

**SRS Report**  
**Enhancing Railway Safety using Computer Vision and Cloud Based Technologies**

**Tech Wizards**

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# **1.Introduction**

This document provides a comprehensive overview of a web application designed to enhance railway safety. Its purpose is to provide a detailed analysis of all system requirements for the respected clients. The SRS document is intended for stakeholders and developers to gain a better understanding of the project's concepts and scope.

Furthermore, this document describes the target audience of the project and the software requirements. This document aims to provide a clear and concise understanding of the software's scope, functional and non-functional requirements, and its role in achieving the project's objectives. By outlining the key features and functionalities of the software, we aim to give readers a complete understanding of the computer vision and cloud-based approaches used in this project.

## **2.Project scope**

Our initiative aims to improve railway safety by utilizing computer vision and cloud-based technology. For this activity, we employ a camera fixed in front of the train to capture the locomotive driver's view. If the camera detects an object, such as an elephant, buffalo, human, or large vehicle, on the railway track or nearby, our system alerts the locomotive driver, providing information about both the current and upcoming locations, as well as the weather conditions. The system derives this information from cloud services. Furthermore, our system provides a visual interface with voice alerts for locomotive drivers regarding meteorological information and locations.

## 2.1. Use case diagram

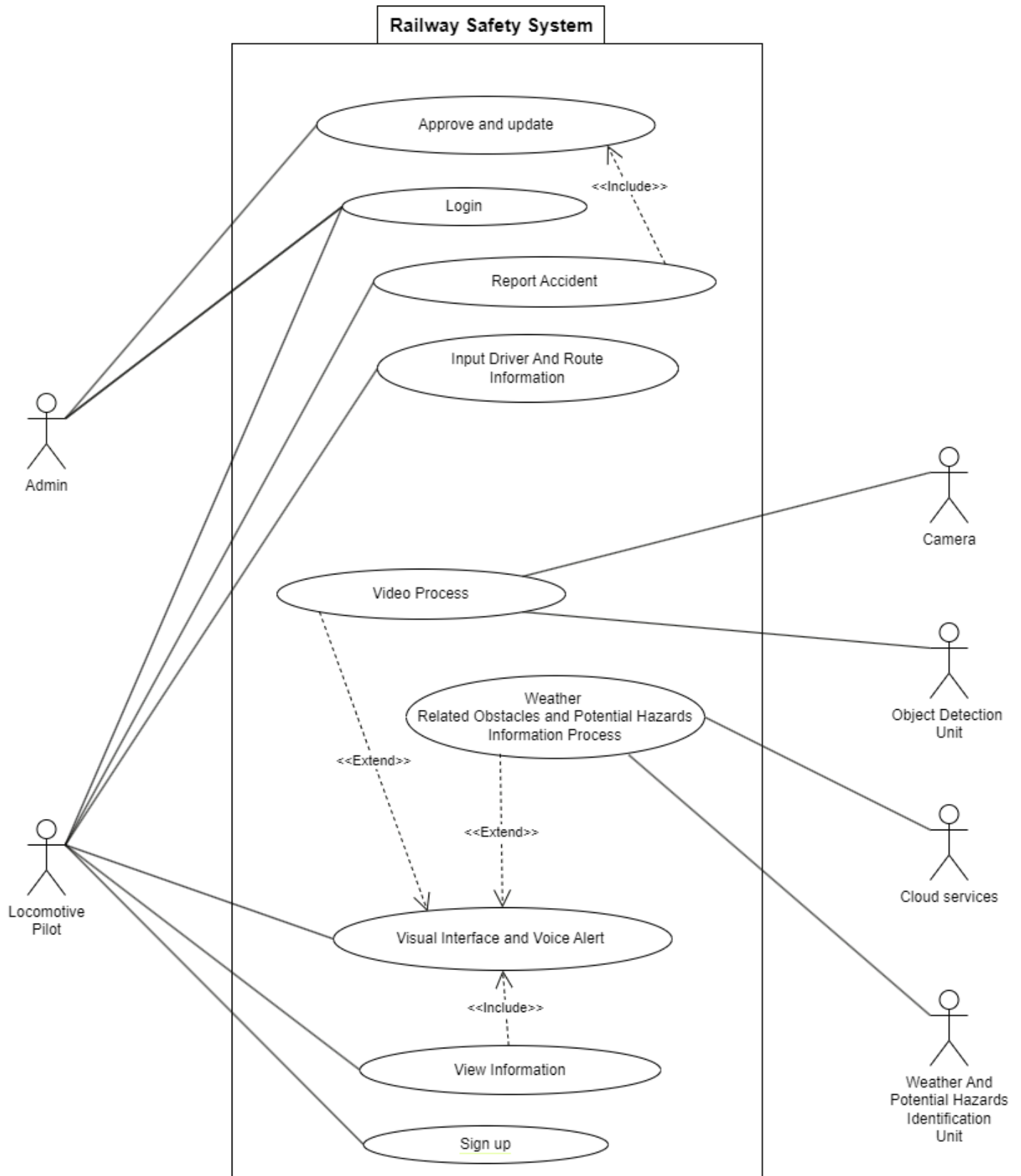


Figure.1. Use case diagram

## 2.2 Actors and Use cases

### 2.2.1 Actors

- Admin
- locomotive pilot
- Camera
- Cloud services
- Object detection unit
- Weather related obstacles and potential hazards identification unit

### 2.2.2 Use cases

- **Sign up**  
The sign-up process begins with the locomotive pilot selecting the sign-up option and filling the registration form. After the submission, the system verifies the details, creates a database record, and sends verification message. Upon successful registration, locomotive pilots are redirected to the login page.
- **Login**  
A login option is presented, where locomotive pilots or admins input their email and password. After submission, the system verifies the details and redirects users to the main home page. Here, users can access tailored options and settings. Allowing them to navigate the system seamlessly.
- **Input driver and route information**  
Locomotive pilots need to input driver and route information into the system. Subsequently, the system displays route details, including weather conditions, location, and other pertinent information to assist pilots during their journey.
- **View Information**  
Locomotive pilots can view real-time updates on current and next location's weather conditions, and other relevant information, aiding locomotive pilots in making informed decisions.
- **Video Process**  
Using a camera, capture video feeds, and employ an object detection model to identify objects on or near the railway track. Subsequently, promptly issue alerts to the locomotive pilot, ensuring timely notification and a proactive response to potential hazards.
- **Weather Related Obstacles and Potential Hazards Information Process**  
Identify weather-related obstacles and potential hazards by utilizing cloud services to detect weather conditions. This feature alerts about the current weather at their location and the next location identifies any obstacles caused by weather. Detailed information about the weather and related hazards is displayed to ensure locomotive pilots make informed decisions.

- **Visual and voice alert generation**

The intuitive web interface provides locomotive pilots with real-time updates on detected objects, weather conditions, location, and other relevant data in an easily understandable format. Additionally, voice-enabled output functionality is implemented, allowing drivers to interact with the application seamlessly for enhanced usability and safety.

- **Report accidents**

Locomotive pilots have the capability to report detailed information about new accident locations and reasons directly into the system.

