ROAD TRAFFIC PREDICTION FOR INTELLIGENT TRANSPORTATION SYSTEM

VARSHA C
MES20MCA-2058
PRODUCT OWNER: Dr.GEEVAR C ZACHARIAS

TABLE OF CONTENTS

1. Introduction
2. Methodology
3. Modules
4. Future Enhancement
5. User Story
6. Project Plans
7. Product Backlog
8. Sprint plans
9. Sprint Actual

ROAD TRAFFIC PREDICTION FOR INTELLIGENT TRANSPORTATION SYSTEM

- A human-based road damage monitoring system could be the first answer but not a perfect solution because it is affected by a different condition such as weather, speed of the vehicle, the complexity of the road, and the difference of criteria from the individual inspection. Deep learning-based technology is a good key to unlock the object detection tasks in our real world. By using deep neural networks, we could break a problem that is dangerous and very time-consuming but has to be done every day like detecting the road state. This paper describes the solution using YOLO to detect the various types of road damage in the IEEE Big Data Cup Challenge 2020.

- This also aims to develop a tool for predicting accurate and timely traffic flow Information and an accident detection mechanism. Traffic Environment involves everything that can affect the traffic flowing on the road, whether it's traffic signals, accidents, rallies, even repairing of roads that can cause a jam. If we have prior information which is very near approximate about all the above and many more daily life situations which can affect traffic then, a driver or rider can make an informed decision.

- The accident detection mechanism aims to detect the accident occurs while travelling and inform it to the neighbours. So that neighbours can easily get the information and take necessary actions.

ROAD TRAFFIC PREDICTION FOR INTELLIGENT TRANSPORTATION SYSTEM

- The project is been executed to accomplish the results by:
  - Road damage detection
  - Traffic prediction
  - Accident detection

METHODOLOGY

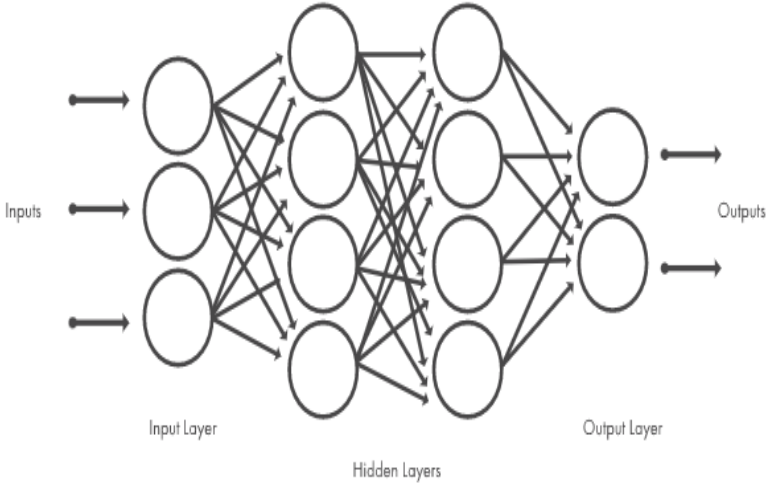
DEEP LEARNING

- A main point is that object detection could be a combination of classification and localization, thus many approaches have developed to solve object detection tasks using deep learning-based technology. The detection model is trained with the image dataset which contains the bounding-boxes and the labels to detect an object. From the perspective of region proposal-based methods, they propose a region that may include the object, classify the object, refine and get rid of overlapped bounding boxes, and score them based on other objects in the input image. And there are representative region-based models such as R-CNN , Fast R-CNN , and Faster R-CNN , and they also called by two-stage object detectors.

METHODOLOGY

DEEP LEARNING

- Deep learning is a machine learning technique that teaches computers to do what comes naturally to humans.
- Deep learning models are trained by using large sets of labeled data and neural network architectures that learn features directly from the data without the need for manual feature extraction.
- Nowadays, deep learning has an important role in image classification. It extracts the feature maps from an input image using a neural network with hidden layers, and several deep learning networks based on Convolutional Neural Networks (CNNs), such as AlexNet , VGGNet , ResNet , etc, achieved a successful performance in the ImageNet Large Scale Visual Recognition Challenge (ILSVRC).



