehicle manufacturers
- Safety groups
- Insurance companies
- Road maintenance authorities
- Governments

Activities

Activities are the various tasks which are done by the users. These affect the domain.

- Driving
- Construction
- Traffic controlling
- Crossings
- Lane changing
- Using maps
- Waiting
- Speed controlling
- Following rules

Story Boarding

Happy story-1

A busy road which has many speed breakers for which overspeeding led to accidents. But due to speed breaker detector, the driver already got notified to reduce the speed for the upcoming speed breaker. It prevented a big Accident.

- **Happy story-2**

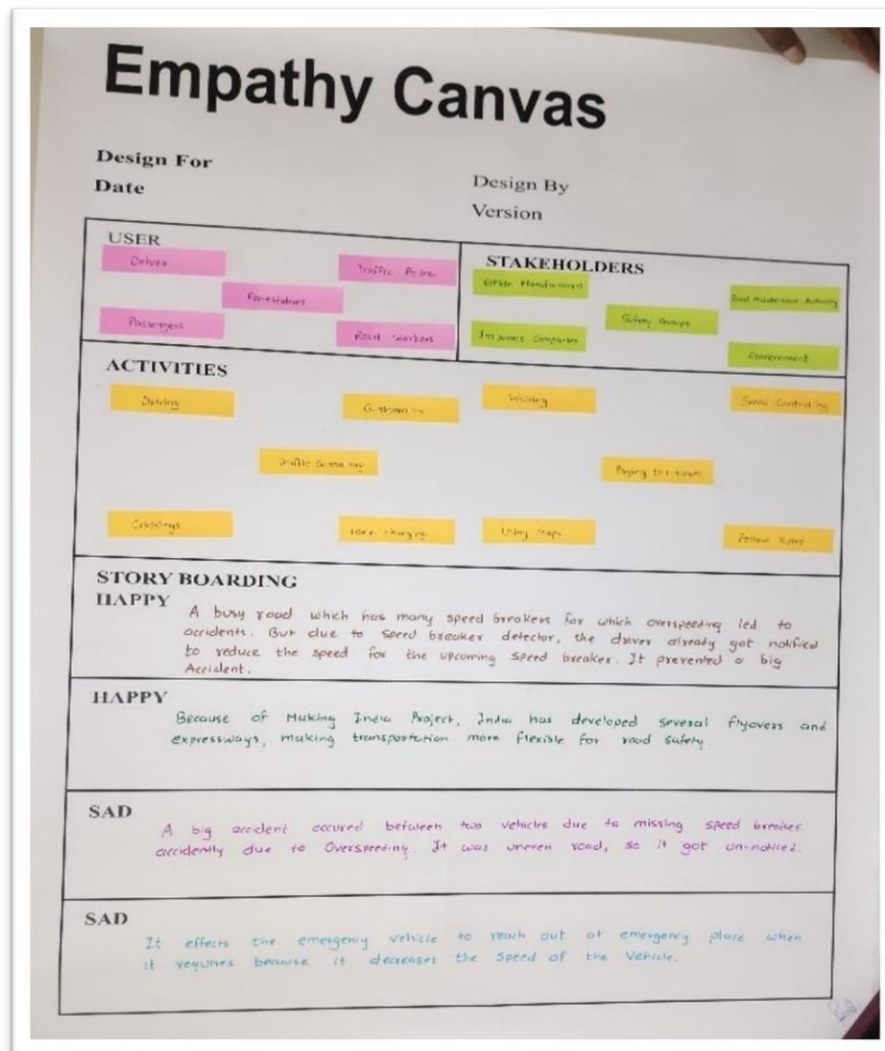
Because of Making India Project, India has developed several flyovers and expressways, making transportation more Flexible for road safety.

- **Sad story-1**

A big accident occurred between two vehicles due to missing speed breakers accidentally due to Over speeding. It was uneven road, so it got unnoticed.

- **Sad story-2**

It effects the emergency vehicles to reach out at emergency place when it requires because it decreases the Speed of the Vehicle.



(Fig 2.3: Empathy Mapping canvas)

2.4 Ideation Canvas

People

- Beggars
- Senior citizens
- Traffic police
- Street vendors
- Mechanics
- Drivers
- Passengers
- Animals
- Road workers
- Handicaps
- Pedestrians
- Students