- **Approve and Update**

Locomotive pilots input new accident locations, types, and descriptions into the system. The admin then ensures reported accidents and potential hazards and approves them. After approval, they are updated in the system.

## 2.3 Use case scenarios

Use case number	01
Use case name	Sign-up
Actors	Locomotive pilots
Pre-condition	System presents a welcome screen to users
Scenario description	<ol style="list-style-type: none"> <li>1A1 User selects the sign-up option. 2A1 if user selects the Sign-in option</li> <li>System displays sign up form to enter details.</li> <li>Users fill the form and submit. <ol style="list-style-type: none"> <li>3.1. User does not enter any of the fields (username, confirm password and password)</li> </ol> </li> <li>System validates form details, creates an account, and redirects the user to the home screen with the successful registration message. <ol style="list-style-type: none"> <li>4.1. E1 Connection error</li> <li>4.2. E2 Entered email format is invalid.</li> <li>4.3. E2 Entered password format is invalid.</li> <li>4.4. E2 Entered confirm password is not matched.</li> </ol> </li> </ol>
Post condition	System displays the login screen.
Business rules	<ol style="list-style-type: none"> <li>1. When a user signup, they should give their username, password and confirm password</li> <li>2. User should have a password with a maximum of 12 characters and a minimum of 8 characters, and it should have uppercase, lowercase, and symbols</li> </ol>

Use case number	02
Use case name	Login
Actors	Admin, Locomotive pilots
Pre-condition	System displays a login screen.
Scenario description	<ol style="list-style-type: none"> <li>2A1 User selects login option. 1A1 User selects sign-up option.</li> <li>System displays a sign in screen to enter email and password.</li> <li>User fills the details and submits. <ol style="list-style-type: none"> <li>3.1 User does not enter email or password.</li> </ol> </li> <li>System validates the email and its corresponding password and redirects to the home screen. <ol style="list-style-type: none"> <li>4.1 E1 Connection error</li> <li>4.2 E2 Entered email format is invalid.</li> <li>4.3 E2 Entered password format is invalid.</li> <li>4.4 E2 Entered confirm password is not matched.</li> </ol> </li> </ol>
Post condition	System displays the home screen.

Use case number	03
Use case name	View information
Actors	Locomotive pilots
Pre-condition	<ol style="list-style-type: none"> <li>1. The railway safety system is operational and integrated with weather monitoring services.</li> <li>2. Real-time weather data and other relevant information are available for the current and next location along the railway route.</li> </ol>
Scenario description	Locomotive pilots log into the system to access real-time updates on weather conditions and other relevant information for their current and next locations along the railway route. The system provides a user-friendly interface displaying accurate data.
Post condition	The system successfully displays real-time updates on weather conditions and other relevant information
Business rules	<ol style="list-style-type: none"> <li>1. Information updates must be displayed accurately and in real-time.</li> <li>2. The system should provide information for both the current and next locations along the railway route.</li> <li>3. The system should prioritize user-friendly interfaces and intuitive navigation to facilitate ease of use for locomotive pilots.</li> </ol>

Use case number	04
Use case name	Detect obstacles
Actors	Camera, Object detection unit
Pre-condition	<ol style="list-style-type: none"> <li>1. The system is operational and configured to detect obstacles.</li> <li>2. Camera and detection mechanisms are functioning properly.</li> </ol>
Scenario description	<ol style="list-style-type: none"> <li>1. The system continuously monitors the environment for obstacles using a camera.</li> <li>2. If an obstacle is detected within the predefined detection range, <ol style="list-style-type: none"> <li>2.1 The system detects an obstacle (elephant, buffalo, large vehicle, human)</li> <li>2.2 An alert is generated by the system for locomotive drivers.</li> <li>2.3 The alert includes information about the detected obstacle and its location.</li> </ol> </li> </ol>
Post condition	The alert is delivered successfully to the locomotive pilot, and the information are displayed on the screen
Business rules	<ol style="list-style-type: none"> <li>1. The system detects obstacles within the specified detection range.</li> <li>2. The system should prioritize real-time detection and alerting to ensure timely response to potential hazards.</li> <li>3. The alert notification must be clear and concise, providing essential information about the detected obstacle.</li> </ol>



Use case number	05
Use case name	Identify Weather Related Obstacles and potential Hazards
Actors	Cloud services, Weather related obstacles and potential hazards identification unit
Pre-condition	The system is configured to identify specific types of weather-related obstacles and hazards, such as heavy rainfall, fallen trees, landslides.
Scenario description	<ol style="list-style-type: none"> <li>1. The system continuously monitors weather conditions along the railway route and its surroundings using cloud services and weather monitoring systems.</li> <li>2. If a weather-related obstacle or potential hazard is detected within the predefined detection range: <ol style="list-style-type: none"> <li>2.1 The system cross-references the detected unusual weather conditions with historical weather data and predictive models to assess potential hazards.</li> </ol> </li> <li>3. An alert is generated by the system to notify locomotive pilots about the presence of the detected weather-related obstacles.</li> </ol>
Post condition	The locomotive pilots stay alert about the presence of detected weather-related obstacles.
Business rules	<ol style="list-style-type: none"> <li>1. The system must accurately detect and identify weather-related obstacles and potential hazards to ensure railway safety during adverse weather conditions.</li> <li>2. Alert notifications should be timely and informative, providing detailed information about the detected hazard to facilitate appropriate response measures.</li> </ol>

Use case number	06
Use case name	Visual and voice alert
Actors	Locomotive pilots
Pre-condition	<ol style="list-style-type: none"> <li>1. The railway safety system is operational and integrated with visual and voice alerting mechanisms.</li> <li>2. Sensors, cameras, and audio devices are deployed along the railway tracks to detect hazards and obstacles.</li> </ol>
Scenario description	The system continuously monitors the railway track and surroundings, detecting hazards and obstacles. Upon detection, it generates visual alerts on designated screens and broadcasts voice alerts through audio devices, promptly notifying railway personnel and nearby individuals for immediate action
Post condition	Informed about the detected event through visual and voice alerts.
Business rules	<ol style="list-style-type: none"> <li>1. The system must generate visual and voice alerts promptly and accurately to prevent potential hazards and ensure railway safety.</li> <li>2. Voice alerts should be clear and concise, providing essential information about the detected event to facilitate immediate action.</li> <li>3. Visual alerts should be displayed prominently on designated screens or panels for easy visibility.</li> </ol>

Use case number	07
Use case name	Report accident or potential hazards
Actors	Locomotive pilots
Pre-condition	<ol style="list-style-type: none"> <li>1. Locomotive pilots are logged into the system and have the necessary permissions to report accidents.</li> <li>2. E4 Detailed accident reporting forms are available within the system.</li> </ol>
Scenario description	Locomotive pilots, logged into the system, access the accident reporting feature to report new accidents. They fill out detailed forms, including accident location and reason
Post condition	The system successfully records the detailed information about the reported accident, including its location, reasons, and etc.
Business rules	<ol style="list-style-type: none"> <li>1. The accident reporting forms should be user-friendly and intuitive to facilitate easy data entry for locomotive pilots.</li> <li>2. Locomotive pilots must provide accurate and detailed information about the reported accidents</li> </ol>

