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A Project Report on

ROAD ACCIDENT PREDICTION MODEL USING MACHINE LEARNING

Submitted in partial fulfillment of the requirements for the Degree of

Bachelor of Engineering in Computer Engineering

BY

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2022-2023

VPKBIET, Baramati

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Certificate

This is to certify that the project entitled

ROAD ACCIDENT PREDICTION MODEL USING MACHINE LEARNING

submitted by

Ms.Khandomalke Shraddha Balraj **Ms.Masal Prajakta Pandurand**

Ms.Mukadam Mahadevi Dhondiram **Ms.Mulani Samina Rajubhai**

is a record of bona-fide work carried out by them/him/her, in the partial fulfillment of the requirement for the award of Degree of **Bachelor of Engineering** in Computer Engineering at Vidya Pratishthan's Kamalnayan Bajaj Institute Of Engineering and Technology, Baramati under the Savitribai Phule Pune University, Pune. This work is done during year 2022-23, under our guidance.

Prof.N.P.Shah	Dr. C. S. Kulkarni	Dr. R. S. Bichkar
Project Guide	Head of Dept.	Principal

Examiner 1: - - - - - - -

Examiner 2: - - - - - - -

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Ms.Khandomalke Shraddha Balraj

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Abstract

Today, road accident prediction is one of the Government's top priorities. Given the importance of the problem of identifying the causes of road accidents, the main goal is to reduce the causes of injury from traffic accidents. In their paper, they applied machine learning and data mining concepts to identify various factors that influence road accidents and their severity.

The application takes various inputs such as weather conditions, road conditions, time of day and age, and uses machine learning algorithms to calculate the severity of possible accidents. This data can be used to analyze future inputs.Improves the accuracy of system output. Develop an accident prediction model using the data mining approach using a priori algorithms and support vector machines.This model could be further improved to send reports of accidents to relevant authorities such as hospitals, ambulances, insurance agents, etc., and would thus be of great help in reducing his accident mortality rate in the country.

It proves useful Using the latest technology to design and control traffic is becoming more and more important. Data mining research requires the discovery of information from systematic and purposeful data structures derived from random and meaningless data. Machine Learning, a sub-branch of Artificial Intelligence, uses the Data Ware house to deliver computer learning. For , the receptive capacity of learning computer systems increases, and machine learning is a popular and useful method for making empirical decisions.

Contents

List of Figures

Keywords

List of keywords-Accident Prediction,RF(Random Forest) Model,Decision Tree,SVM(Supprt Vector Machine),KNN(K-Nearest Neighbour).

Notation and Abbreviations

ABBREVIATION	ILLUSTRATION
RF	Random Forest
KNN	K-Nearest Neighbour
SVM	Support Vector Machine

Chapter 1

Introduction

1.1 Introduction

Road accident prediction is one of the most important research areas in road safety. The occurrence of traffic accidents is primarily influenced by road geometry, traffic flow, driver characteristics, and road environment. Many studies have been conducted to predict accident rates and analyze the characteristics of traffic accidents, such as dangerous spot/hot spot identification studies,crash injury severity analysis, and crash time analysis.Several studies have focused on accident mechanisms. Other factors include weather and street lighting.Traffic accident prediction plays an important role in integrated traffic planning and control. As such, the randomness of traffic accidents includes non-linear factors such as people, vehicles, roads, and climate.

It's amazing that death statistics released by the World Health Organization show that there are 4,444 road accidents worldwide every year. Road accidents kill 1,204,444 people and injure 50 million people each year. About 3,300 people died and 4,444,137,000 were injured every day. With direct economic losses of 43 billion and a staggering 4,444 road accidents, life and property safety are immediately threatened. There is no concrete method for the traffic police to predict which areas are prone to accidents.

1.2 Motivation

The motive is to get better and more accurate performance measures for the algorithm by improving and enhancing the performance of the given model features. Number of accidents in India is True. India accounts for roughly six percent of the global accident. Negligence of people towards the speed of the vehicle. Growing population Estimation of various factors related to accident prediction.

1.3 Problem Definition and Objectives

With the number of vehicles increasing exponentially, road safety is a very important issue. Road accidents kill 1.2 million people each year. 4,444 road accidents cost him US 518 billion worldwide and cost him 1-2 percentage of each country's economy.In 2017 he had 2367 reported injuries in Hyderabad alone.Actions have been taken to address this issue, but to no avail.

Machine Learning algorithms can process large number of classification parameters and are able to obtain useful patterns. It can process huge amounts of data efficiently and can be scalable. In computer science and related fields, artificial neural networks are computational models that simulate the central nervous system of the animal (especially the brain), allowing the machine to learn and identify information like the human brain.

1.4 Project Scope

The rule inside uncovers some hidden facts about the accident's influencing factors.Early detection of accident areas helps to avoid accidents.It will improve safety on city streets. Government and many organizations are helpful in this analysis.So becomes an essential requirement to control and arrange an advanced system to decrease the number of accidents in our country.By taking simple precautions on the prediction of a sophisticated system may prevent accidents.

Chapter 2

Literature Survey

Analysis of road accident severity pridiction based on Decision Level of Machine Learning and Deep Learning [1]

Here, in this paper Mubariz Manzoor, Muhammad Umer[1] predicts the road accident frequency level by using machine learning and deep learning model which includes RFCNN.Various features are identified by Random Forest and most of the features that severity of accident such as distance, temperature, humidity and wind direction.Some features identified by Random Forest are also used as input to the model and promote accuracy. The classification results of RFCNN are higher than those of RF, AC, ETC,GBM and the voting classifier (LR + SGD). RF achieved an accuracy of 0.744, a precision of 0.784 and a recognition of 0.790.

Road Accident prediction model using data mining techniques[2]

Dhanya Vishwanath, Preethi K. In their studies successfully developed an application that helps in predicting traffic accidents based on some factors such as vehicle types, age of driver, weather conditions, road condition and so on.SVM and Apriori techniques are used to predict accident.SVM (Support Vector Machine) is used to predict the probable accident risk and Apriori is used to perform rule mining i.e. generate a set of frequent elements based on a given data set. The model is divided into four modules: Rule Mining, Risk Prediction, Graph Plot, and New Data Input.

Location based accident prediction using machine learning[3]

P.Shivkumar, S.Vijay they fount that different conditions affect to road accidents so after all the research work it is found that the conditions like vehicle type driver age, weather conditions so affect to road accident cases.So, they created an application that accurately predict road accidents depending on that factors.The dataset is obtained from kaggle Banglore road accidents dataset.The support vector machine algorithm has been used in the system and the model accuracy is 88.6 percent. The goal of such a model is to be able to predict what conditions will lead to an accident and to take preventive measures. EDA is an approach used to analyze data using visualization techniques and make predictions using static summaries and graphical representations.

Analysis of road accident in india using data mining classification algorithm[4]

DR The algorithm that has the lowest mean absolute error and higher accuracy is selected as the best algorithm. They used the KNN algorithm for both the classification and the regression problem. It is a simple algorithm that stores all available cases and classifies new cases by evaluating the Kneighbours.Considering the different parameters for accuracy and error rate, it is found that the KNN classification algorithm is the best algorithm with a maximum accuracy of 93.7, compared to other classification algorithms.

Comarision of machine learning algorithm for preditcting traffic accident severity[5]

Keneth Morgan Kwayuand Maha Reda Alkasisbeh studied the efficiency of four machine learning algorithms, including Random Forest, Logistic Regression, Naive Bayes, and Adaboost. This research study shows that the algorithms can predict accidents with 75.50 percent accuracy, which helps provide useful information for highway engineers and traffic planners to design safer roads.

Traffic accident prediction based on CNN model[6]

In their studies, Amani Thaduri, Vijaykumar Polepally,and Swathy Vodithala developed a version of the accident prediction model that relies entirely on Convolutional NeuralNetworks to predict traffic accidents on highways. The experimental results show that the proposed CNN prediction method has fewer losses and higher prediction accuracy than the conventional machine learning algorithm.

Chapter 3

Proposed Work

3.1 Problem Definition

With the number of vehicles increasing exponentially, road safety is a very important issue.Road accidents kill 1.2 million people each year. 4,444 road accidents cost him US 518 billion worldwide and cost him 1-2 percentage of each country's economy.In 2017 he had 2367 reported injuries in Hyderabad alone.Actions have been taken to address this issue, but to no avail.

3.2 Project Scope

The rule inside uncovers some hidden facts about the accident's influencing factors.Early detection of accident areas helps to avoid accidents.It will improve safety on city streets.Government and many organizations are helpful in this analysis.So becomes an essential requirement to control and arrange an advanced system to decrease the number of accidents in our country.By taking simple precautions on the prediction of a sophisticated system may prevent accidents.

3.3 Project Objectives

To study the causes of accidents and suggest corrective measures at potential location.

Machine Learning algorithms can process large number of classification parameters and

are able to obtain useful patterns. It can process huge amounts of data efficiently and can be scalable. In computer science and related fields, artificial neural networks are computational models that simulate the central nervous system of the animal (especially the brain), allowing the machine to learn and identify information like the human brain.

3.4 Project Constraints

There is severity of the most seriously injured casualty involved either slight serious or fatal.There are several problems of the accident occurred in the localities and it provide information to the people regarding the factor causing the accident will act as guideline to the traveller.Road accident victim pay for the accident with a life.This estimation will be helpful for collecting data and it shows the risk in a particular area is high or low.There is higher risk of having sever crash when the crash occur off the roadways.However in urban areas both the single and multi vehicle crashes are significant.

Chapter 4

Software Requirements Specification

4.1 Assumptions and Dependencies

The traffic speeds were assumed to be equal to the speed limit and road most of the road consisted of segment of different road type. Resources dependencies it deals with availability of resource. The dependencies of this project is on features like weather condition,age of driver,driving experience,type of junction,light condition,cause of accident.

4.2 Functional Requirements

- Divided the dataset into a training dataset and a testing dataset.
- Find the relation between the Data points.
- Using a classification model system divides the data into one similar cl ass or cluster.
- Using a decision model system takes the decision to which class a particular entity belongs.
- System must perform data pre-processing to remove redundant and unwanted data.
- Take user id and password and allow users to login
- Logged in users can input the necessary conditions in the appropriate fields to calculate accident severity

4.3 Nonfunctional Requirements

- Privacy: Privacy should maintain throughout the system.
- User Friendliness: GUI should be user-friendly.
- Responsive: The system should give response to the request quickly and Accordingly.
- Performance Requirements: Every user should be provided clear instructions on how to utilize the system. The absence of any of the specified prerequisites is another issue that impacts performance.
- Safety Requirements: To insure the system's safety, internal workers must be taught.He will need to be taught how to deal with extreme occurrences of mistake.

4.4 System Requirements

4.4.1 Software Requirements :

Anaconda:

Anaconda is a free and open-source distribution of the Python and R programming languages for scientific computing like data science, machine learning applications, large scale data processing, predictive analytics, etc. that aims to simplify package management and deployment. Anaconda Navigator is a desktop graphical user interface (GUI) included in Anaconda distribution that allows users to launch applications and manage anaconda packages, environments and channels without using command-line commands.

Jupyter Notebook

The JupyterNotebook is an open-source web application that allows you to create and share documents that contain live code, equations, visualizations and narrative text. Uses include: data cleaning and transformation, numerical simulation, statistical modelling, data visualization, machine learning, and much more.

LDraw

Edraw has the UML diagram tools to make it easy to create professional-looking UML

diagrams. A variety of UML diagram templates and UML diagram examples will help to quickly create most common UML diagrams. Easy to draw UML model diagram, UML use case diagrams, UML sequence diagrams, UML activity diagrams, UML collaborate diagrams, UML statechart diagrams, UML component diagrams, UML static structure diagrams, UML package diagrams and UML deployment diagrams.

4.4.2 Hardware Requirements

- Processor : Any Processor above 500 MHz
- RAM :22 MB
- Hard Disk : 10 GB
- Input device :Standard Keyboard and Mouse
- Output device :High Resolution Monitor

4.5 Analysis Models:

Incremental Model to be applied

Incremental Model is a process of software development where requirements divided into multiple standalone modules of the software development cycle. In proposed system model, each module goes through the requirements, design, implementation and testing phases. Every subsequent release of the module adds function to the previous release. The process continues until the complete system achieved. In the first phase of the incremental model, the product analysis expertise identifies the requirements. And the system functional requirements are understood by the requirement analysis team.