Activities

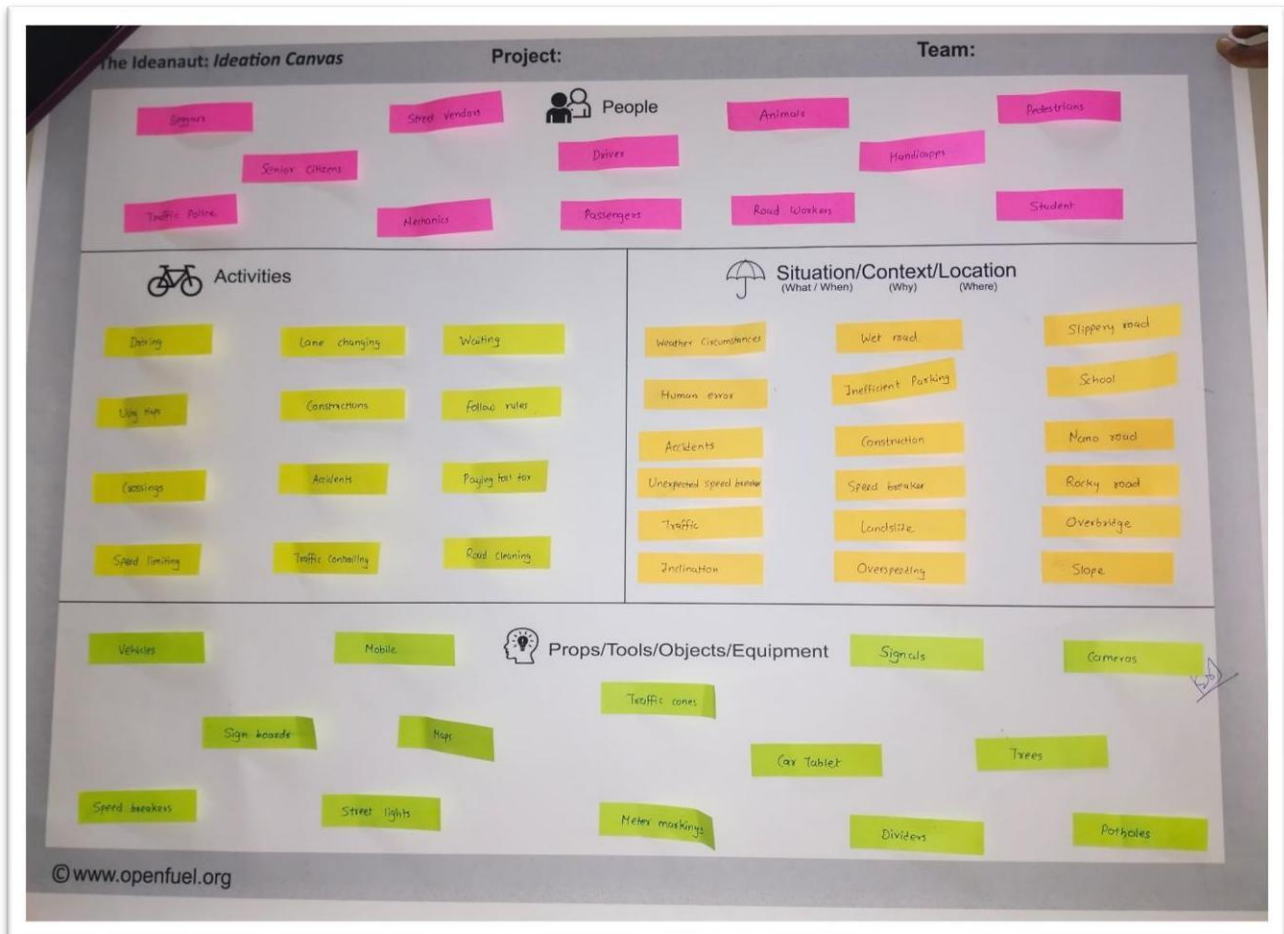
- Driving
- Lane changing
- Waiting
- Using maps
- Construction
- Following rules
- Crossings
- Accidents
- Paying tolls
- Speed limiting
- Traffic controlling
- Road cleaning

Situation/Context/Location

- Weather circumstances
- Slippery road
- Human error
- Inefficient parking
- School zones
- Accidents
- Construction
- Nano road
- Unexpected speed breaker
- Speed breaker
- Rocky road
- Landslide
- Overbridge

Props/Tools/Objects/Equipment

- Vehicles
- Mobile devices
- Sign boards
- Speed breakers
- Street lights
- Maps
- Traffic cones
- Meter markings
- Car tablet
- Signals
- Trees
- Dividers
- Cameras
- Potholes



(Fig 2.4: Ideation canvas)

2.5 Product Development Canvas

This canvas consists of product development details. They are as follow:

Purpose

It refers to the purpose of the concept that we are developing.

- To solve problem of unexpected speed breakers by alerting.

People

They are the key user segment who will use this product/ service or the end product of the concept we are pursuing.

- Drivers
- Passengers
- Road workers
- Traffic police
- Street vendors
- Beggars

Product Experience

Functions are the product's answers to user's problems/needs. They do something that user wants. The functions required in our device are:

- Speed breaker alert
- Data analysis
- Accident risk control
- Turn by turn directions
- Speed breaker location marking

Product Functions

Product features are specific. One or more features will power a function. The features required in our device are:

- Real time integration
- Alternate route suggestions
- Traffic aware
- Customizable alerts
- GPS services
- Information display

Component

Components built up the features. They are the can be major components or the auxiliary (additional) components that make the major components work. The components required are:

- Mobile
- GPS software
- Operating system
- Car screen
- Vehicles
- UI software
- Database
- Network modules
- API

Customer revalidation

Customer revalidation means testing with the customer or user that whether the product is useful.