Use case number	08
Use case name	Approve and update
Actors	Admin
Pre-condition	<ol style="list-style-type: none"> <li>1. Locomotive pilots have the capability to input new accident locations, types, and descriptions into the system.</li> <li>2. The system must be capable of displaying the updated accident details input by the pilot for admin review and approval.</li> </ol>
Scenario description	<ol style="list-style-type: none"> <li>1. Locomotive pilots input new accident locations, types, and descriptions into the system, which are then queued for admin review.</li> <li>2. The admin logs in, meticulously reviews each report for accuracy and completeness, and approves them accordingly.</li> <li>3. Approved reports are then updated in the system, ensuring that all stakeholders have access to the latest information on reported accidents and potential hazards.</li> </ol>
Post condition	Following the input of accident details by the pilot, the admin reviews and approves the information within the system.
Business rules	<ol style="list-style-type: none"> <li>1. Admins need to check the reliability of the information.</li> <li>2. Check whether reported hazard and type is already existing or not.</li> </ol>

### 2.3.1 Alternatives scenarios

Alternative number	1.A.1
Alternative name	If the user selects the sign-up option.
Pre-condition	User selects the sign-up option.
Description	Continue with the sign-up use case step.
Post-condition	User directs to the home screen.

Alternative number	2.A.1
Alternative name	If the user selects the log in option.
Pre-condition	User selects the log in option.
Description	Continue with the log in use case step.
Post-condition	User directs to the home screen.

Alternative number	2.A.2
Alternative name	User selects other options.
Pre-condition	User selects the other option.
Description	Continue with the selected use case step.
Post-condition	User directs to the home screen.
Business rule	<ul style="list-style-type: none"><li>• User selects other available options.</li><li>• Locomotive Pilot (Next Location, Report an accident or potential hazard)</li><li>• Admin (View reported information)</li><li>• Except their relevant options others will be alternate options.</li></ul>

Alternative number	3.A.1
Alternative name	The locomotive pilot selects the cancel option without submit report form.
Pre-condition	Locomotive pilot entered all fields with values to add an accident or potential hazard.
Description	Locomotive pilot selects the cancel option, and their entered values will not be saved.
Post-condition	User will direct to the reporting screen after clicking the close option.

Alternative number	4.A.1
Alternative name	Admin selects the cancel option without approve the reported accident or hazard.
Pre-condition	Admin entered all fields with values to approve.
Description	Admin cancels option and their entered values will not be saved.
Post-condition	Admin directs to the home screen after clicking the close option.

### 2.3.2 Exceptional scenarios

Exceptional scenario number	E1
Exceptional scenario	Sign-Up Error Handling
Pre-condition	User attempts to sign up.
Description	During the sign-up process, the system encounters an unexpected error, such as server downtime or database failure.
Post-condition	User receives an error message indicating the issue and is prompted to try again later or contact support for assistance.

Exceptional scenario number	E2
Exceptional scenario	Log-In Credentials Invalid
Pre-condition	User attempts to log in.
Description	The user provides incorrect credentials (e.g., username or password).
Post-condition	User receives a notification indicating that the credentials are invalid and is prompted to retry with the correct information or reset their password if needed.

Exceptional scenario number	E3
Exceptional scenario	Missing Information in Reporting Form
Pre-condition	Locomotive pilot attempts to submit a report on an accident or hazard.
Description	The locomotive pilot fills out the report form but leaves essential fields blank or provides incomplete information.
Post-condition	The system prompts the locomotive pilot to review and complete all required fields before allowing submission of the report.

Exceptional scenario number	E4
Exceptional scenario	Admin Approval Error
Pre-condition	Admin attempts to approve a reported accident or hazard.
Description	The admin encounters an error while trying to approve the report, such as network connectivity issues or database corruption.
Post-condition	The admin receives an error message informing them of the issue and is advised to retry the approval process later or contact technical support for assistance.

Exceptional scenario number	E5
Exceptional scenario	Unexpected System Shutdown
Pre-condition	User is in the middle of a task (e.g., signing up, signing in, reporting an accident, approving a report).
Description	The system experiences an unexpected shutdown due to power failure, system crash, or other unforeseen circumstances.
Post-condition	Upon system reboot, users may need to log in again if their session was terminated, and any unsaved data from the interrupted task may be lost. The system should ideally have mechanisms in place to minimize data loss during such events, such as auto-saving drafts or transaction rollbacks.