To develop the software under the incremental model, this phase performs a crucial role.Next phase of the Incremental model of SDLC, the design of the system functionality and the development method are finished with success. When software develops new practicality, the incremental model uses style and development phase.In the incremental model, the testing phase checks the performance of each existing function as well as

additional functionality. In the testing phase, the various methods are used to test the behavior of each task.

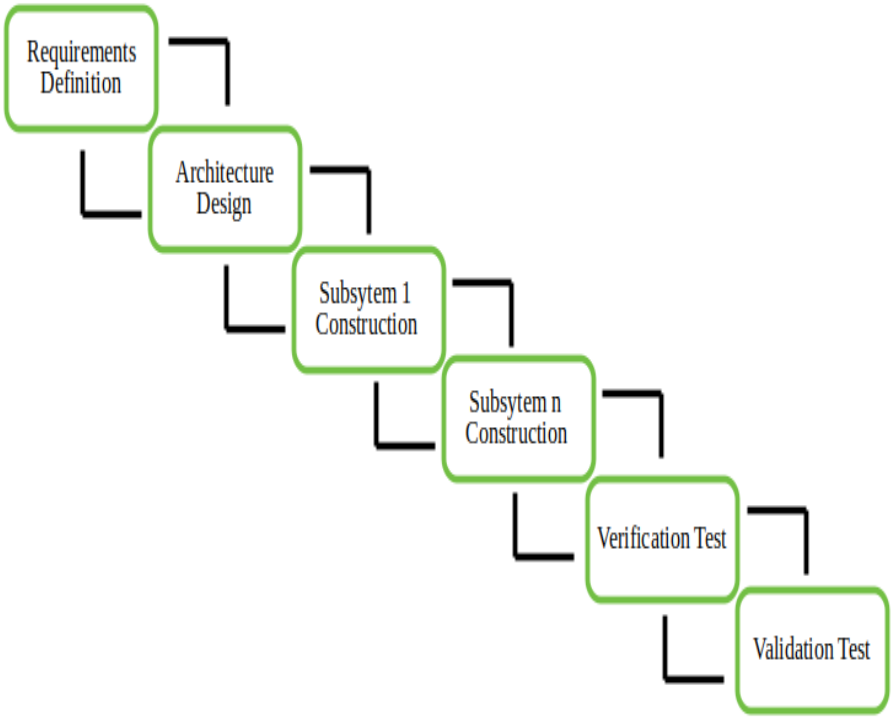


Figure 4.1: Incremental Model

Chapter 5

System Design

5.1 System Architecture

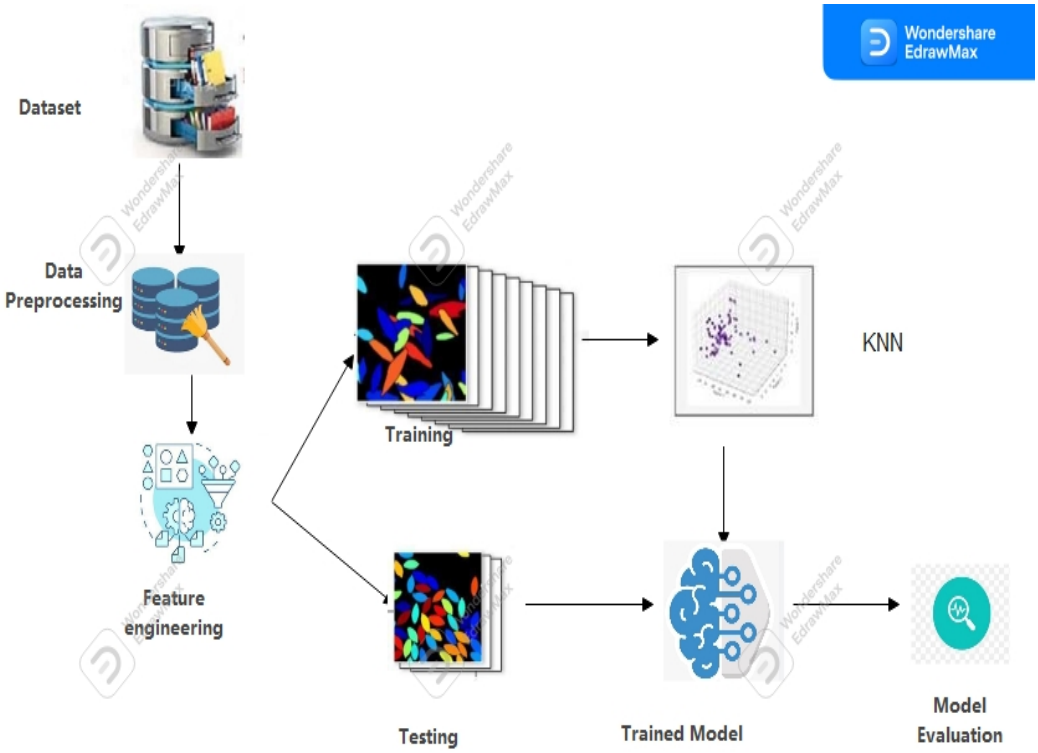


Figure 5.1: System Architecture