- User friendly
- Easy to use
- Accurate
- Scalability
- Easy maintenance

Reject, redesign, retain

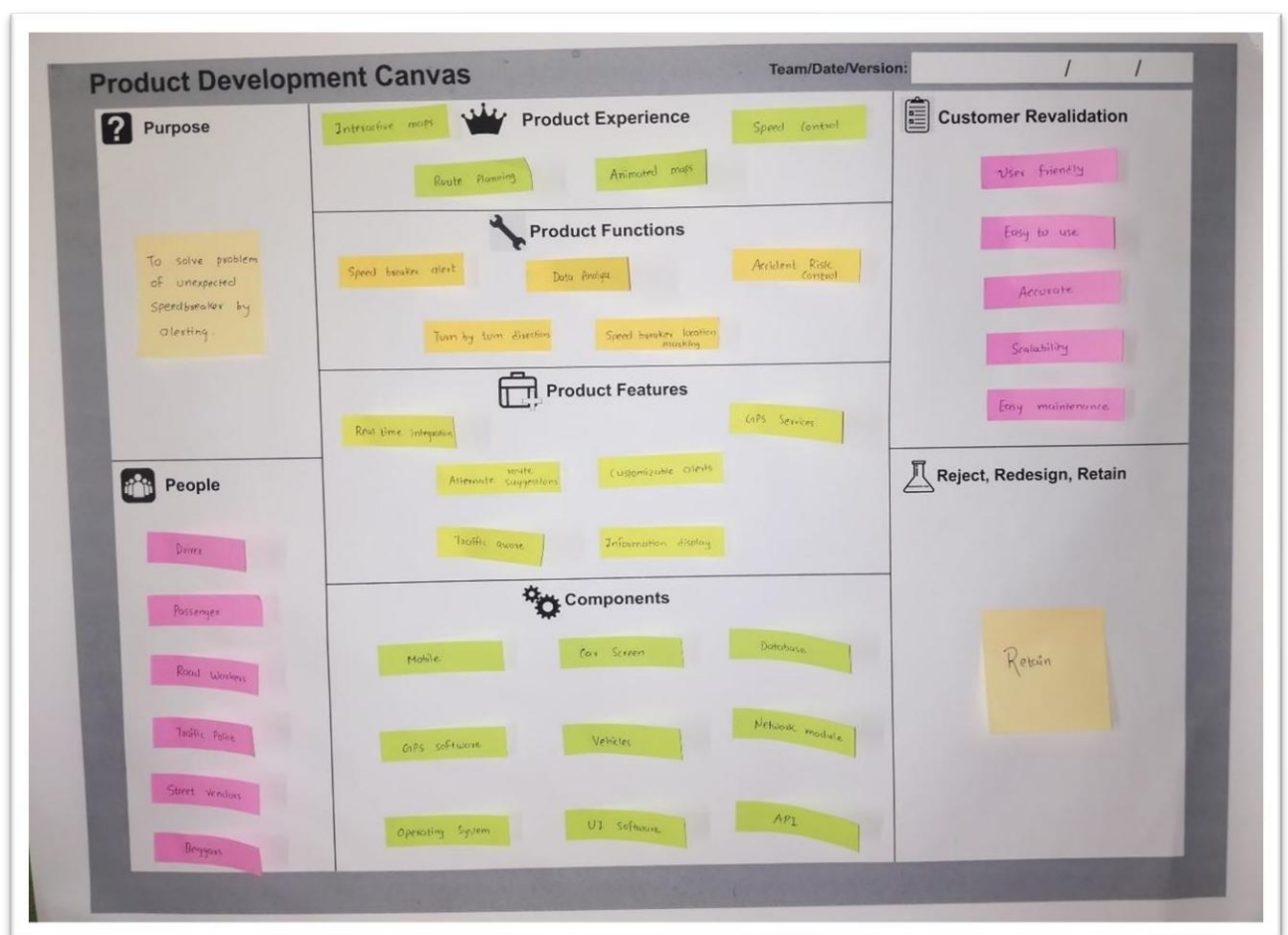
- Retain

Rejection of those features or functions that users didn't find useful. Redesigning those that were partially useful and retaining those that met the bar.

Reject: According to the user's review capturing the video errors was main issue and other problems are capturing failure.

Redesign: We will work on the errors and the issues faced by the user and modify it so as to make our product efficient and users friendly.

Retain: All the futures of our product which received positive feedback and were liked by the users are retained.

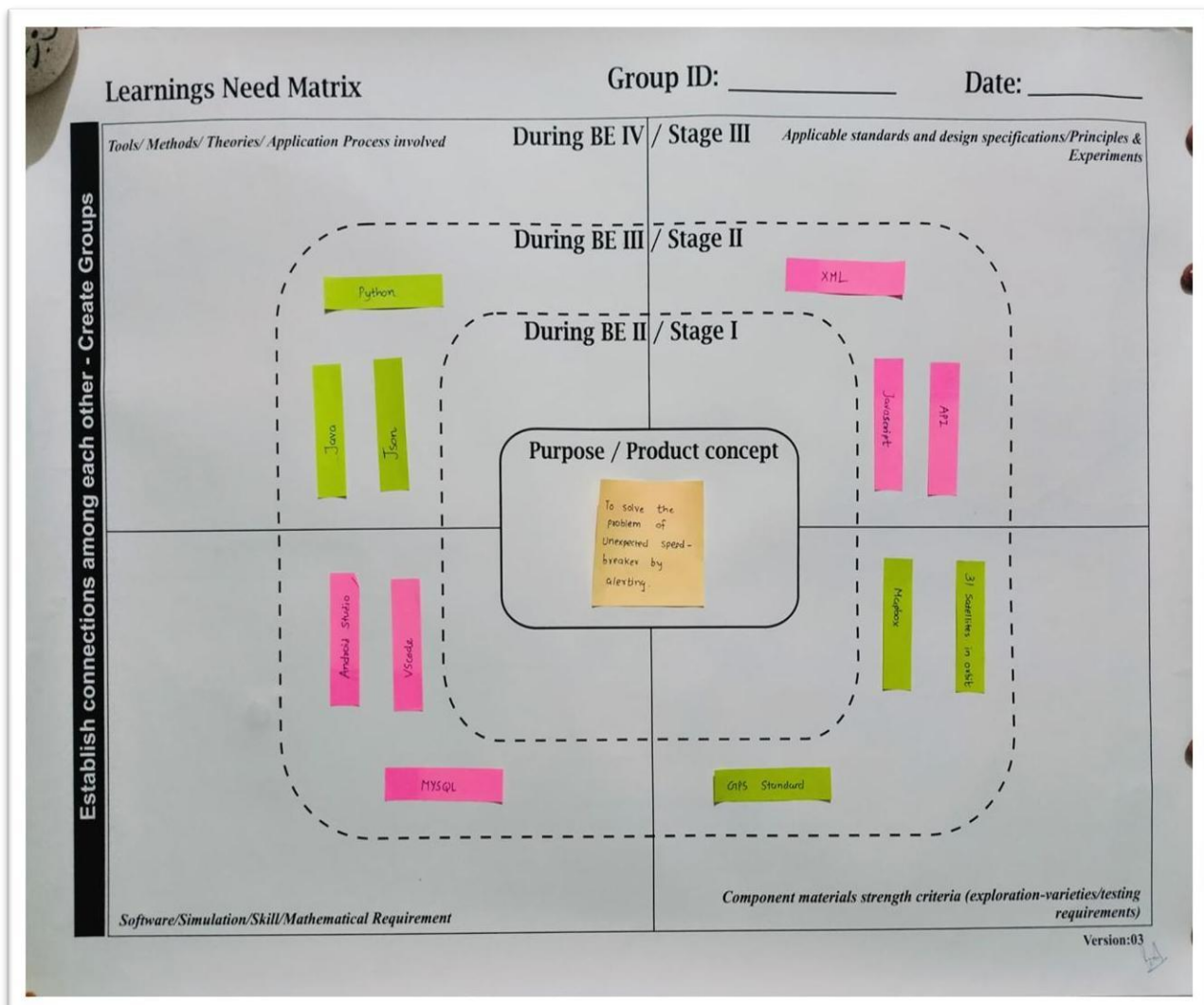


(Fig 2.5: Product development canvas)

2.6 LN Matrix Canvas

LNM canvas will help students to identify the learning requirement at an early stage along with prioritization of specific learning along with define time allocation for each. Identification will be focused with listing out syllabus based and out of syllabus learning and skill development. Students are to identify requirements in each four dimensions.