## 2.4 Activity diagrams

### Sign up

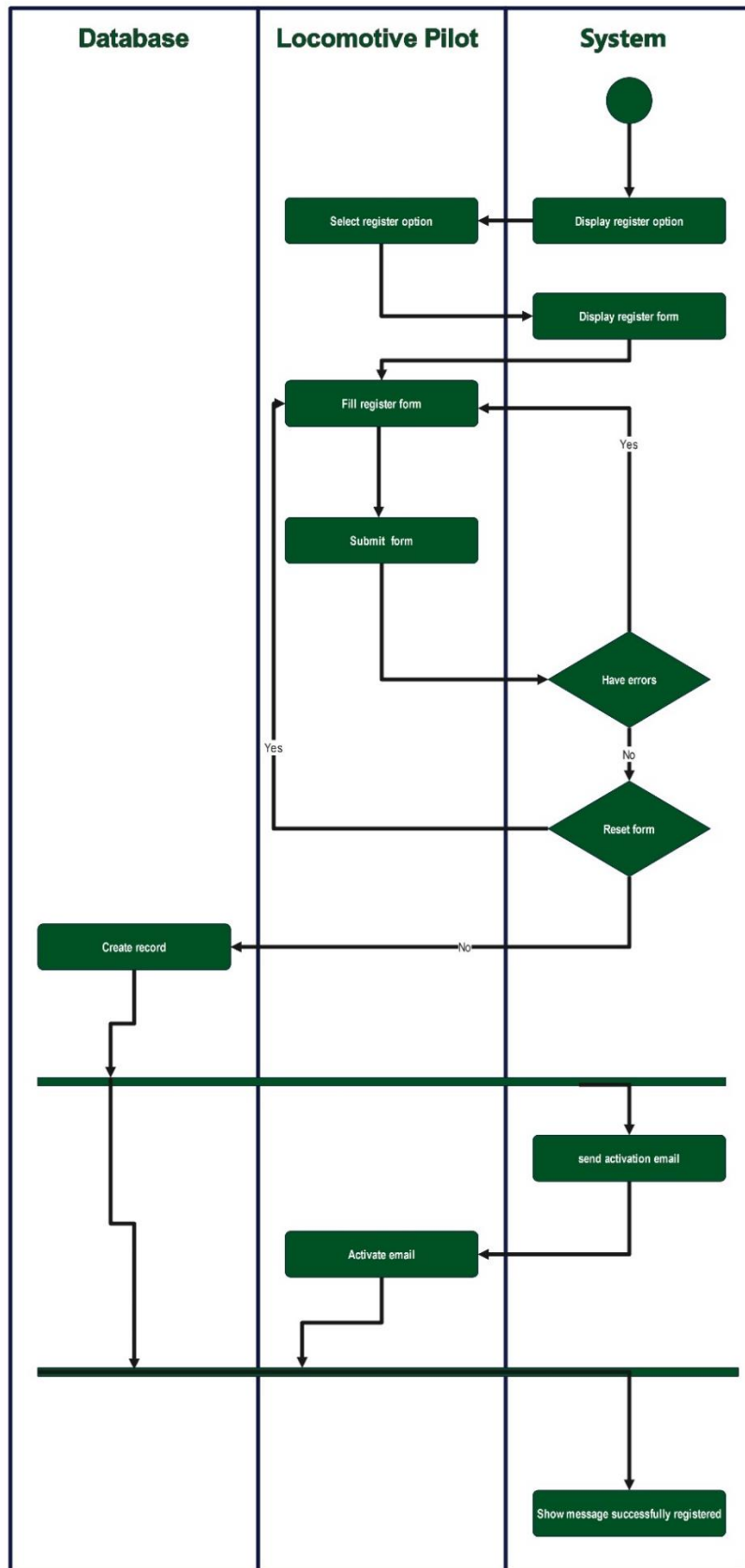


Figure.2. Activity diagram Sign up

# Log in

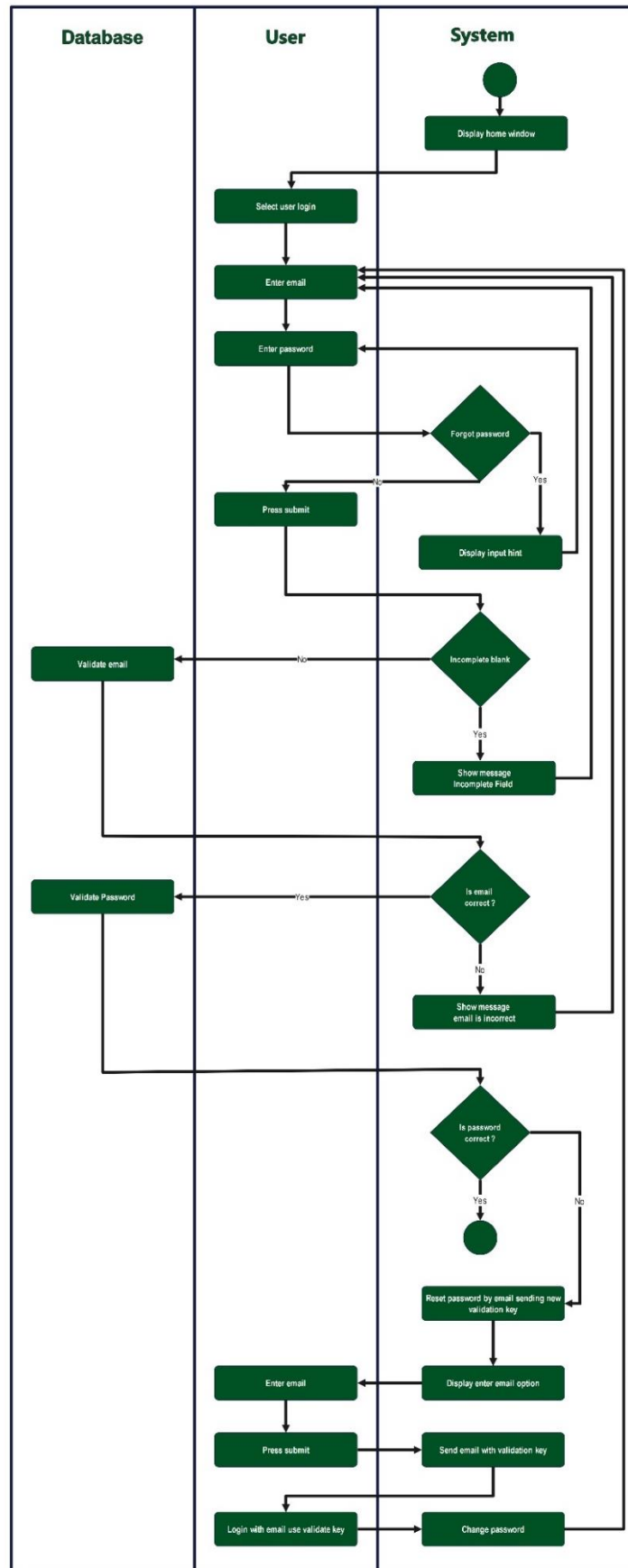


Figure.3. Activity diagram login



## Object detection

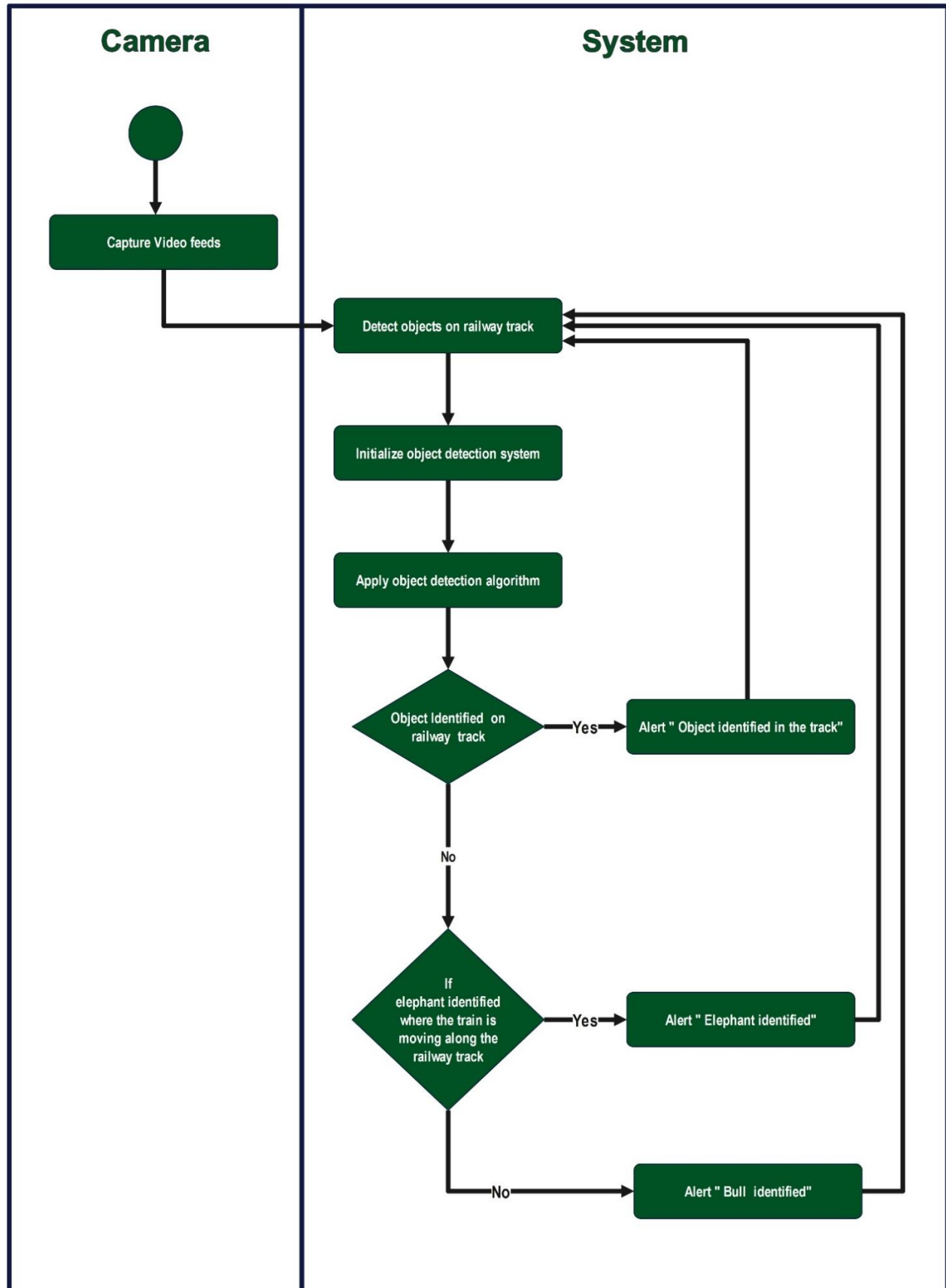