5.2 Data Flow Diagrams

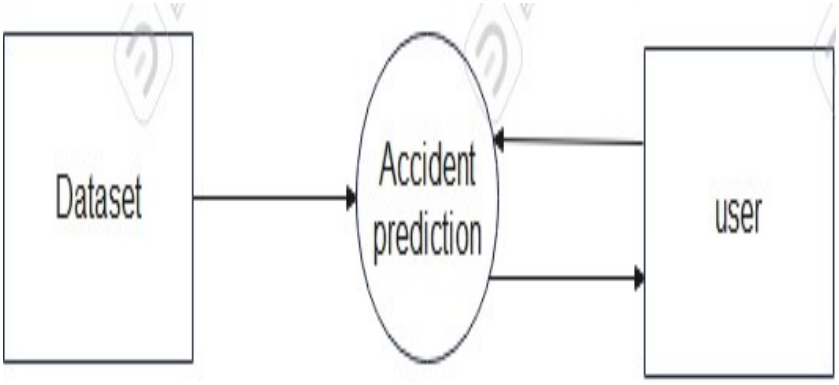


Figure 5.2: DFD Level 0

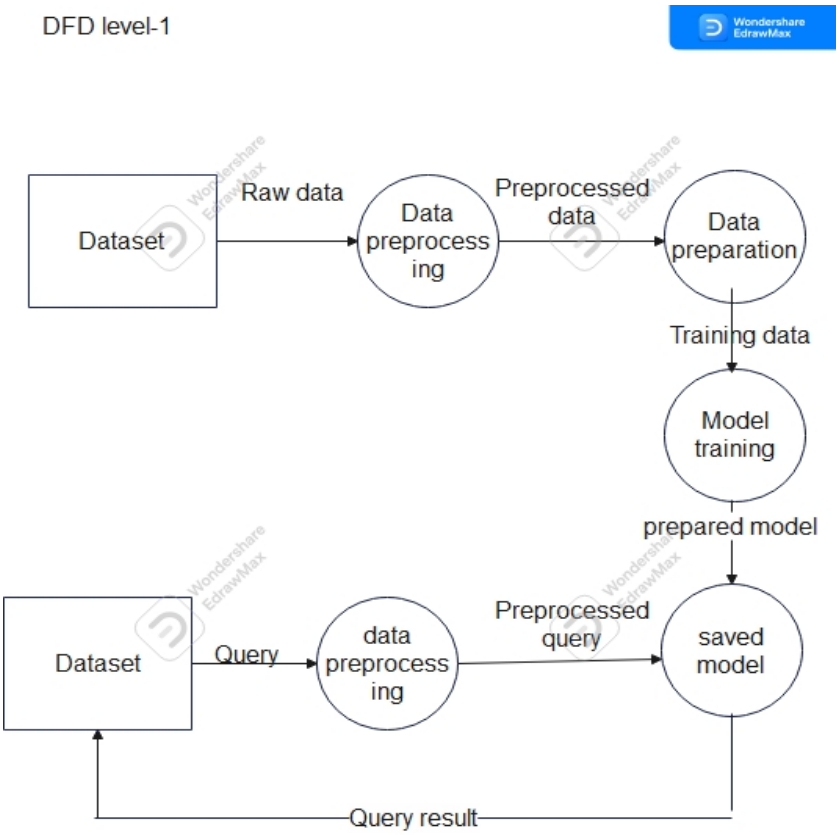


Figure 5.3: DFD Level 1

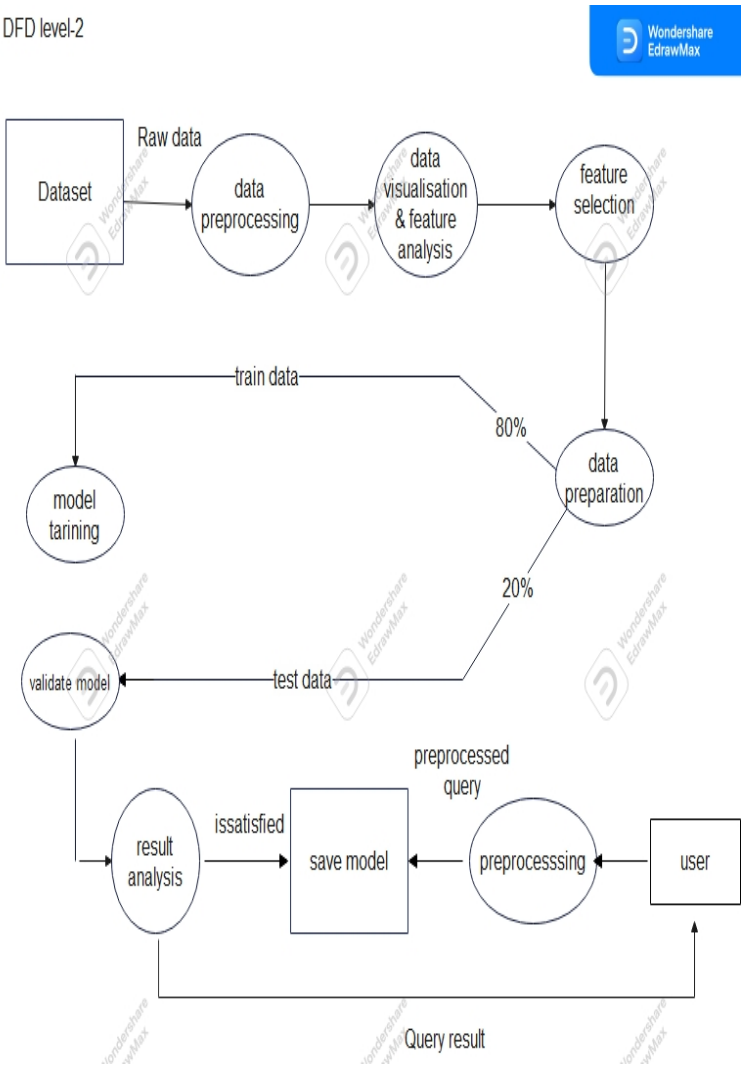


Figure 5.4: DFD Level 2

5.3 Use case Diagram

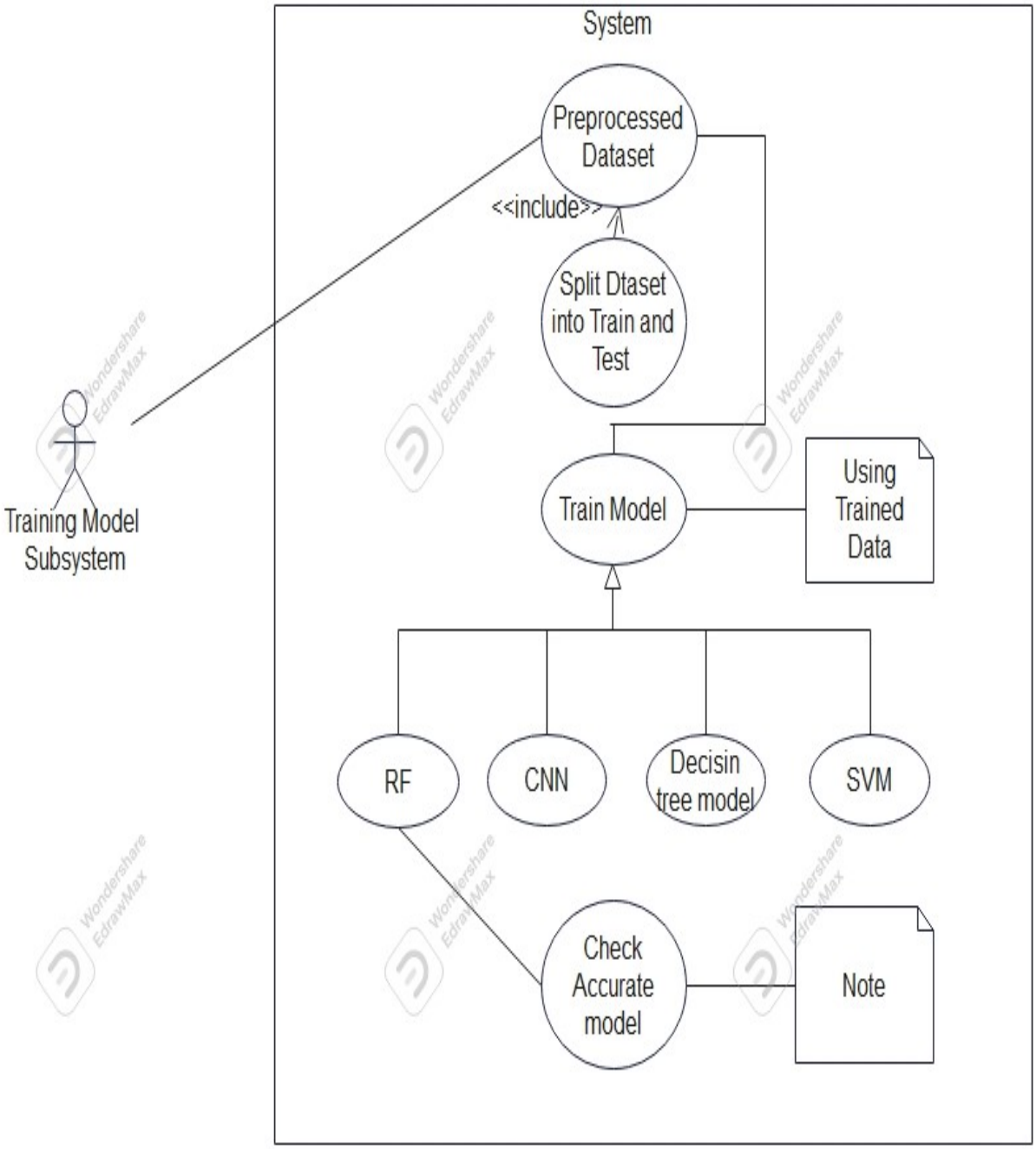


Figure 5.5: Use Case Diagram 1

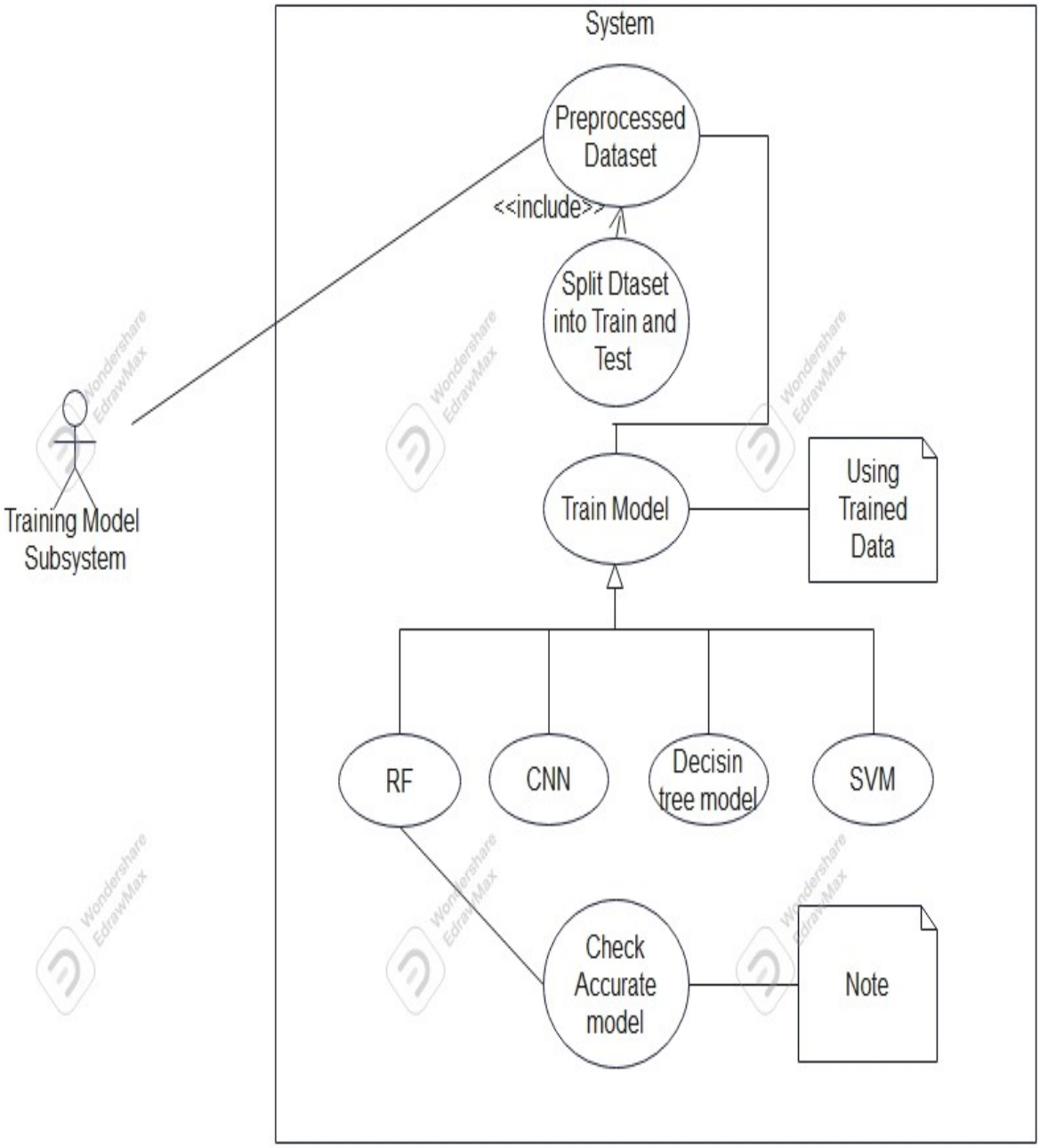


Figure 5.6: Use Case Diagram 2

5.4 Class Diagram

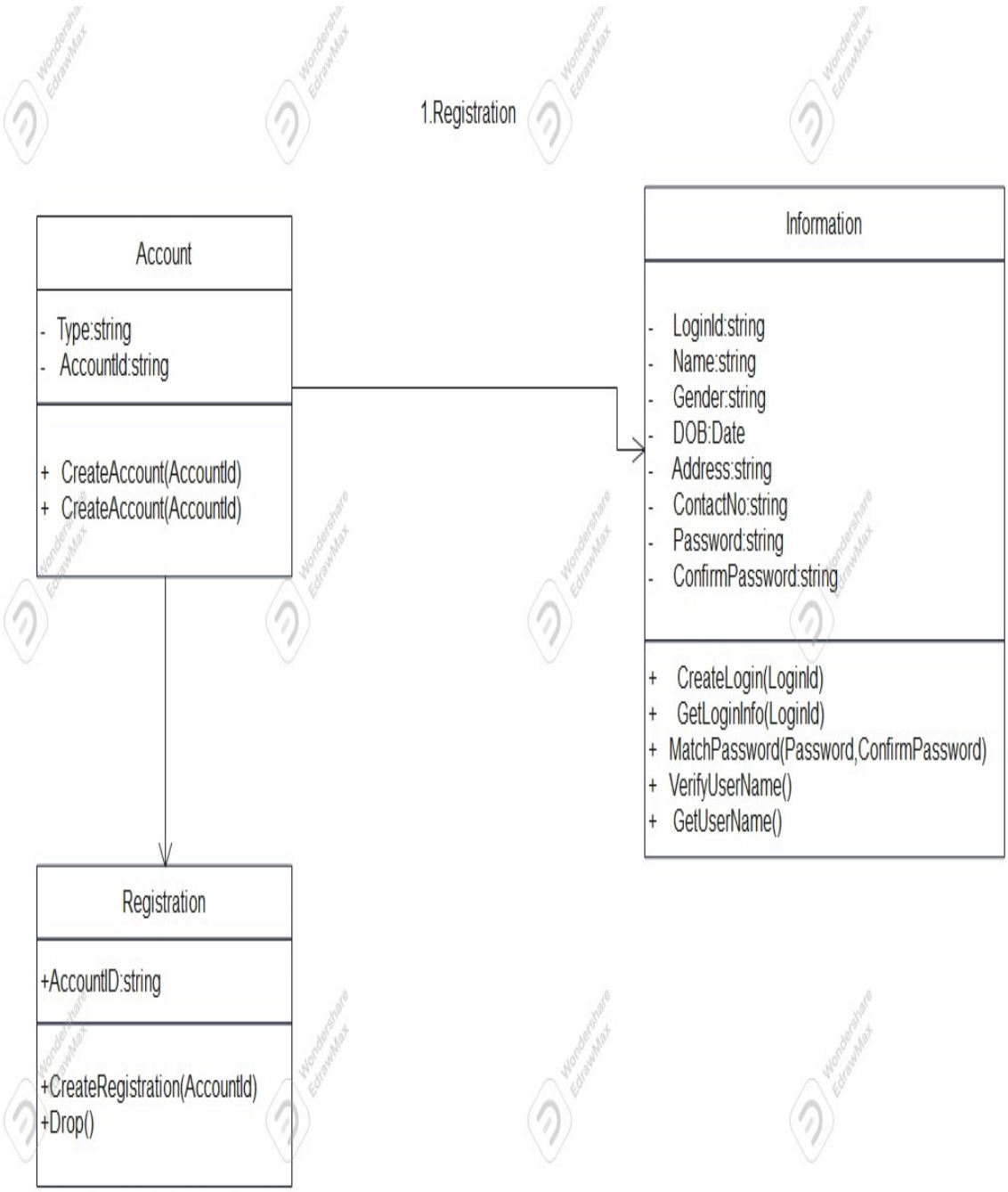


Figure 5.7: Class Diagram 1

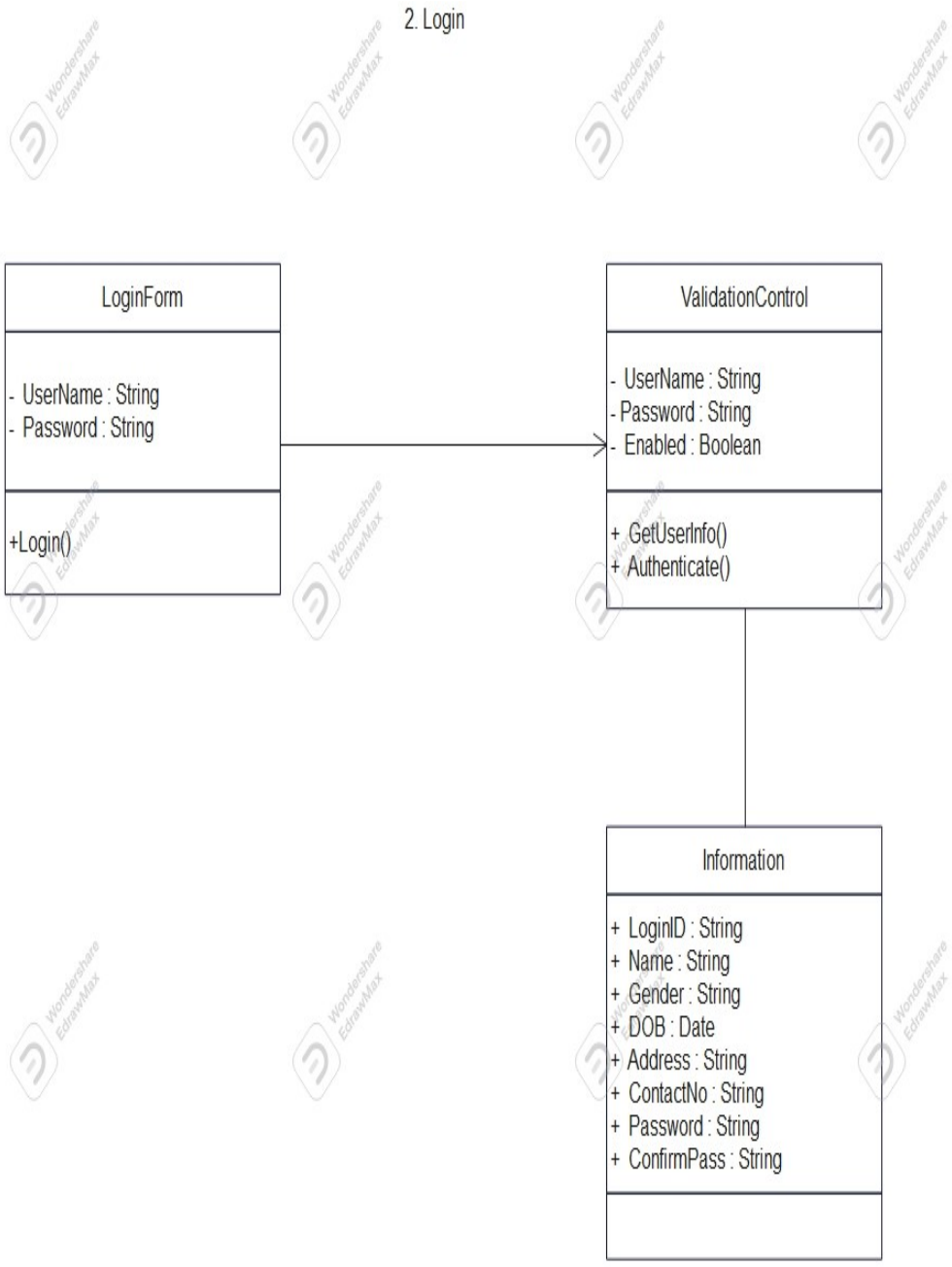


Figure 5.8: Class Diagram 2

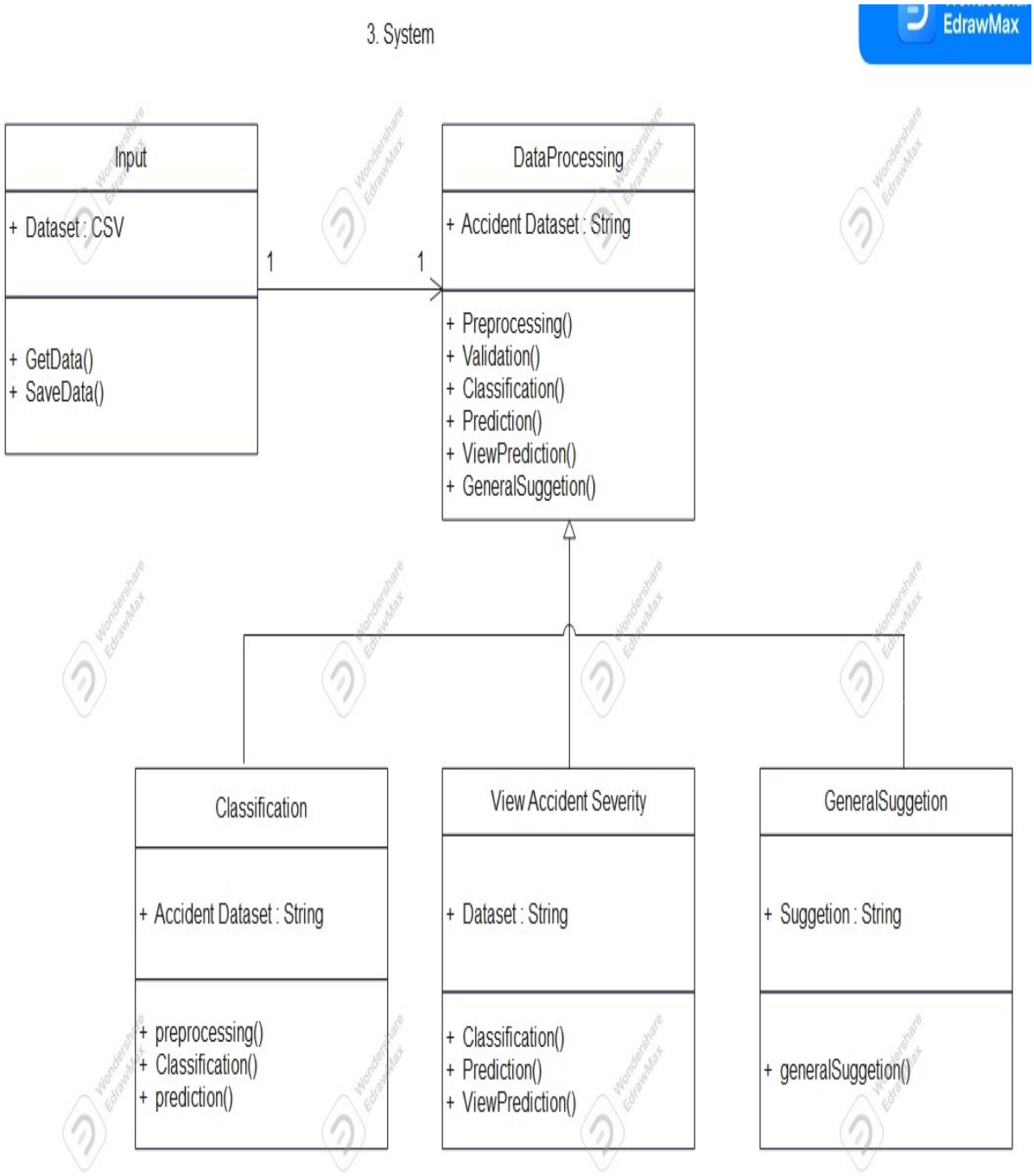


Figure 5.9: Class Diagram 3

5.5 Sequence Diagram

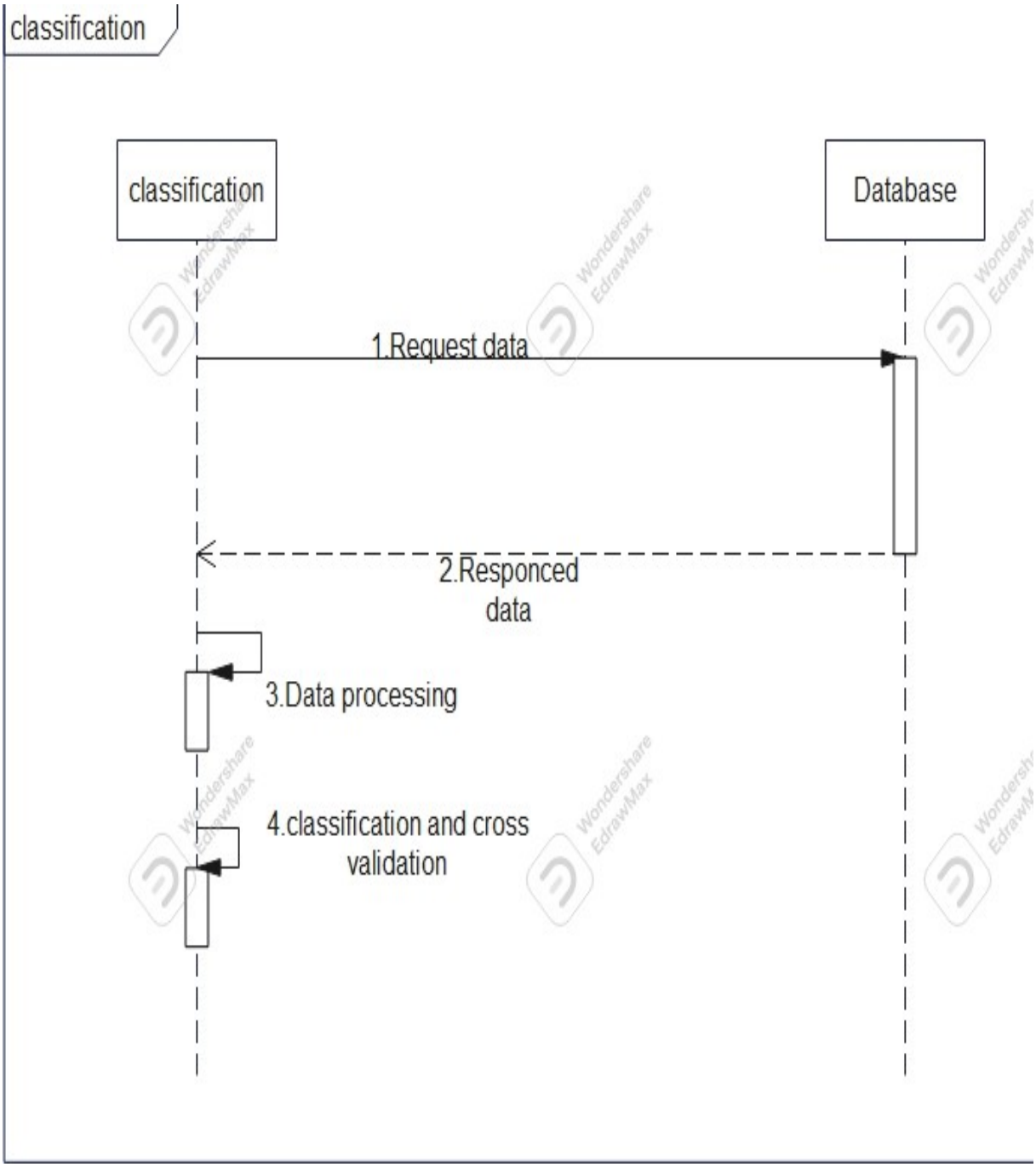


Figure 5.10: Sequence Diagram 1