Priority learning shall be taken up in SEM 5 of BE 3 and by the end of BE 3 students will be developing working model. By that time most of all quadrants shall be covered under learning.



(Fig 2.6: LN Matrix canvas)

2.7 Literature review / Prior Art Search

Literature Review

- GPS and Mapping Integration: Review how GPS data is used in navigation systems to map road features like speed breakers. Systems like Google Maps or OpenStreetMap already integrate road features, but their detection of speed breakers might be limited.
- Geotagging of Speed Breakers: Explore studies where road anomalies, including speed breakers, are geotagged manually or automatically using vehicle data or smartphone sensors. These points are then displayed on a map to alert drivers.
- Crowdsourced Data: Investigate applications that allow users to mark speed breakers on maps, similar to how apps like Waze let users report accidents, roadblocks, or speed traps.
- Real-time Mapping: Explore how real-time data is processed and integrated into maps, such as using IoT devices or connected vehicles to update road conditions in real-time.

Prior Art Search (Map-Based Systems):

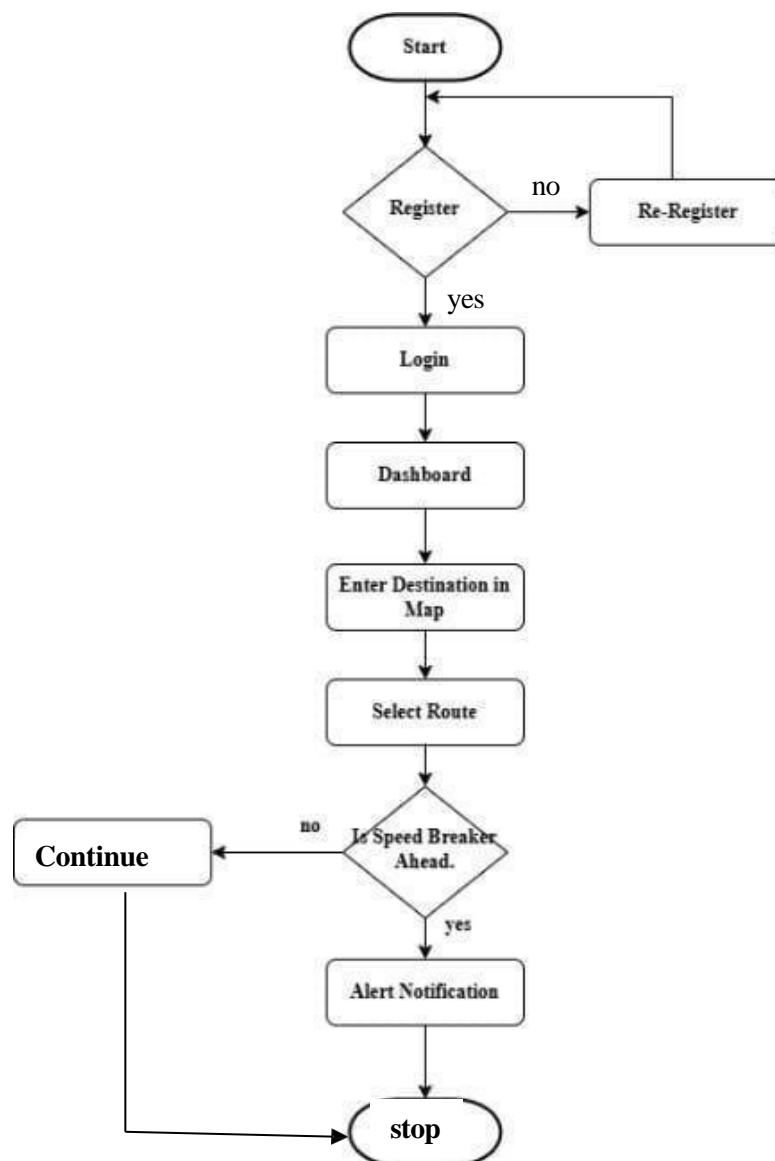
- Patents on GPS and Mapping for Speed Breakers: Look for patents that cover the detection of speed breakers using GPS and map data, especially those that combine sensors and maps to alert drivers.
- Existing Map-Based Alert Systems: Analyze systems like Waze, Google Maps, or dedicated road safety apps that use GPS-based mapping to provide road alerts. Understand how these systems gather, process, and display data.
- Map APIs and Software: Investigate existing software tools and APIs like Google Maps API, Mapbox, or OpenStreetMap that allow integration of custom data (like speed breaker locations) into maps. These tools can be used to develop a visual interface for speed breaker alerts.

CHAPTER 3: DESIGN CALCULATION

3.1 Flow Chart

A flowchart is a type of diagram that represents an algorithm, workflow or process, showing the steps as boxes of various kinds, and their order by connecting them with arrows. This diagrammatic representation illustrates a solution model to a given problem. Flowcharts are used in analyzing, designing, documenting or managing a process or program in various fields.

Flowcharts are used in designing and documenting simple processes or programs. Like other type of diagrams, they help visualize what is going on and thereby help understand a problem, and perhaps also find flaws.

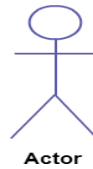


(Fig3.1: flow Chart)

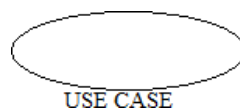
3.2 Use Case Diagram

Actors: An Actor is a direct external user of system. Something with a behavior or role.