Figure.4. Activity diagram Object detection

## Weather related obstacles and potential hazards identification

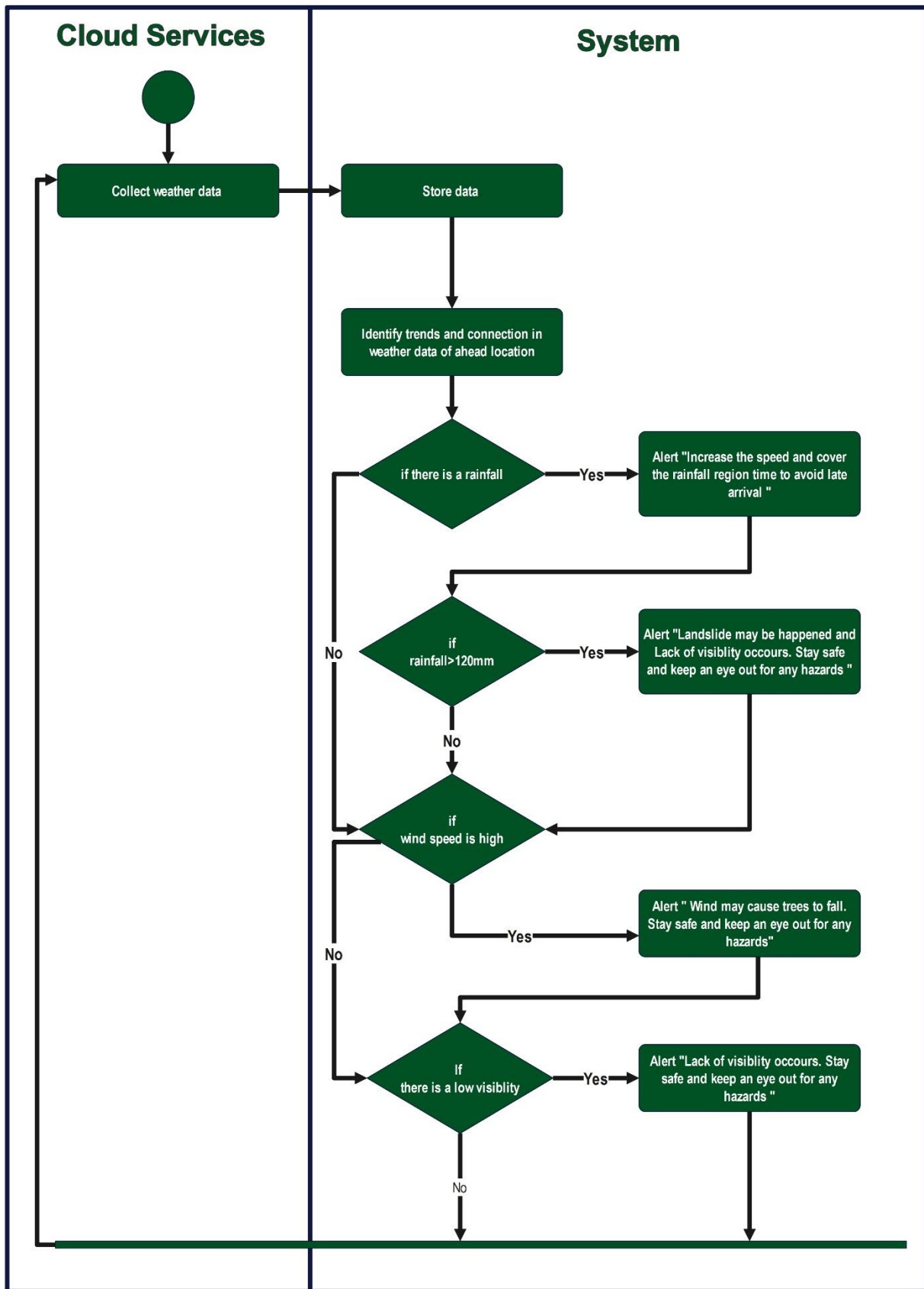


Figure.5. Activity diagram Weather related obstacles and potential hazards identification