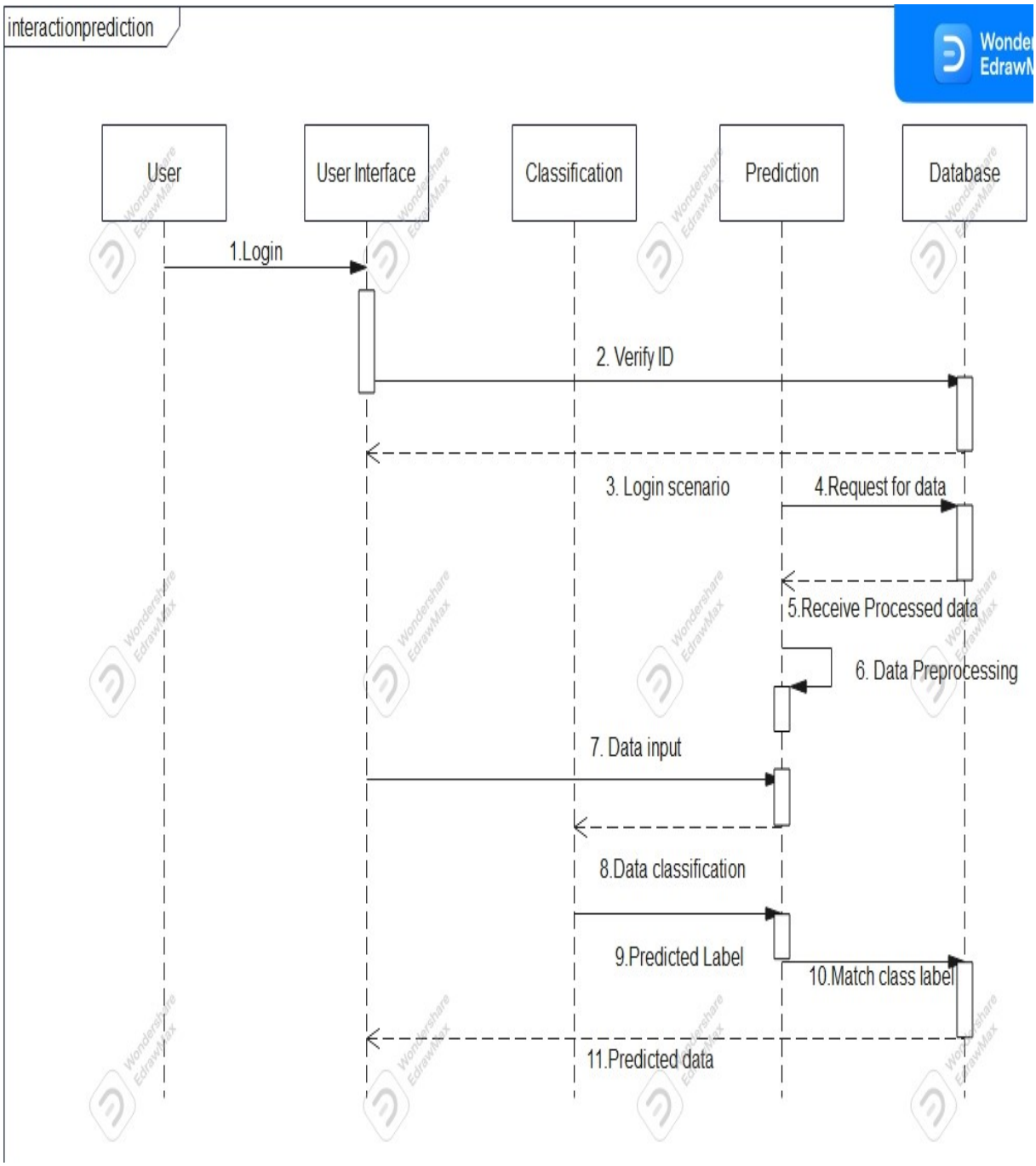


Figure 5.11: Sequence Diagram 2

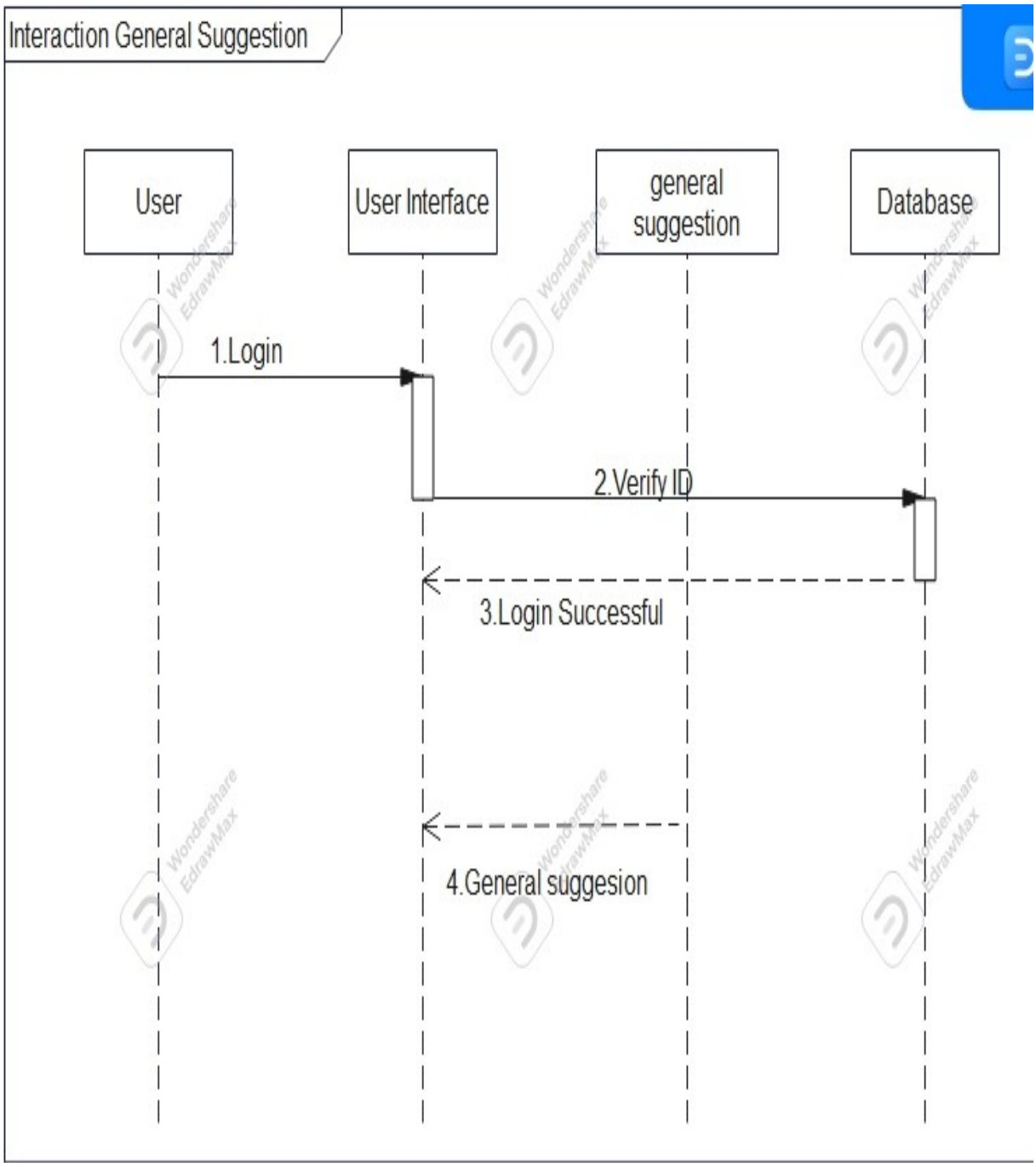


Figure 5.12: Sequence Diagram 3

5.6 Entity Relationship Diagram

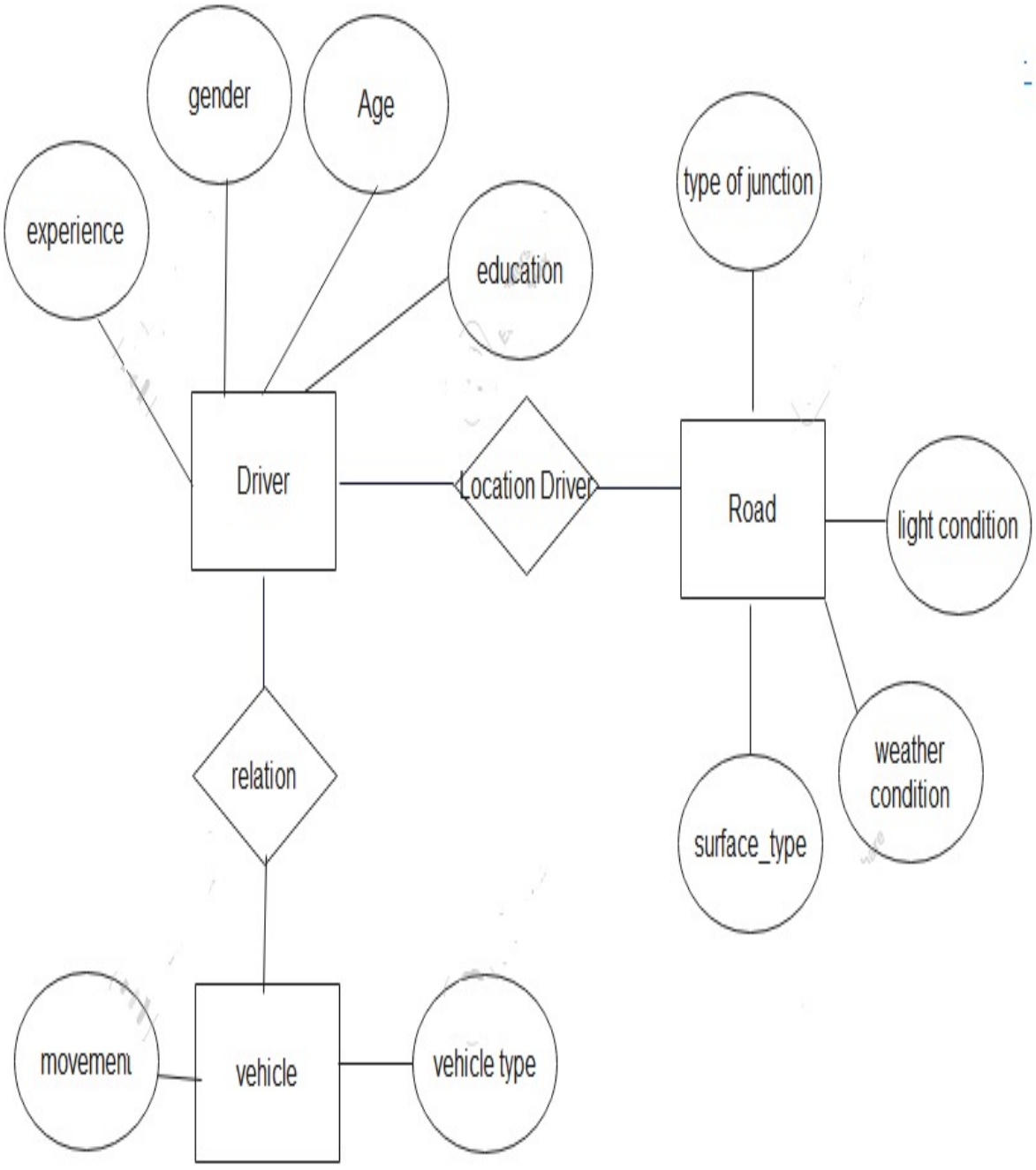


Figure 5.13: ER Diagram

5.7 Activity Diagram

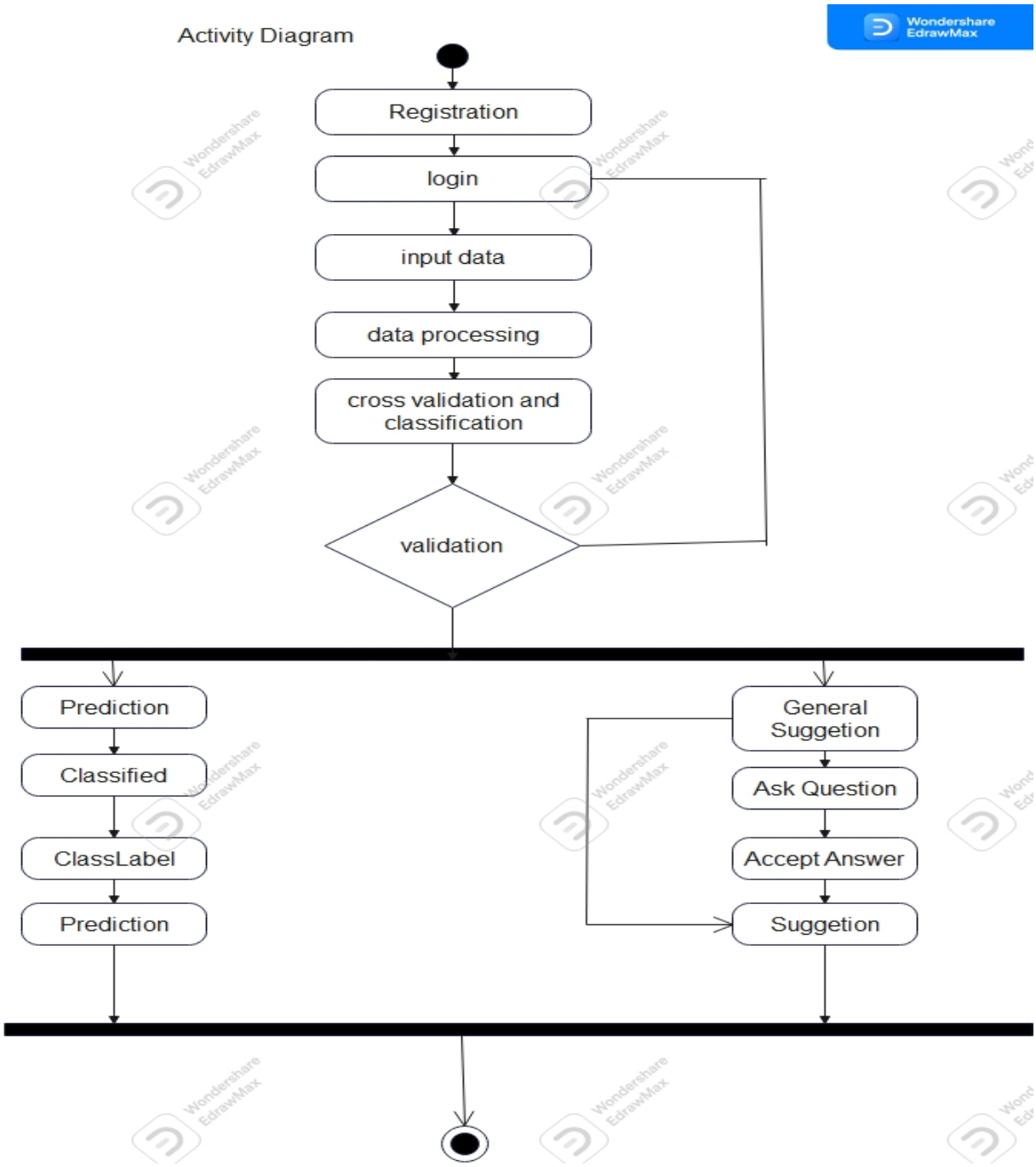


Figure 5.14: Activity Diagram

5.8 State Diagram

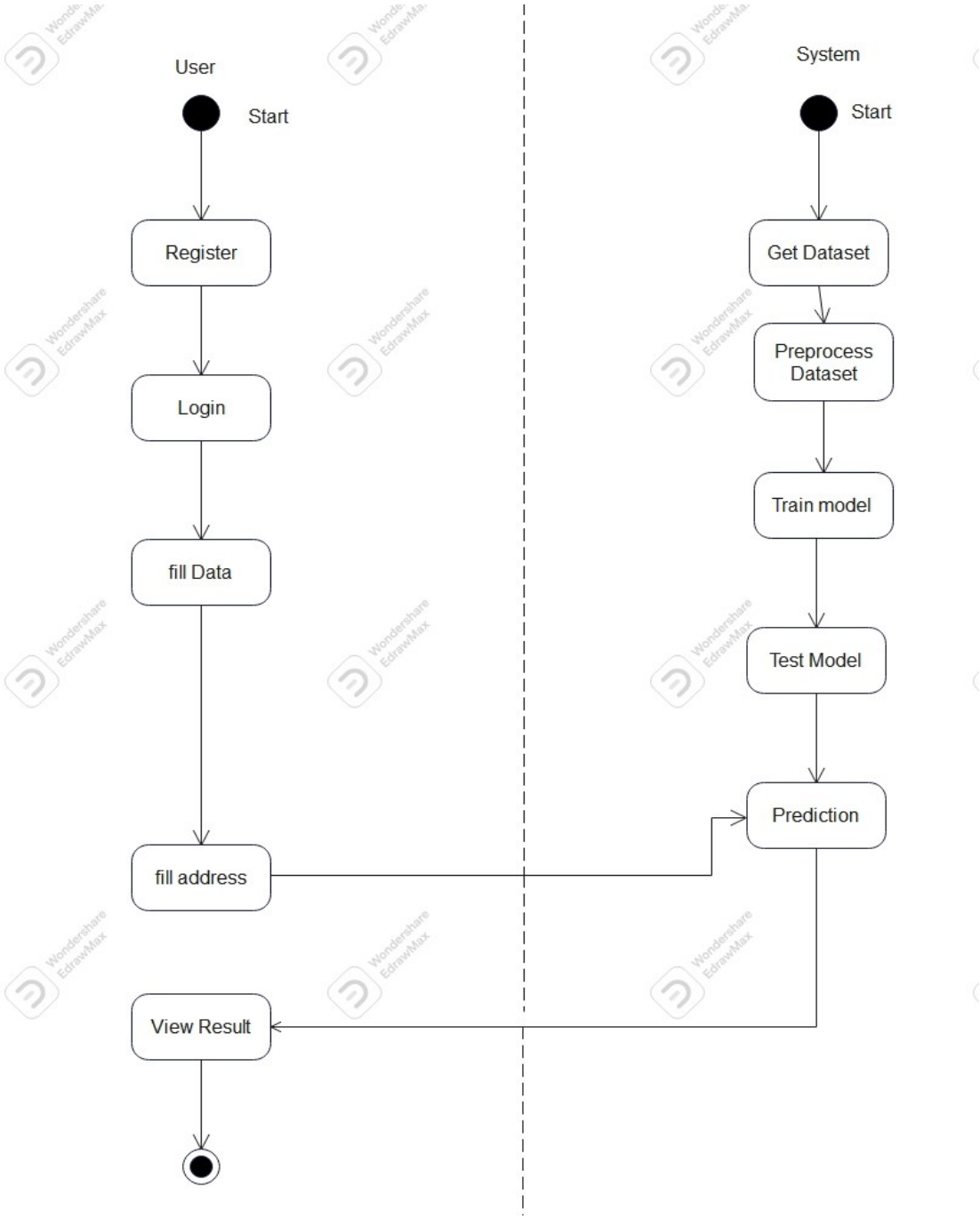


Figure 5.15: State Diagram

5.9 Component Diagram

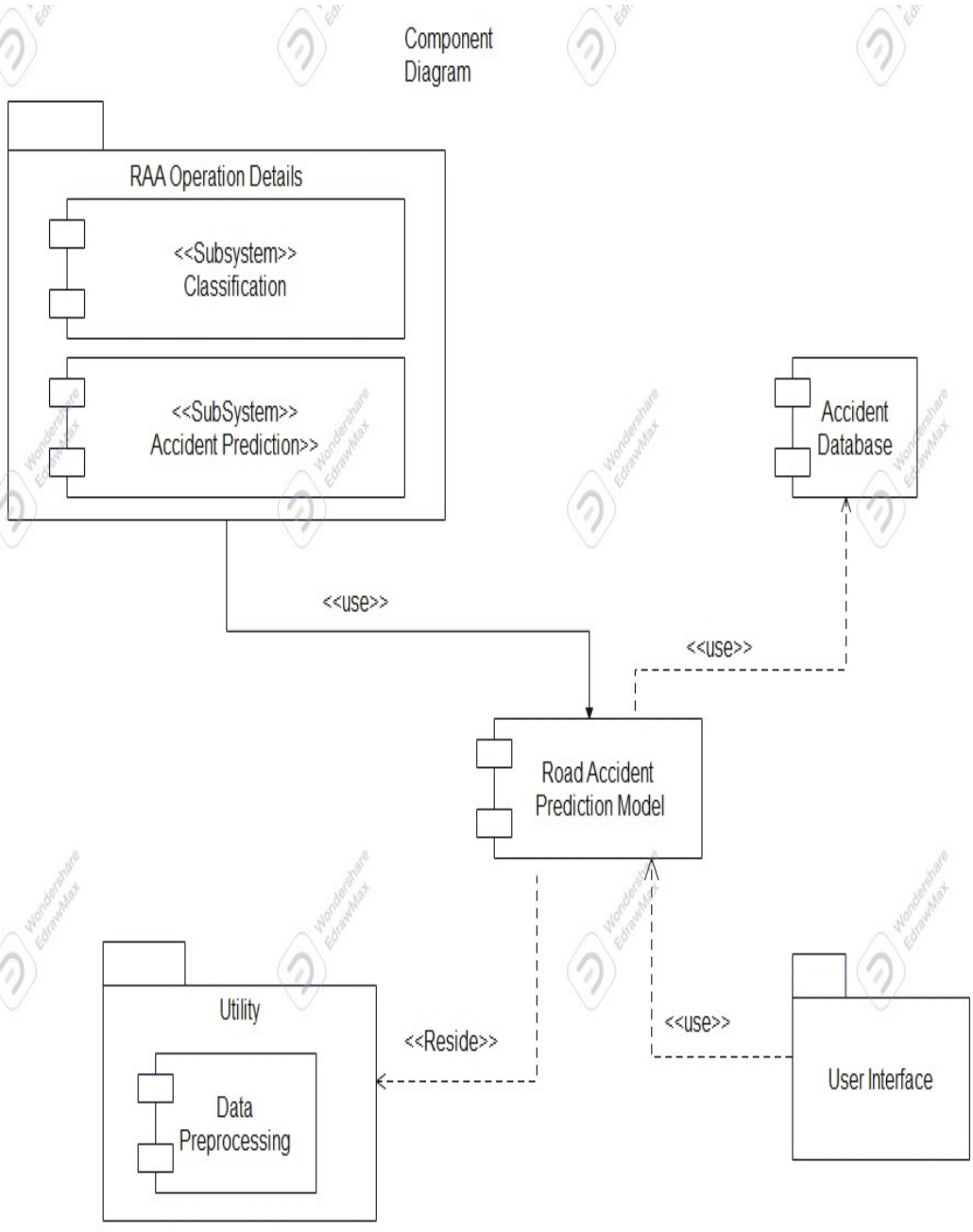


Figure 5.16: Component Diagram

5.10 Deployment Diagram

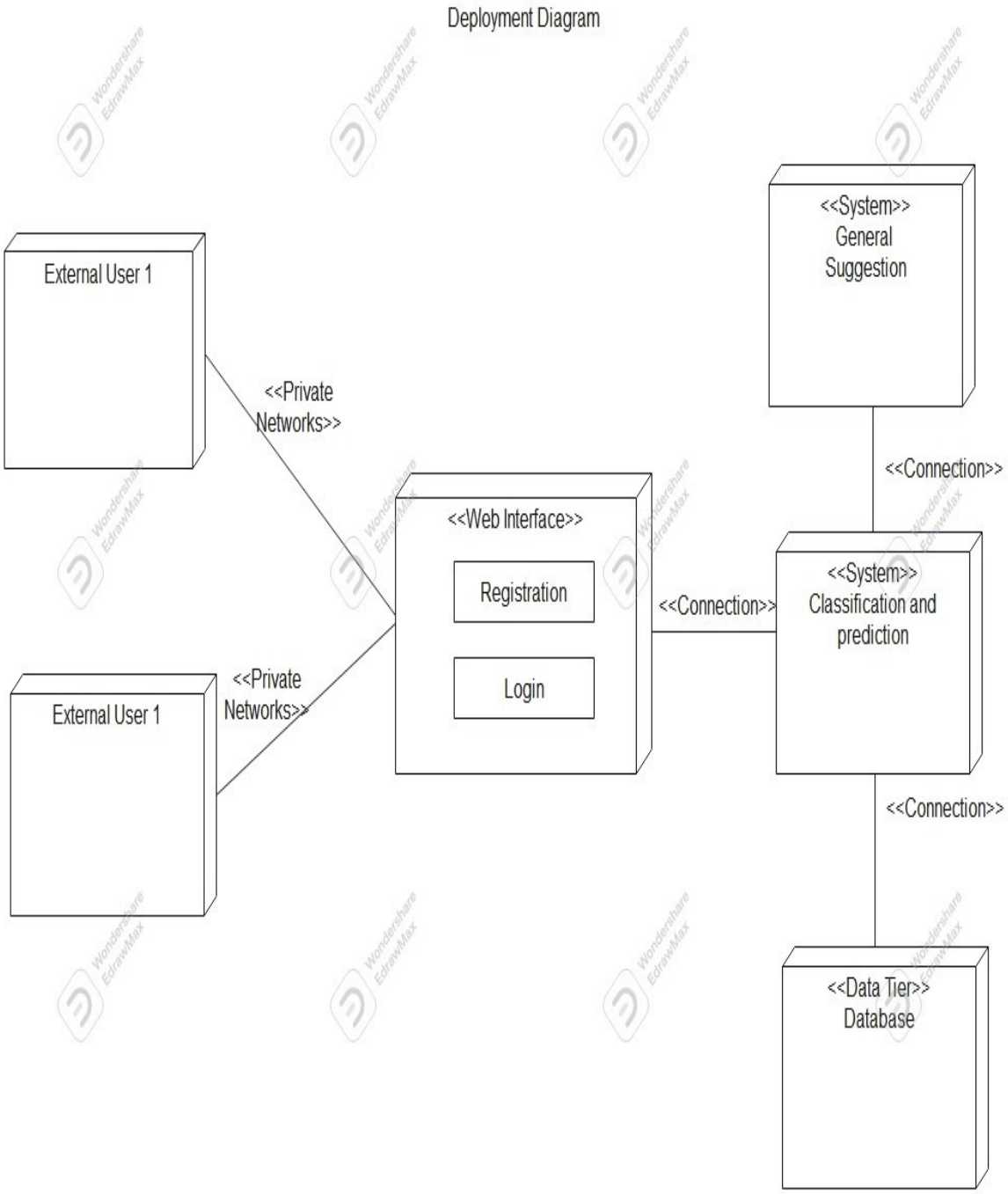


Figure 5.17: Deployment Diagram

Chapter 6

Project Plan

6.1 Project Estimate

1. Purpose The project can be broken down into 4 Major states.