METHODOLOGY

TRAFFIC PREDICTION:-

- This predicts accurate traffic flow information. This module divided into two sub modules:

1. Data collection
2. Data processing

METHODOLOGY

Data collection

This module for identify the congested situations, Collect the traffic data in every 5 min with features: Location (Measured with GPS), Direction, Speed and Start-End Junction. Then Group every 5 min interval with their corresponding data and calculate the distance between each vehicle with all other vehicles within specified junction. If the distance is less than the specific threshold between two vehicles then those vehicles are considered to be the neighborhood vehicles else not considered as Neighbour vehicles.

Data processing

This module for classify the congested situations. Give the collected data to a matrix. Compare it with threshold value and identify the neighborhood vehicles. Repeat above steps in every 5 min for 45 min and plot the graph between neighborhood vehicles and time interval. If the neighborhood vehicles show an increasing graph, then the traffic congestion is identified else No traffic.

METHODOLOGY

PROCESS OF TRAFFIC PREDICTION

1. Created the application which can provide us the GPS coordinates.
2. Perform the decision tree algorithm
3. Evaluate the matrix for the dataset
4. Divide the the dataset into training and testing.
5. Predict the 45 min interval parameters through machine learning algorithm
6. Conclude about the traffic congestion

METHODOLOGY

Algorithm 1 For identifying the congested situation

1. Collect the traffic data in every 5 min with features:
   A. Location (Measured with GPS)
   B. Direction
   C. Speed
   D. Start-End Junction
2. Group every 5 min interval with their corresponding data.
3. Calculate the distance between each vehicle with all another vehicles within specified junction.

if the distance is less than the specific threshold between two vehicles **then**
   those vehicles are considered to be the neighbourhood vehicles
else
   Not considered as neighbour vehicles.
end if

Algorithm 2 For classifying the congested situation

1. This will eventually give us the matrix A.
2. Now assign 1 to $A[i, j]$

if $A[i, j] < threshold$ **then**
   $A[i, j] = 1$
else
   $A[i, j] = 0$
end if

3. Count $A[i, j]$=1 and label i, j as neighbourhood vehicles
4. Repeat above steps in every 5 min for 45 min
5. Plot the graph between neighbourhood vehicles and time interval.

if the neighbourhood vehicles shows an increasing graph **then**
   the traffic congestion is identified
else
   No traffic
end if

METHODOLOGY

ACCIDENT DETECTION:-

- The accident is detected based on the intensity of shake occurred while travelling. And the classification of intensity of shake is done based on the dataset is taken from kaggle .
- The dataset is divided into train and test dataset. Each of these contains set of values which is less than the limited intensity and greater than the limited intensity.
- The features including in dataset are accelerometer and gyroscope. The inputs taken are compared with the dataset values and if it is greater than the limited intensity then send a message that an accident occurred to the emergency contacts with the location.

METHODOLOGY

DECISION TREE ALGORITHM

- The goal of this algorithm is to predict the value of the target variables. Decision tree learning represents a function that takes as input a vector of attributes value and return a ”Decision ” a single output value. Ii falls under the category of supervised learning algorithm. It can be used to solve both regression and classification problem. DT identify its results by performing a set of tests on the training dataset .

METHODOLOGY

STEPS INVOLVED IN DECISION TREE

- **Step-1:** Begin the tree with the root node, says S, which contains the complete dataset.
- **Step-2:** Find the best attribute in the dataset using **Attribute Selection Measure (ASM).**
- **Step-3:** Divide the S into subsets that contains possible values for the best attributes.
- **Step-4:** Generate the decision tree node, which contains the best attribute.
- **Step-5:** Recursively make new decision trees using the subsets of the dataset created in step -3. Continue this process until a stage is reached where you cannot further classify the nodes and called the final node as a leaf node.