## Report hazard

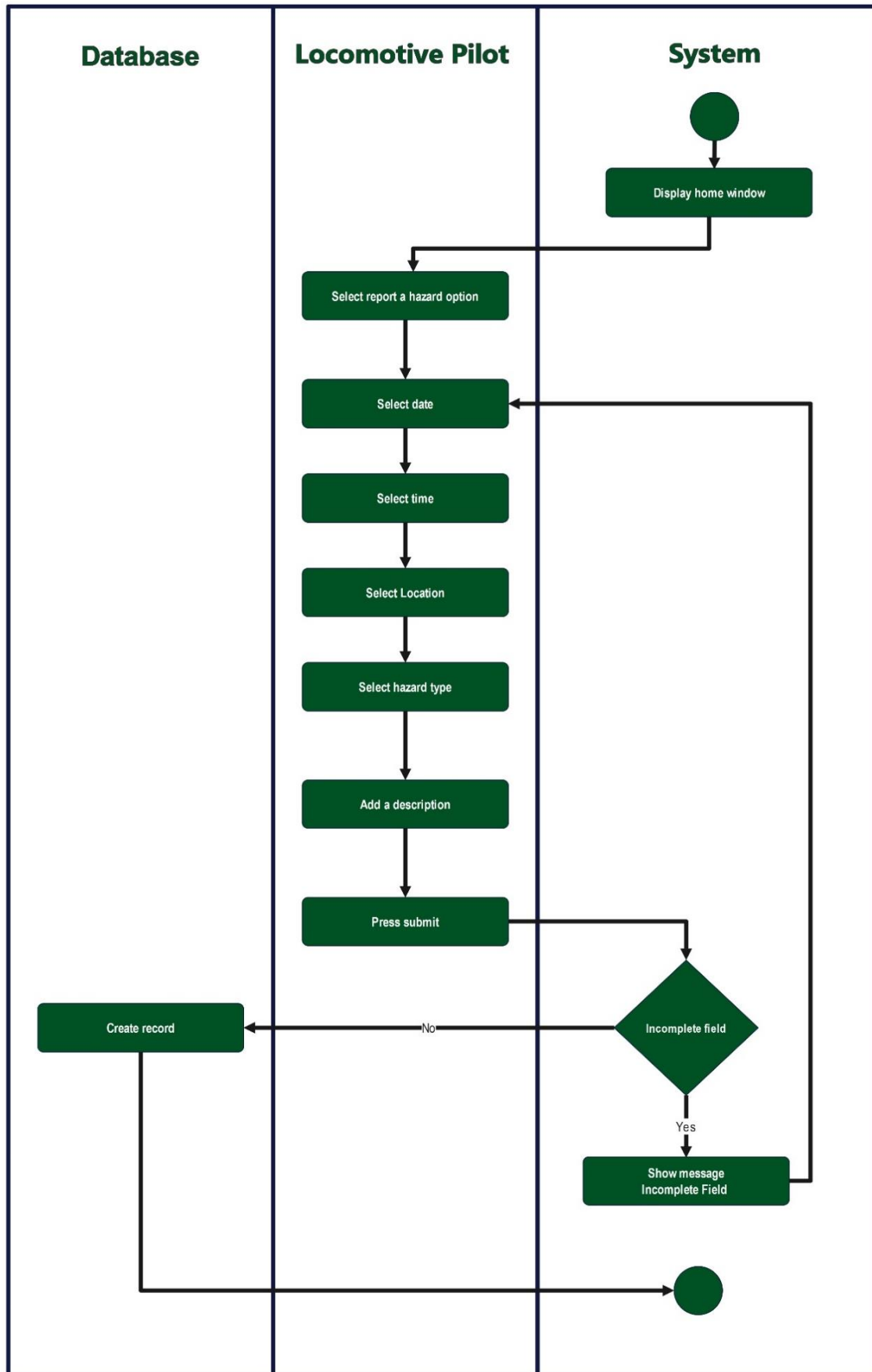


Figure.6. Activity diagram Report hazard

## Approve hazard

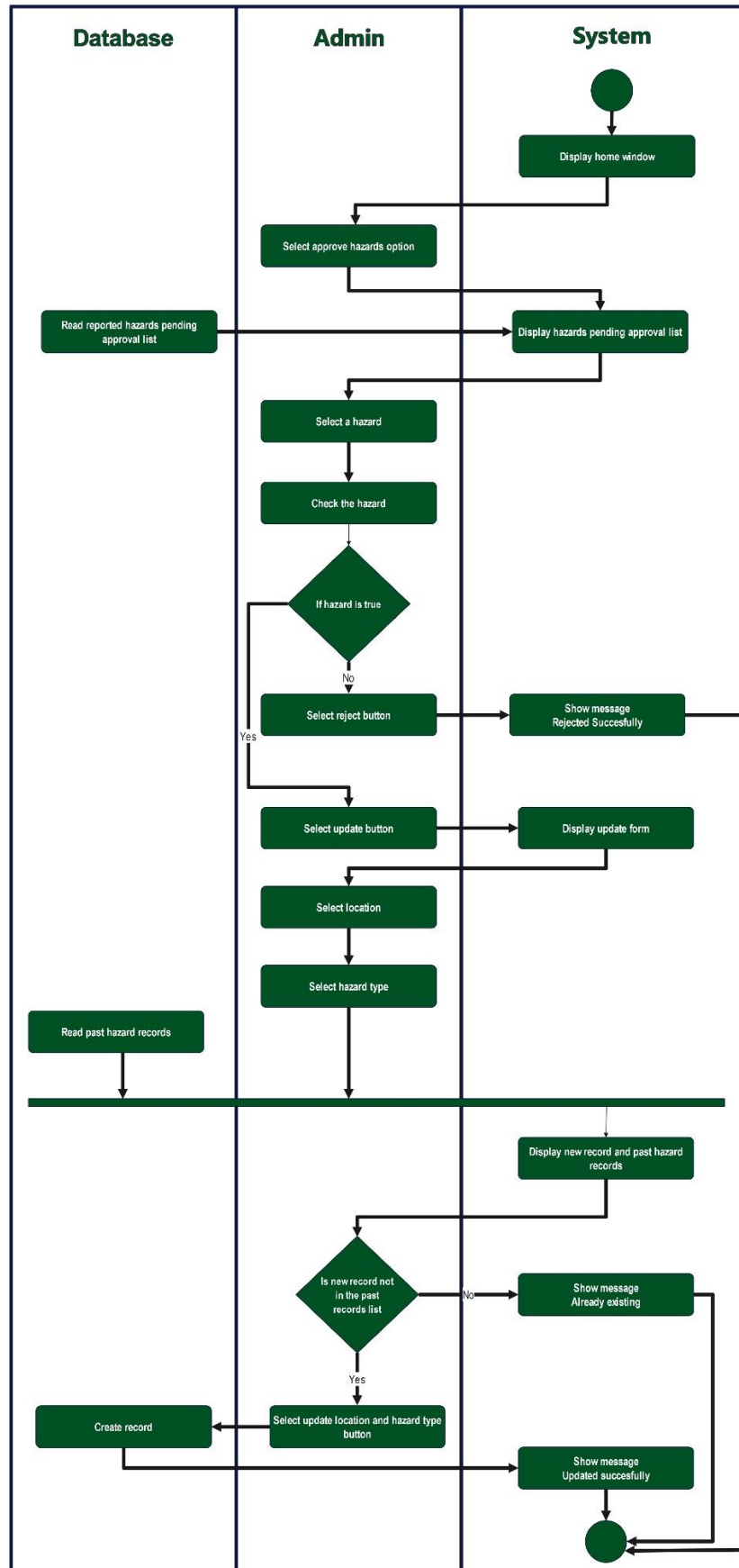


Figure.7. Activity diagram Approve hazard

### 3. Functional requirements

Priority Number	1
Function Name	Object Detection Model Functionality
Description	Utilizing advanced object detection algorithms to accurately identify elephants, bulls, humans, and large vehicles on the railway track, furthermore, identify elephants and bulls in surrounding area of the drivers view. ensuring reliable performance in diverse environmental conditions.
Input	Live footage captured by camera positioned in front of the train.
Process	<ul style="list-style-type: none"> <li>Processes video feed using advanced algorithms.</li> <li>Analyzes each frame to detect and classify objects.</li> <li>Prioritizes detection of safety risks.</li> <li>Real-time processing for immediate response</li> </ul>
Output	<ul style="list-style-type: none"> <li>Identifies and marks objects in video.</li> <li>Provides alerts to pilots.</li> </ul>
Business Rules / Other Considerations	<ul style="list-style-type: none"> <li>The accuracy of the system must be ensured to operate effectively in critical situations.</li> </ul>

Priority Number	2
Function Name	Location-Awareness and Weather Integration Functionality
Description	The Location-Awareness and Weather Integration utilizes cloud-based technologies and real-time data sources to provide locomotive pilots with current and ahead geographical position and weather conditions along the railway route, aiding drivers in making informed decisions.
Input	<ul style="list-style-type: none"> <li>Geographical position data from cloud services.</li> <li>Real-time weather data from meteorological cloud services</li> </ul>
Process	<ul style="list-style-type: none"> <li>Integration of cloud-based technologies for accessing and processing real-time location and weather data.</li> <li>Correlation of geographical location information with weather data along the railway route.</li> <li>Continuous updating and monitoring of changes in weather condition</li> </ul>
Output	<ul style="list-style-type: none"> <li>Locomotive pilots receive real-time updates on their ahead geographical location and current weather conditions.</li> <li>The application provides information on factors such as precipitation, visibility, wind speed and potential hazards.</li> <li>Timely alerts are generated to assist locomotive pilots in making informed decisions based on weather-related factors.</li> </ul>