2. The first stage of project is to take the support and confidence values from the user and provide the rules to the driver.
3. The second stage is to plot graphs based on the input selected by the user.
4. The third stage is to predict the risk of accidents in a particular area chosen by the user. 5. The Final stage is to report new accidents encountered by the people which will be used for the collection of data sets in future.

Sr No	Milestone Name	Milestone Description	Timeline
1	Requirement Analysis	Complete Specification of System	18/07/2022 to 06/08/2022
2	High Level Design	Identify different modules , different entities and relationship	07/08/2022 to 23/08/2022
3	Detailed Design	GUI Design, Program Specification	01/10/2022 to 1/11/2022
4	Build	Implementation of different modules	02/11/2022 to 15/01/2023
5	Testing	Test different modules together	16/01/2023 to 10/03/2023
6	Final Review And Deployment	Change as per suggestions	11/03/2023 to 04/05/2023

Figure 6.1: Project Estimate

6.2 Risk Management

- Risk management is the process of identifying, assessing and controlling threats to an organization's capital and earnings.
- Risk management encompasses the identification, analysis, and response to risk factors that form part of the life of a business.
- **Technical Risk**

  The application not connected to the internet then System will not Work.

- **Operational Risk**

  We are predicting the Road accidents,if user give wrong parameters,model fails and give wrong prediction.