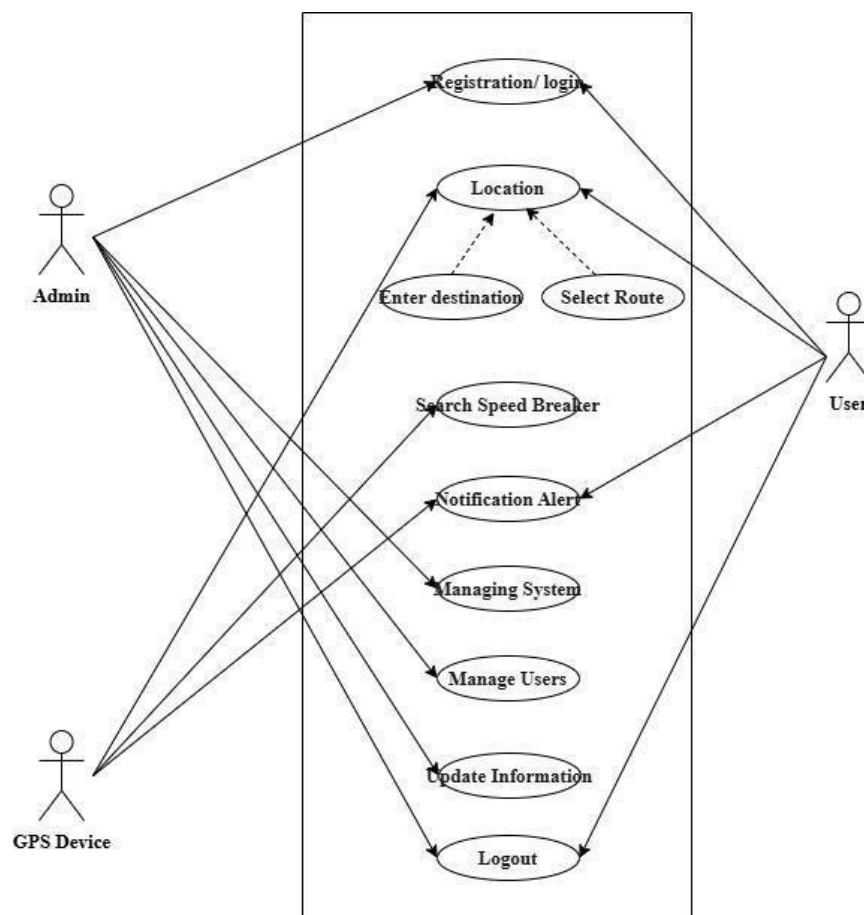
e.g., a person, another system, organization.



Use Cases: The various interactions of actors with a system are quantized in to use cases. A collection of related success and failure scenarios, describing actors using the system to support a goal.



Use Case Diagram: A system involves a set of use cases and a set of actors. Use case diagrams are considered for high level requirement analysis of a system. So, when the requirements of a system are analyzed the functionalities are captured in use cases



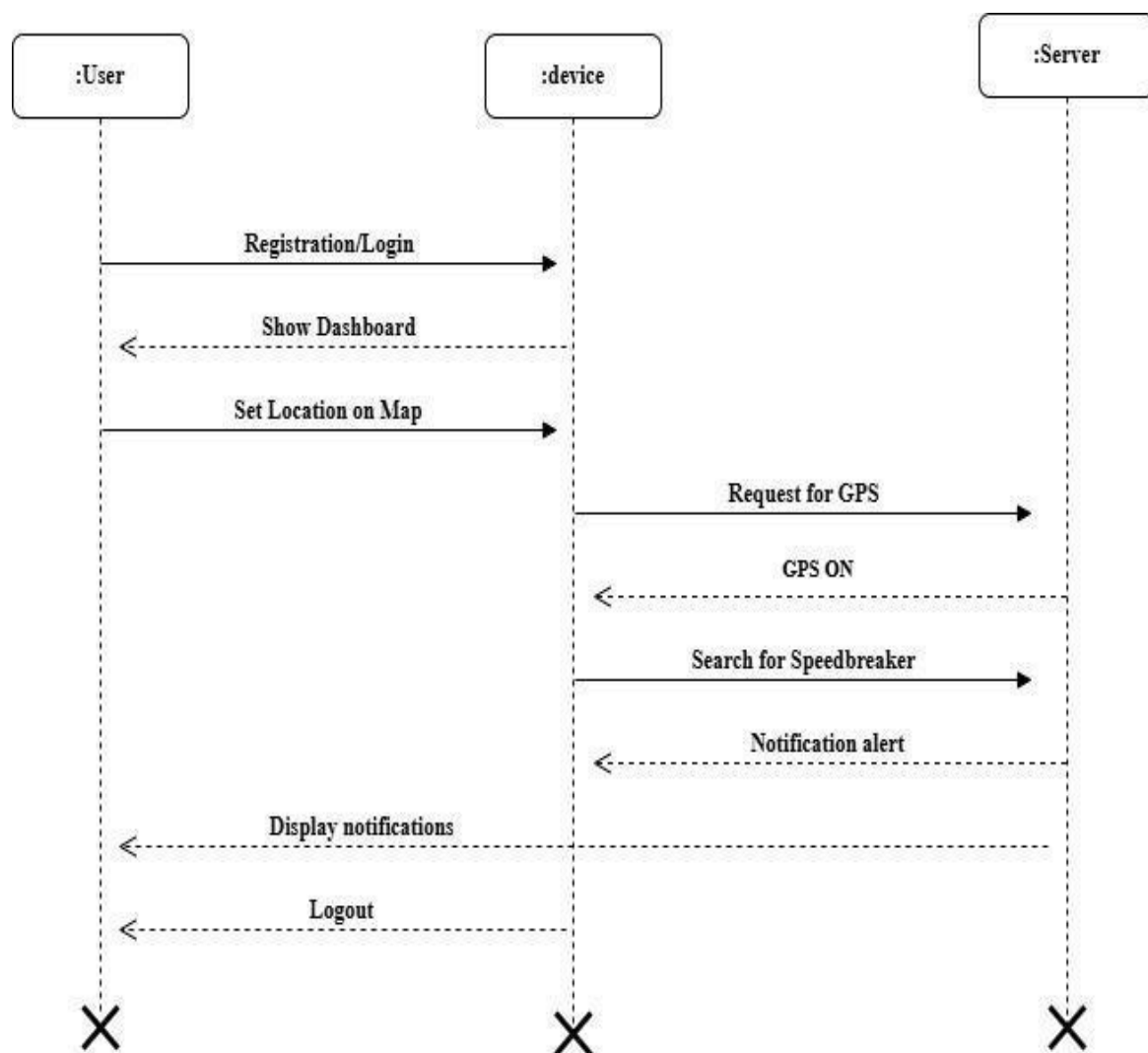
(Fig3.2: Use case diagram)

3.3 Sequence Diagram

Scenarios: - A Scenario is a sequence of events that occurs during one particular execution of a system, such as for a use case. The scope of a scenario can vary it may include all events in the system, or it may include only those events impinging on or generated by certain object.