Business Rules / Other Considerations	<ul style="list-style-type: none"> <li>reliability of weather data sources to ensure the validity of information provided to locomotive pilots.</li> </ul>
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Priority Number	3
Function Name	Live Data Processing
Description	The Real-time Data Processing System aims to process live camera streams and other real-time data promptly, providing instant feedback to locomotive pilots on detected objects, location, and weather conditions.
Input	<ul style="list-style-type: none"> <li>Live camera feeds from the camera installed in front of the locomotive engine.</li> <li>Real-time data streams including location updates and weather information.</li> </ul>
Process	<ul style="list-style-type: none"> <li>The system processes live camera feeds and real-time data streams with optimized algorithms.</li> <li>It analyzes arriving data to detect objects, determine geographical position, and assess weather conditions.</li> </ul>
Output	<ul style="list-style-type: none"> <li>Instantaneous alert to locomotive pilots on detected objects, location, and current weather.</li> <li>The system generates real-time alerts to aid pilots in timely decision-making based on analyzed data.</li> </ul>
Business Rules / Other Considerations	<ul style="list-style-type: none"> <li>Data privacy and security measures to protect sensitive information processed by the system.</li> </ul>

Priority Number	4
Function Name	Login
Description	The system will allow users to log in with a username and password.
Input	Username and Password as a text
Process	When the user inputs their username and password, the system should check whether the username and password are in the database. If both the username and password are correct, the system lets the user log in to the system
Output	Display home screen
Business Rules / Other Considerations	If the username is incorrect, the system should indicate that the username is incorrect and prevent the user from logging in. Similarly, if the password is incorrect, the system should indicate that the password is incorrect and prevent the user from logging in.

Priority Number	5
Function Name	Alert Generation Functionality
Description	This functionality rapidly notifies locomotive drivers of objects on the track, within their view, and potential weather hazards. It analyzes live video feeds, identifying and categorizing objects for timely alerts, including upcoming weather conditions.
Input	Live video feeds from camera, and weather data sources.
Process	<ul style="list-style-type: none"> <li>Analyzing the live video feed to identify and classify objects on the track.</li> <li>Analysis interpretation of weather data to assess potential hazards.</li> <li>Initiating the alert generation process based on predefined thresholds or rules.</li> </ul>
Output	<ul style="list-style-type: none"> <li>Timely alerts provided to locomotive drivers regarding detected objects and weather conditions</li> </ul>
Business Rules / Other Considerations	<ol style="list-style-type: none"> <li>Ensure that alerts are clear, concise, and easily understandable to facilitate quick responses from drivers.</li> <li>Implement mechanisms to prioritize alerts based on the severity of detected objects and weather conditions.</li> </ol>

Priority Number	6
Function Name	Input locomotive pilot and route information Functionality
Description	This functionality allows locomotive pilots to input pilot and route information into the system.
Input	Information entered by locomotive pilots, including pilot details (email, name, ID) and route information
Process	The system processes the inputted information, verifying its reliability and completeness.
Output	Display of route details, including weather conditions, location, and other pertinent information, to assist pilots during their journey.
Business Rules / Other Considerations	<p>Ensure data accuracy and integrity by validating input information.</p> <p>Implement user authentication mechanisms to ensure only authorized personnel can input data.</p>

Priority Number	7
Function Name	Accident Reporting
Description	This function enables locomotive pilots to provide detailed information regarding new accident locations and related information directly to the system.
Input	Information entered by the locomotive pilot includes the accident location, type, and a brief description.
Process	The system validates and processes the input of new accident information, ensuring its reliability and completeness by admin. And admin updates the system with the reported accident details.
Output	The system records and stores the provided details regarding new accident locations and related information directly to the system.
Business Rules / Other Considerations	Implement validation checks to verify the authenticity and relevance of the reported accident details.

Priority Number	8
Function Name	Approval Functionality
Description	This functionality allows locomotive pilots to input new accident locations, types, and descriptions into the system. The admin is responsible for reviewing reported accidents and potential hazards and approving them for inclusion in the system.
Input	Locomotive pilots provided the new accident location, type, and description.
Process	The system facilitates the submission of accident details by locomotive pilots. The admin reviews and approves reported accidents and potential hazards before updating them in the system.
Output	Approved accident reports and potential hazards are updated and integrated into the system for further action and analysis.
Business Rules / Other Considerations	Updates and maintenance are necessary to keep the accident records current and relevant to operational safety measures.



## 4. Non-functional requirements

### 4.1 Product Requirements

Name of the requirement	Performance
Purpose	<ul style="list-style-type: none"><li>• The device and application should be optimized to ensure fast and accurate system.</li><li>• The device and application should respond quickly and accurately to inputs.</li><li>• The application should be able to manage data and function smoothly without significant latency.</li><li>• To get the best performance from the system, we use various optimization techniques.</li></ul>
Measurement	<ul style="list-style-type: none"><li>• The application should be able to manage data and function at an error rate of less than 5%.</li><li>• The system should be able to process images and data rapidly, with minimal latency, to provide real-time or near-real-time results.</li><li>• The device and application should respond within seconds to inputs</li></ul>

Name of the requirement	Usability
Purpose	It is easy to use and understand for its intended users, allowing them to accomplish their tasks efficiently and effectively.
Measurement	<ul style="list-style-type: none"><li>• The system should have an intuitive user interface, providing clear feedback and guidance to users interacting with the computer vision and machine learning functionalities.</li><li>• In the web application, we use simple interface without frustrating the user.</li></ul>

Name of the requirement	Availability
Purpose	This requirement emphasizes ensuring that the device and application are consistently accessible and operational, ready to respond to user interactions without interruption. It aims to minimize downtime and ensure that users can access the system whenever needed, thereby enhancing user experience and satisfaction.
Measurement	<ul style="list-style-type: none"><li>• The effectiveness of this requirement can be measured by evaluating the system's uptime and responsiveness. Specifically, it should be verified that the application is available and responsive to user inputs within seconds.</li><li>• The system should process images and data rapidly, providing real-time or near-real-time results with minimal latency, thus demonstrating its availability and responsiveness.</li></ul>

## 4.2 Organizational Requirements

Name of the requirement	Maintainability
Purpose	The ease with which the system can be modified, updated, and repaired over its lifecycle. This includes aspects such as code readability, modularity, and documentation.
Measurement	<ul style="list-style-type: none"><li>Monitoring methods can include logging, performance testing, and bug tracking, which can help identify issues and areas for improvement.</li><li>The system should be designed and implemented in a way that facilitates easy maintenance, updates, and enhancements over time, without significant disruptions to functionality.</li></ul>