6.3 Project Schedule

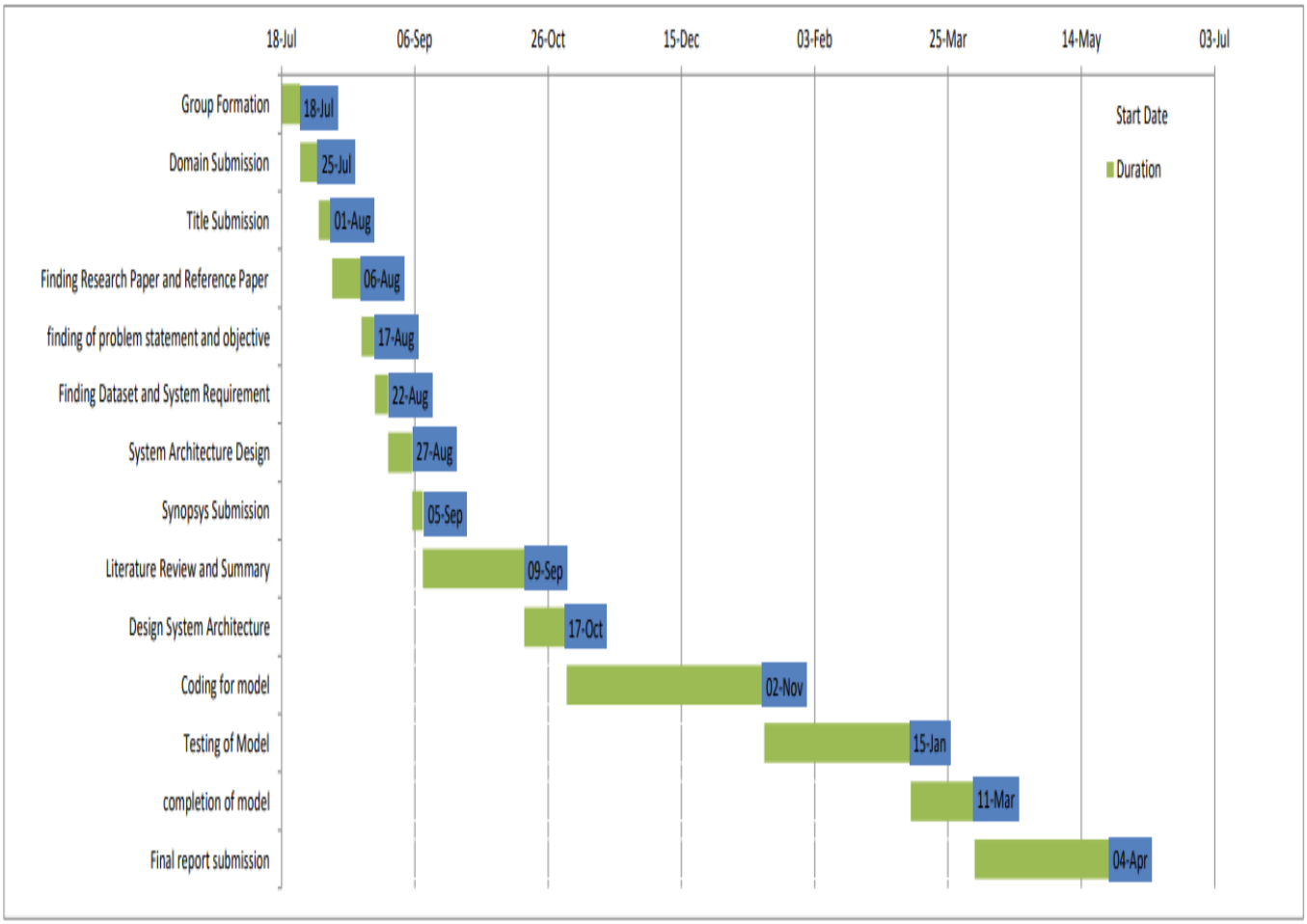


Figure 6.2: Project Scedule

Chapter 7

Project Implementation

7.1 Overview of Project Modules

Machine Learning is a field within Artificial Intelligence where the objective is to enable computers to learn and make decisions in a manner similar to humans. In Machine Learning, the computer learns through experiences in an automated way. Instead of explicitly programming the computer with specific rules, Machine Learning models are fed information, such as observations and real-world interactions, to facilitate learning. Unlike traditional programming, where developers write code based on predefined rules and patterns, Machine Learning takes a different approach. Machine Learning models are designed to identify patterns within datasets without prior knowledge of the specific patterns they need to find. These models are trained on various datasets, allowing them to recognize patterns and learn from them. Once trained, a Machine Learning program can analyze new datasets and identify patterns without explicitly being told what to look for.

7.2 Tools and Technologies Used

7.3 Algorithm Details

Support vector Machine : Support Vector Machine (SVM) is a supervised machine learning algorithm used for classification and regression tasks. It is particularly effective

for binary classification problems, but can also be extended for multi-class classification. SVM requires labeled training data, where each data point is represented by a feature vector and a correspond ing class label. If needed, you may perform feature selection or dimensionality reduction techniques to identify the most relevant features for training the SVM model.SVM aims to find an optimal hyperplane that best separates the data points belonging to different classes. In a binary classification scenario, the hyperplane is a line that divides the fea ture space into two regions.SVM seeks to maximize the margin, which is the distance between the hyperplane and the closest data points from each class. The data points that lie on the margin are called support vectors.SVM can handle linearly inseparable data by applying the kernel trick. The kernel function transforms the input features into a higher-dimensional space, where the classes can be separated by a hyperplane.The SVM algorithm solves an optimization problem to find the best hyperplane by minimiz ing the classification error and maximizing the margin. This optimization problem can be formulated as a quadratic programming problem. Once the SVM model is trained, it can be used to predict the class label of unseen data points by evaluating which side of the hyperplane they belong to.

Random Forest : Random Forest is a popular machine learning algorithm that is widely used for both classification and regression tasks. It is an ensemble learning method that combines multiple decision trees to make predictions. The basic idea behind Random Forest is to create an ensemble of decision trees, where each tree is trained on a different subset of the training data and uses a random subset of the input features. This randomness helps to reduce overfitting and increase the generalization ability of the mod.lRandom Forest randomly selects subsets of the training data with replacement (known as bootstrap sampling). Each subset, called a bootstrap sample, is used to train a decision tree. At each node of the decision tree, a random subset of features is selected. The algorithm considers the best split among these features to determine how to split the node. Using the selected features, each decision tree is grown by recursively partitioning the data into subsets based on the selected features.

Random Forest Algorithm Pseudocode:

Step 1: First, start with the selection of random samples from a givendataset.

Step 2: Next, this algorithm will construct a decision tree for every sample. Then it will get the prediction result from every decision tree.

Step 3: In this step, voting will be performed for every predicted result.

Step 4: At last, select the most voted prediction result as the final prediction result.

KNN: K-nearest neighbors (KNN) algorithm is a type of supervised ML algorithm which can be used for both classification as well as regression predictive problems. However, it is mainly used for classification predictive problems in industry. The following two properties would define KNN well

- Lazy learning algorithm KNN is a lazy learning algorithm because it does not have a specialized training phase and uses all the data for training while classification.
- Non-parametric learning algorithm KNN is also a non-parametric learning algorithm because it doesn't assume anything about the underlying data.

KNN Algorithm Pseudocode:

Step 1: For implementing any algorithm, we need dataset. So, during the first step of KNN, we must load the training as well as test data.

Step 2: Next, we need to choose the value of K i.e. the nearest data points. K can be any integer.

Step 3 : For each point in the test data do the following –

- Calculate the distance between test data and each row of training data with the help of any of the method namely: Euclidean, Manhattan or Hamming distance. The most commonly used method to calculate distance is Euclidean.

- Now, based on the distance value, sort them in ascending order.
- Next, it will choose the top K rows from the sorted array.
- Now, it will assign a class to the test point based on most frequent class of these rows.

Step 4: End

Chapter 8

Software Testing

Software testing is actually a set of different tasks whose primary purpose is to fully exercise the computer based system. Although each test has a different purpose, all work to verify that the system elements have been properly integrated and perform allocated tasks. Testing presents an interesting anomaly for the engineer. During earlier software engineering activities, the engineer attempts to build software from an abstract concept to a tangible product. Now comes testing. The engineer creates a series of test cases that are intended to demolish the software that has been built. In fact, testing is the one step in the software process that could be viewed as destructive rather than constructive. Software engineers are by their nature constructive people. Testing requires that the developer discard preconceived notions of the correctness of software just developed and overcome a conflict of interest that occurs when errors are uncovered. If testing is conducted successfully (according to the objectives stated previously), it will uncover errors in the software. As a secondary benefit, testing demonstrates that software functions appear to be working according to specification, that behavioral and performance requirements appear to have been met. In addition, data collected as testing is conducted provide a good indication of software reliability and some indication of software quality as a whole. But testing cannot show the absence of errors and defects, it can show only that software errors and defects are present. It is important to keep this (rather gloomy) statement in mind as testing is being conducted.

8.1 Type of Testing

- **White Box Testing**

  White Box Testing is a software testing method in which the internal structure design implementation of the item being tested is known to the tester. options called glass-box testing is a test case design method that uses the l structure of the procedural design to derive test cases. Using white-boxing methods, the software engineer can derive test cases that: Guarantee that all independent paths within a module have been exercised at least once. Exercise all logical decisions on their true and false sides. Execute all loops at their boundaries and within their operational bounds and Exercise internal data structures to ensure their validity. White-box testing of software is predicated on close examination of procedural detail. Providing test cases that exercise specific sets of conditions and/or loops test logical paths through the software. The status of the program may be examined at various points to determine if the expected or asserted status corresponds to the actual status. Basis path testing is a white-box testing technique first proposed by Tom McCabe. The basis path method enables the test case designer to derive a logical complexity measure of a procedural design and use this measure as a guide for defining a basis set of execution paths. Test cases derived to exercise the basis set are guaranteed to execute every statement in the program at least one time during testing.

- **Black Box testing**

  Black Box Testing is a software testing method in which the internal structure of the item being tested is NOT known to the tester also known as behavioural testing which focuses on the functional requirements That is, black box testing enables the software engineer to derive of input conditions that will fully exercise all functional requirements for a pra Black box testing is not an alternative to white-box techniques. Rather, aa complementary approach that is likely to uncover a different class of er- we than white-box methods. When computer software is considered, black box sting alludes to tests that are conducted at the software

interface. Although they are designed to uncover errors, black-box tests are used to demonstrate that software functions are operational, that input is properly accepted and output is correctly produced and that the integrity of external information is maintained. A black-box test examines some fundamental aspect of a system with a little regard for the internal logical structure of the software. Black box testing attempts to find errors in the following categories

8.2 Test cases and Test Results

Test case No	Input	Expected Output	Actual Output	Remark
1	Login	Verify if a user will be able to login with a valid username and valid password.	Login Successfully	Pass
2	Login	Verify the messages for invalid login.	Login Error	Pass
3	Register	Create a Account	Account Created	Pass
4	Sign in	Already a account do sign in	Sign in using password	Pass

Figure 8.1: Test Cases

Chapter 9

Results

9.1 Outcomes

By thoroughly analyzing the provided data and training a machine learning model to predict the severity of potential accidents, the investigation agency can prioritize its efforts and resources toward the most high-risk situations. This project highlights the value of using data-driven approaches to address complex problems and the importance of continued investment in these initiatives. Losses in road accidents are unbearable, to the society as well as a developing country like us. So, it has become an essentialrequirement to control and arrange traffic with an advanced system to decrease the number of road accidents in our country. Bytaking simple precautions, based on prediction or warnings of a sophisticated system may prevent traffic accidents. Moreover, it's a primary need for our country now, to tackle this situation where every day so many people were killed in a traffic accident and day by day this rate is getting increased. The implementation of machine learning is a functional and a great approach to take an accuratedecision with the experience to manage the current situation and the findings of the analysis part can be suggested to trafficauthorities for reducing the number of accidents.

Statistical analysis also includes other limiting factors such as the age of the vehicle, the type of vehicle, the age group of the person, and the category of road users. The predicted data results are displayed in a graphical representation. Graphical representations help the public understand accident metrics that help reduce mortality.