Sequence Diagram: - A Sequence diagram shows the participants in an interaction and the sequence of messages among them. A Sequence diagram shows the interaction of a system with its actors to perform all or part of use case

Each actor as well as the system is represented by a vertical line called lifeline and each message by a horizontal arrow from the sender to the receiver.

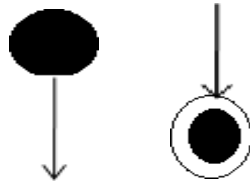


(Fig3.3: Sequence diagram)

3.4 Activity Diagram

Activity diagram: Activity diagram is another important diagram in UML to describe dynamic aspects of the system. Activity diagram is basically a flow chart to represent the flow from one activity to another activity. The activity can be described as an operation of the system.

Initiation & Termination: A Solid circle with outgoing arrows shows the starting point of an activity diagram. A bull's-eye shows the termination Point.



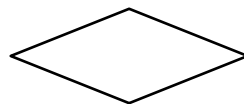
Initiation & Termination

Activity: An activity is some tasks which needs to be done. Each activity can be followed by another activity (sequencing).



Activity

Branches: If several arrows enter an activity, the alternate execution paths merge. Alternatively, several arrows may enter a diamond and one may exit to indicate a merge.

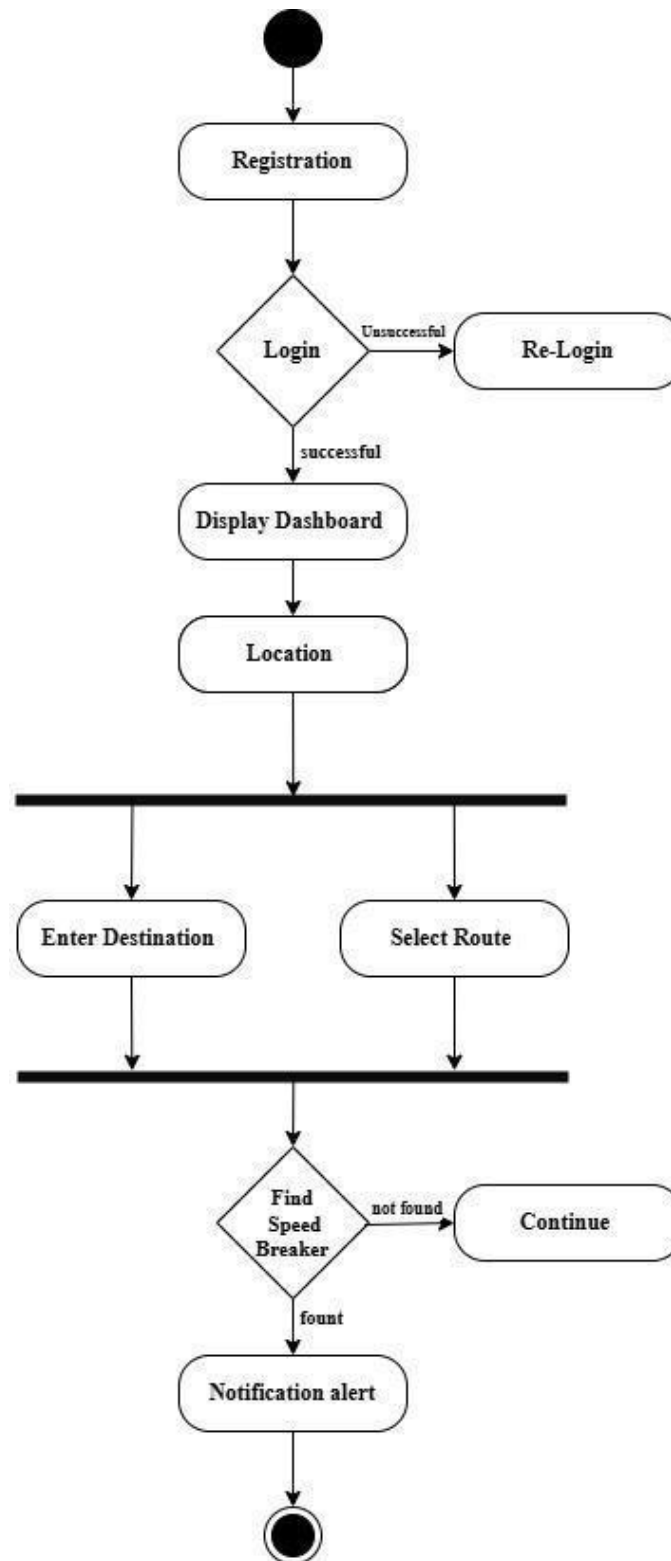


Diamond

Concurrent Activities: If one activity may be followed by another activity, then split into several concurrent activities (A fork control), and finally be combined into a single activity (A merge/join control). A fork or merge is shown by a synchronization bar –a heavy line with one or more input arrows and one or more output arrows.