Name of the requirement	Implementation
Purpose	<ul style="list-style-type: none"><li>The purpose of this requirement is to ensure that the device and application are optimized for fast and accurate performance.</li><li>It emphasizes the importance of responsiveness to user inputs and smooth handling of data and functions without significant latency.</li><li>Various optimization techniques will be employed to achieve the best system performance.</li></ul>
Measurement	<ul style="list-style-type: none"><li>The application should manage data and function with an error rate of less than 5%.</li><li>The system should process images and data rapidly, with minimal latency, to provide real-time or near-real-time results.</li><li>The device and application should respond to inputs within seconds, ensuring prompt interaction with users.</li></ul>

## 4.3 External requirements

Name of the requirement	Ethical Requirement
Purpose	The web application was developed considering the ethical aspects.
Measurement	<ul style="list-style-type: none"><li>Using confidential information of the organization</li></ul>

Name of the requirement	Privacy
Purpose	<ul style="list-style-type: none"> <li>• This requirement specifies that sensitive information stored in the database can only be accessed and modified by authorized personnel, particularly the admin.</li> <li>• By limiting access and modification privileges to designated users, it ensures that sensitive data remains protected from unauthorized access or tampering, thereby enhancing data privacy and security.</li> </ul>
Measurement	<ul style="list-style-type: none"> <li>• The effectiveness of this requirement can be measured by verifying that access to sensitive information is restricted to the admin role within the application.</li> <li>• Only the admin has the capability to make changes in the database.</li> </ul>

## 5. ER diagram

### Description

We have developed a railway safety system that uses computer vision and Cloud based technologies.

Our system contains two distinct user roles: **ADMINISTRATIVE OFFICER** and **LOCOMOTIVE PILOT**. Administrative officers are responsible for feeding details about previously unidentified hazards, is assigned a unique **A\_ID** for identification. Additionally, his **Name**, **Email**, **Password** of the e-mail will be collected by the system. Similarly, each locomotive pilot will be identified by their **LP\_ID**. Along with that, their **Name**, **Phone\_no**, **Email** and **Password** will be noted by the system. Also, they can report the hazards. And Administrative officers can approve them if they are unidentified.

**HAZARDs** are identified using their **H\_ID**. And capture the details such as **Type of hazard**, the **Location** where hazard took place, **Time** it occurred, and a **Description** about the hazard will be recorded for future reference.

**WEATHER** conditions are distinctively identified by the **W\_ID**. Apart from that, weather includes **Temperature**, **WindSpeed(km/h)**, **Precipitation (mm)**, **Visibility** (clearness of the screen), and **Weather\_location (Current\_Location and Next\_location)**. These Weather details can predict the hazards earlier.

Train's **LOCATION** is the train's route from where it starts and ends the journey. The location is tracked using **L\_ID** and **Location\_name**. Under the **Location\_type**, one of the following locations will be updated: elephant location, bull location, or potential hazard location. Also, location details will be updated to administrative officers.

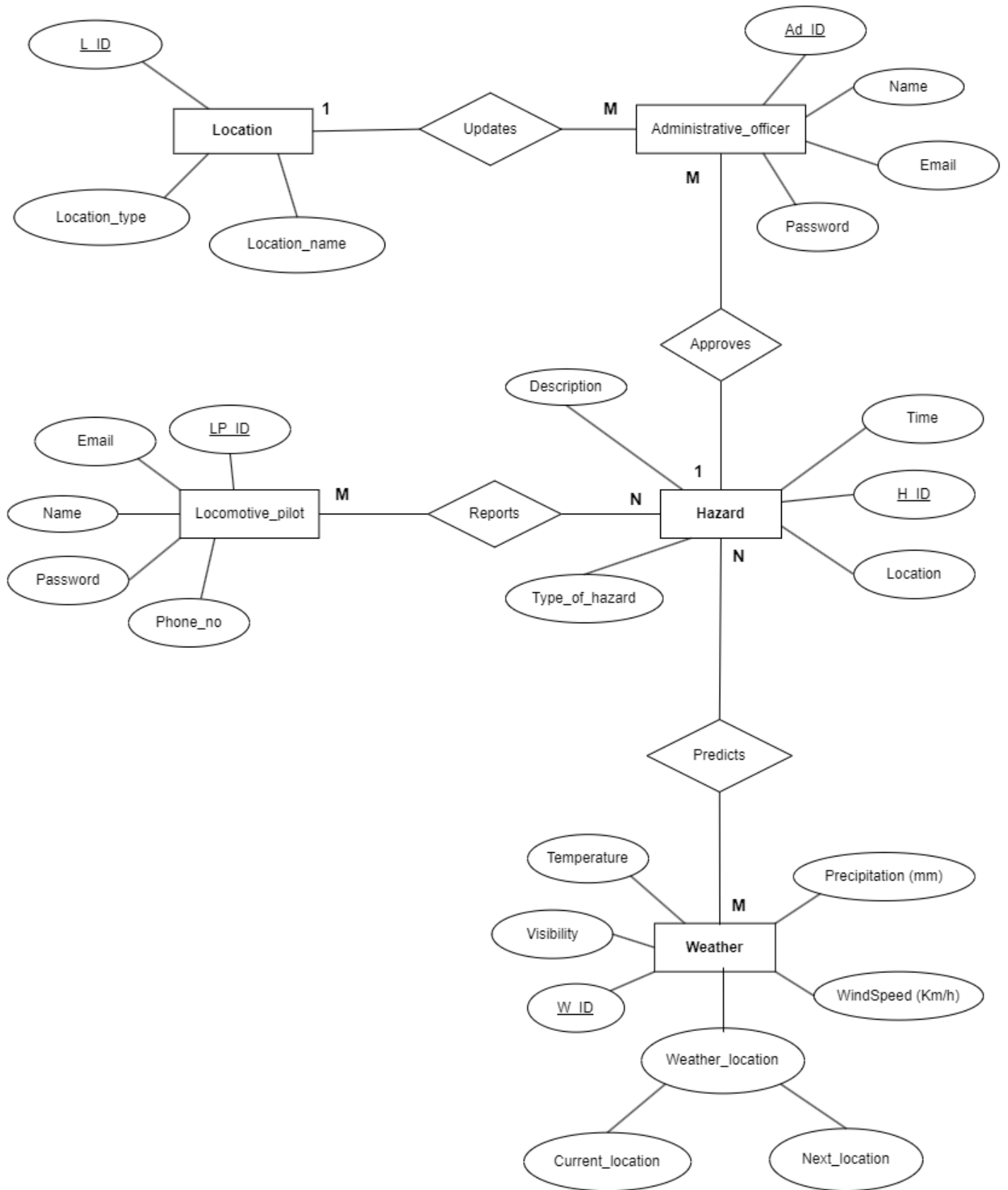







Figure.8. ER diagram

## Signature of Team Members

Name	Registration Number	Index Number	Signature
M.K.M Halis	ASP/19/20/022	4856	
G.E. Vinonsan	ASP/19/20/131	4793	
M.M Mohamed	ASP/19/20/042	4858	
Mathurika. J	ASP/19/20/097	4838	
M.S.F Sumaiya	ICT/19/20/112	5048	

**Date:** 2024/03/20

**Recommendation of the supervisor(s)**

**Name:**

**Department / Organization:**

**Signature:**