9.2 Screen Shots

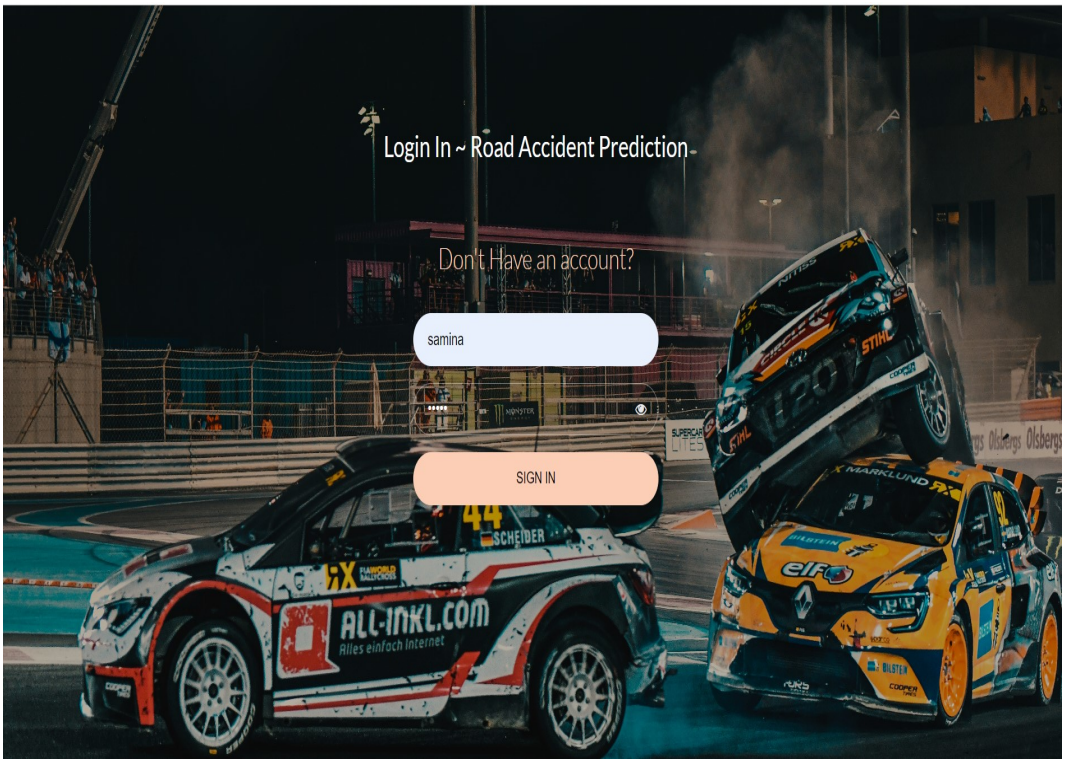
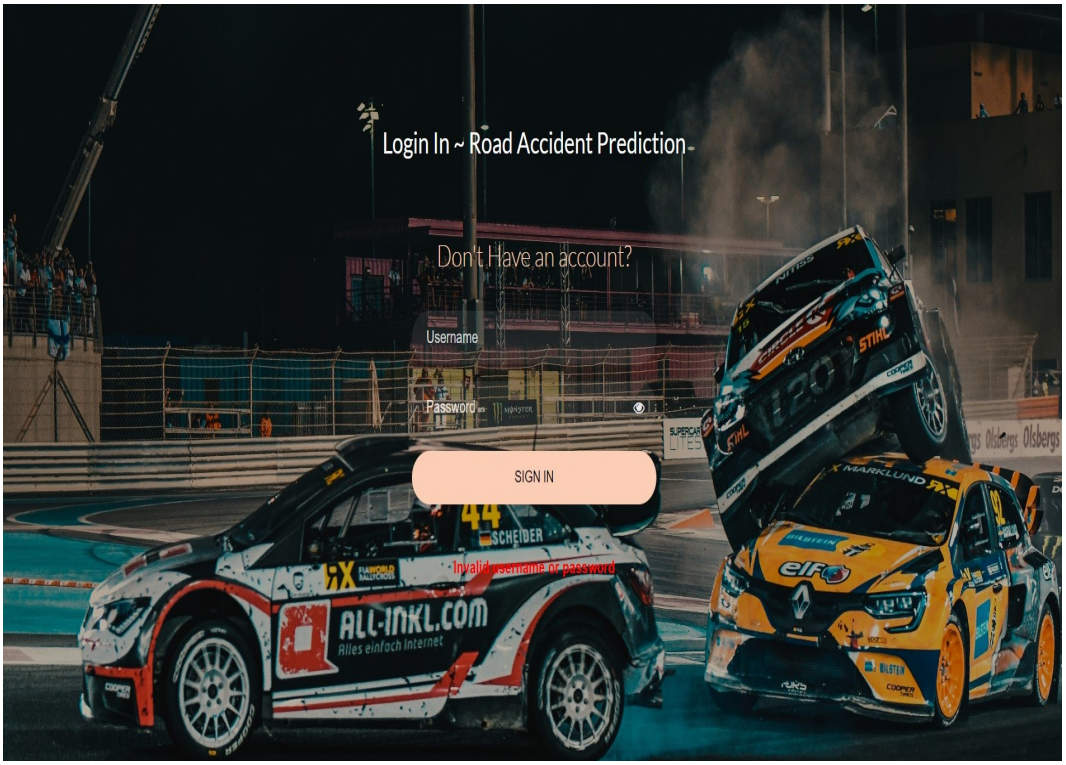


Figure 9.1: Login Page



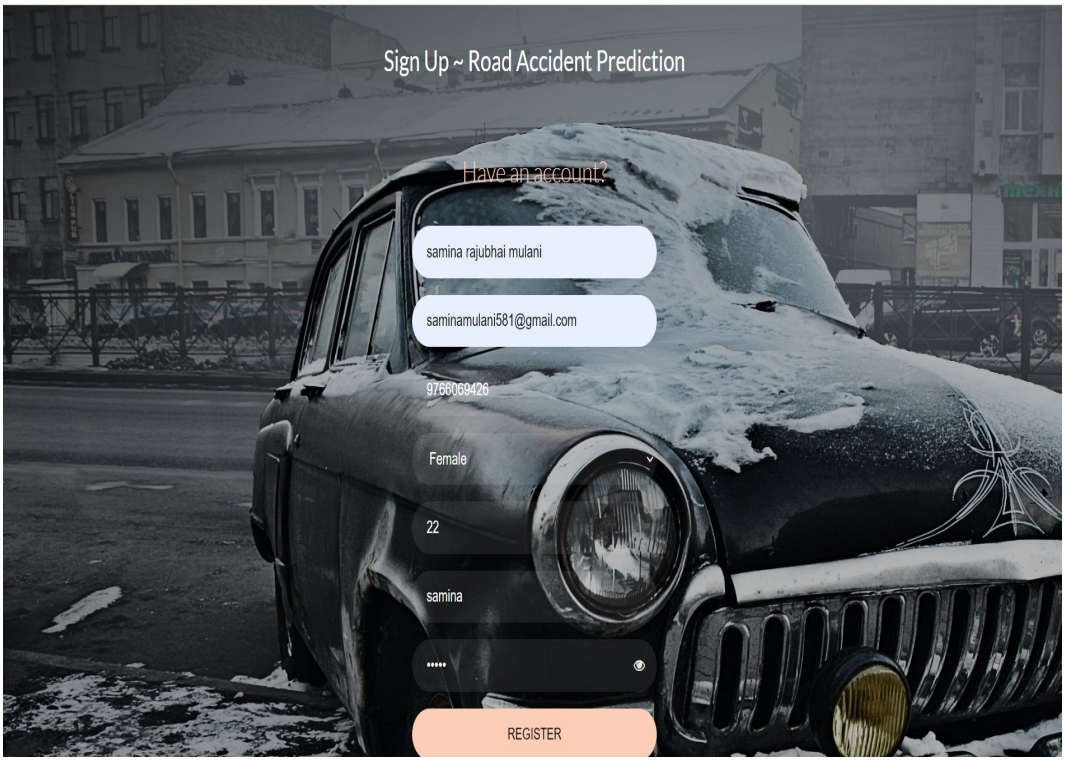


Figure 9.2: Sign Up Page

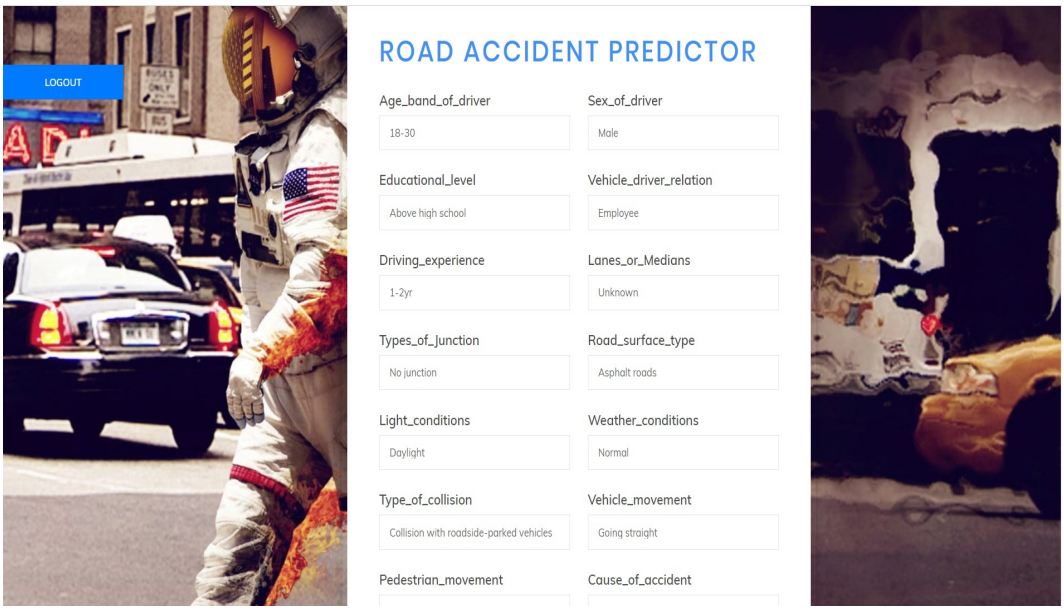


Figure 9.3: Prediction

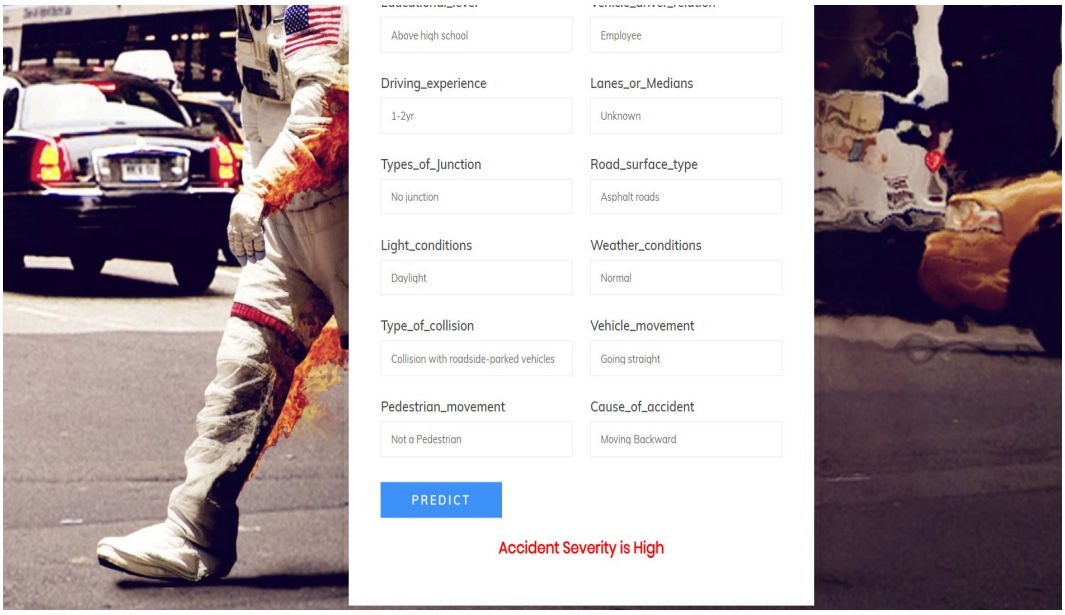


Figure 9.4: Output Page

Figure 9.5: Plot

Chapter 10

Conclusions

Road Accidents are caused by various factors. By going through all the research papers,it can be concluded that Road Accident cases are hugely affected by the factors such as types of vehicles, age of the driver, age of the vehicle, weather condition, road structure and so on. Thus, we have built an application which gives efficient prediction of road accidents based on the above-mentioned factors.By going through all the research paper, it can be concluded that road accident cases are hugely affected by the factors such as types of vehicles, age of the driver, vehicle condition and road structure. Thus, we have built an application which gives efficient prediction of road accidents based on machine learning.

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