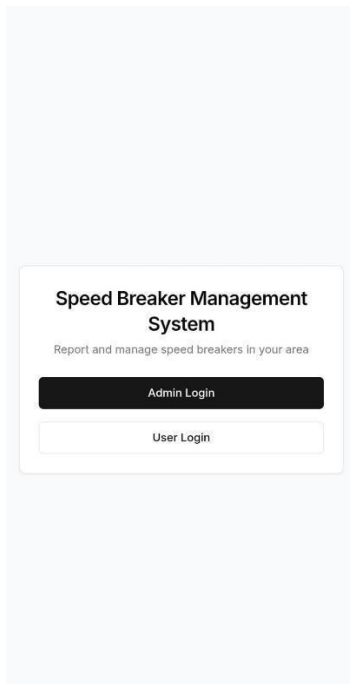
Synchronization Bar



(Fig3.4: Activity diagram)

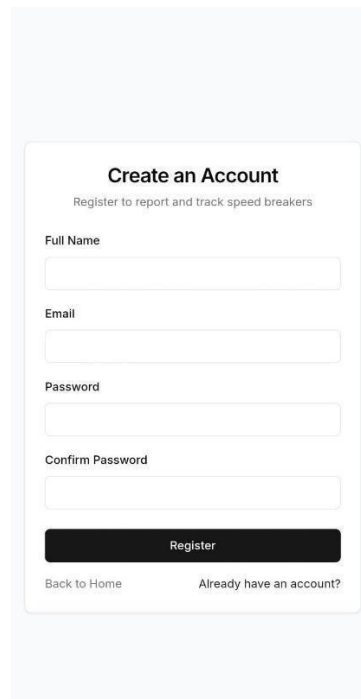
CHAPTER 4: ROUGH PROTOTYPE MODEL

- Welcome Page



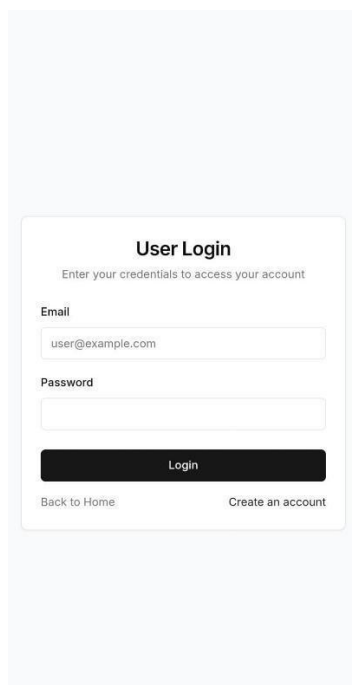
The Welcome Page features a light blue background. At the top, the text "Speed Breaker Management System" is displayed in bold, followed by the subtitle "Report and manage speed breakers in your area". Below this, there are two buttons: a dark blue "Admin Login" button and a white "User Login" button with a dark blue border.

- Sign Up Page



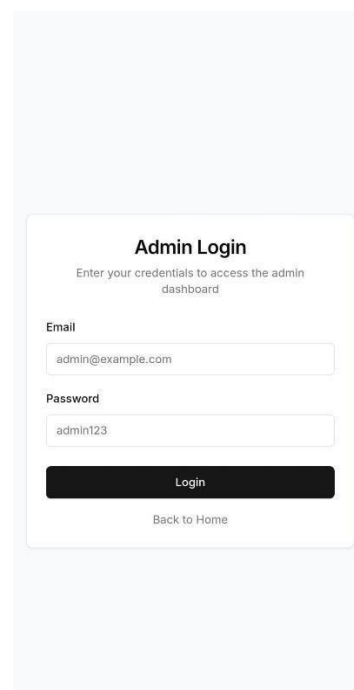
The Sign Up Page has a light blue background. The main heading is "Create an Account", with the subtitle "Register to report and track speed breakers". The form includes fields for "Full Name", "Email", "Password", and "Confirm Password". Below these fields is a dark blue "Register" button. At the bottom, there are two links: "Back to Home" and "Already have an account?".

- Login Page for User



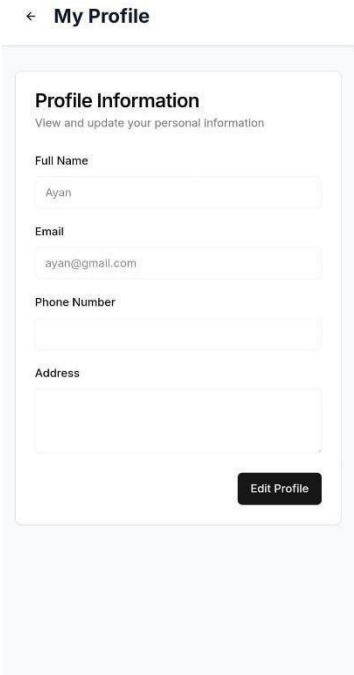
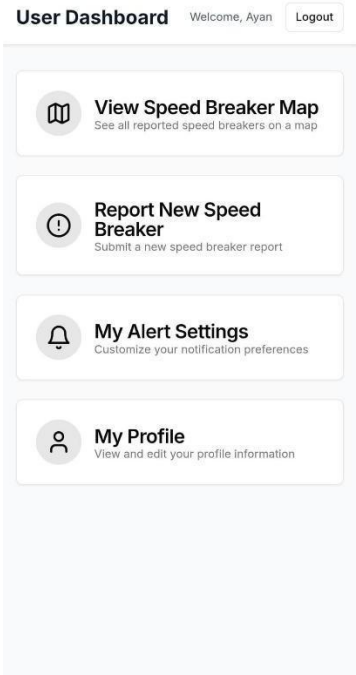
The User Login page has a light blue background. The heading is "User Login", with the subtitle "Enter your credentials to access your account". The form includes fields for "Email" (containing "user@example.com") and "Password". Below these fields is a dark blue "Login" button. At the bottom, there are two links: "Back to Home" and "Create an account".

- Login Page for Admin

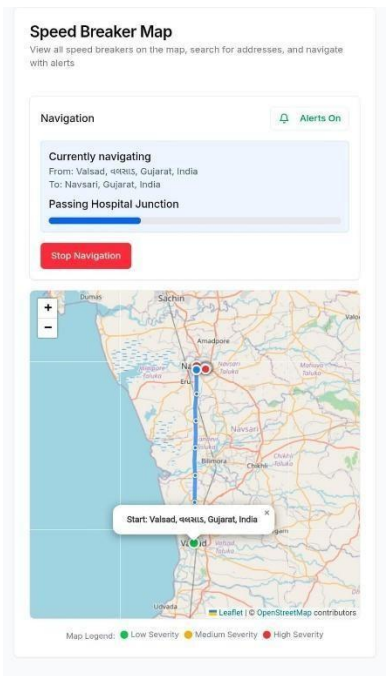


The Admin Login page has a light blue background. The heading is "Admin Login", with the subtitle "Enter your credentials to access the admin dashboard". The form includes fields for "Email" (containing "admin@example.com") and "Password" (containing "admin123"). Below these fields is a dark blue "Login" button. At the bottom, there is a link: "Back to Home".

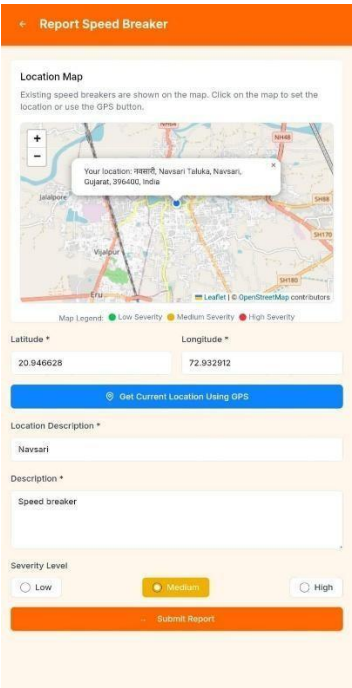
User home page/profile page



View Speed Breaker Map Page



Report New Speed Breaker Page



- Alert notification

Alert Settings

Notification Preferences

Customize how and when you receive alerts about speed breakers

Notify about new speed breakers

Receive notifications when new speed breakers are approved

☒

Notify about nearby speed breakers

Receive notifications when you are near a speed breaker

☒

Distance threshold (meters)

Receive alerts when you are within this distance of a speed breaker

1000 meters

Email notifications

Receive notifications via email

☒

Push notifications

Receive push notifications in your browser

☐

Save Settings

- Admin home page

Admin Dashboard

Welcome, Admin
Logout

Review Pending Approvals
Review and approve/reject user submitted reports

Manage Speed Breaker Locations
Edit or remove existing speed breaker data

View Analytics
View usage statistics and analytics

- Review Pending Reports

Pending Approvals

Review Pending Reports

Approve or reject speed breaker reports submitted by users

Jalalpore Road, Navsari
Reported on 5/2/2025

☒
☐

New speed breaker installed last week

Coordinates: 20.952, 72.956

Navsari Agricultural University
Reported on 5/1/2025

☒
☐

Deep pothole causing traffic slowdown

Coordinates: 20.953, 72.957

- Manage speed breaker location

Manage Speed Breakers

Speed Breaker Map

Map showing all speed breaker locations

Map Legend: ● Low Severity ● Medium Severity ● High Severity

Speed Breaker Locations

Edit or remove existing speed breaker data

Navsari Railway Station
Reported on 4/25/2025

Large speed breaker near the railway station entrance

Coordinates: 20.9467, 72.952

High Severity

Abrama Road, Navsari
Reported on 4/30/2025

Small speed breaker with yellow markings

Coordinates: 20.95, 72.955

Low Severity

Dudhia Talav, Navsari
Reported on 4/28/2025

Medium sized pothole in the middle of the road

Coordinates: 20.948, 72.953

CHAPTER 5: ROUGH PROTOTYPE MODEL

5.1 Hardware Requirements:

- Android Mobile / Tablet / Laptop – For using the app and accessing the admin dashboard
- GPS Module – Built-in on smartphones for real-time location tracking
- Internet Connectivity – Required for maps, database sync, and notifications

5.2 Software Requirements:

- Android Studio – For developing the native Android app using Java or Kotlin
- Firebase – Used for backend services:
- Firebase Realtime Database – For storing speed breaker data
- Firebase Authentication – For user/admin login
- Firebase Cloud Messaging (FCM) – For sending real-time alert notifications
- Leaflet.js with WebView – For map integration inside the mobile app
- Visual Studio Code / Any Code Editor – For developing the admin panel or backend dashboard (HTML/CSS/JavaScript)
- Operating System – Compatible with Windows, macOS, or Linux

5.3 Cost Estimation:

Component	Estimated Cost
Android Device(s) (for development/testing)	₹20,000 – ₹40,000
Laptop/PC (for development)	₹50,000 – ₹1,00,000
Peripherals (Mouse, keyboard, etc.)	₹3,000
Software & Tools	Mostly Free (Firebase, Android Studio, Leaflet.js)
Cloud Services (optional – Firebase Blaze Plan)	Based on usage
Development Cost	Varies (based on team size, outsourcing, etc.)

5.4 Comparison with an existing system:

Feature	Existing Apps (e.g., Google Maps)	Road Safety App (Proposed System)
Speed Breaker Detection	Not available or inconsistent	User-driven speed breaker marking + admin approval

CONCLUSION

The road safety system using maps is a cutting-edge solution designed to enhance road safety and reduce accidents caused by speed breakers. By leveraging GPS, map data, and real-time traffic information, this system provides timely alerts to drivers, promoting defensive driving and minimizing speed-related risks. With its user-friendly interface, scalable architecture, and integration with existing navigation apps, this system has the potential to revolutionize road safety.

REFERENCES

- "Web Mapping Illustrated" by Mitchell (2016) - Focuses on web mapping using open-source tools like Leaflet and Open Layers.
- "Python Geospatial Development" by Uden (2017) - Provides practical guidance on building geospatial applications using Python.
- [Learning React: Modern Patterns for Developing React Apps](#) by Alex Banks & Eve Porcello (2020) – Covers modern React development practices.
- [Fullstack React: The Complete Guide to ReactJS and Friends](#) by Anthony Accomazzo et al. (2017) – Comprehensive guide to React and related tools.
- [Tailwind CSS : From Zero to Production](#) by Adam Wathan (2021) – Practical introduction to utility-first CSS.
- www.reactjs.org – Official website for the React library.
- www.nextjs.org
- www.tailwindcss.com – Official site for the Tailwind CSS framework.
- www.openai.com – Provider of AI APIs used for natural language-based UI generation.
- www.leafletjs.com