METHODOLOGY

Attribute Selection Measures

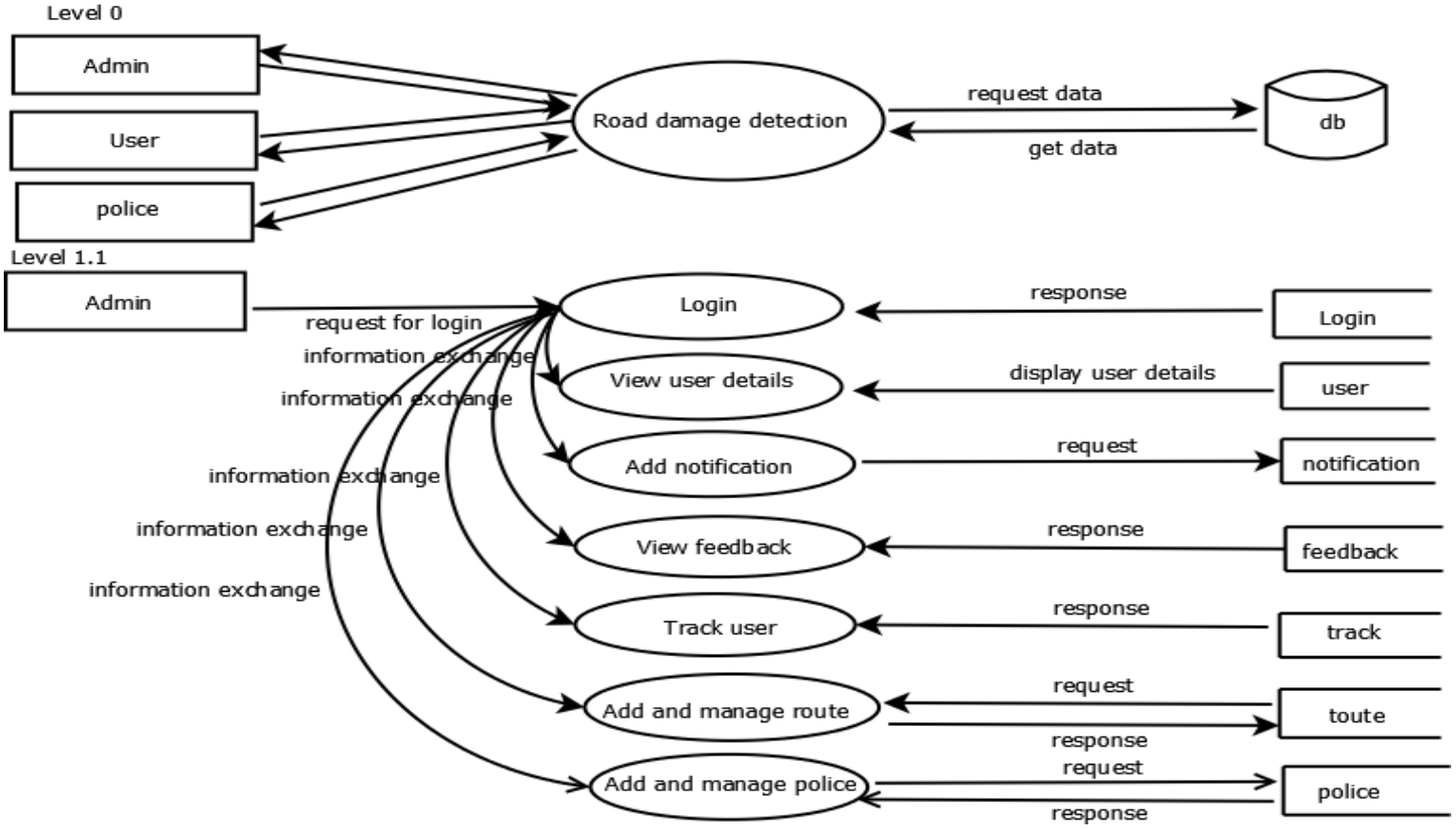
- While implementing a Decision tree, the main issue arises that how to select the best attribute for the root node and for sub-nodes. So, to solve such problems there is a technique which is called as **Attribute selection measure or ASM.**
- Here we use **Gini Index** as the ASM**.**
- Gini index is a measure of impurity or purity used while creating a decision tree in the CART(Classification and Regression Tree) algorithm.
- An attribute with the low Gini index should be preferred as compared to the high Gini index.
- It only creates binary splits, and the CART algorithm uses the Gini index to create binary splits.
- Gini index can be calculated using the below formula:

$$\text{Gini Index} = 1 - \sum_j P_j^2$$

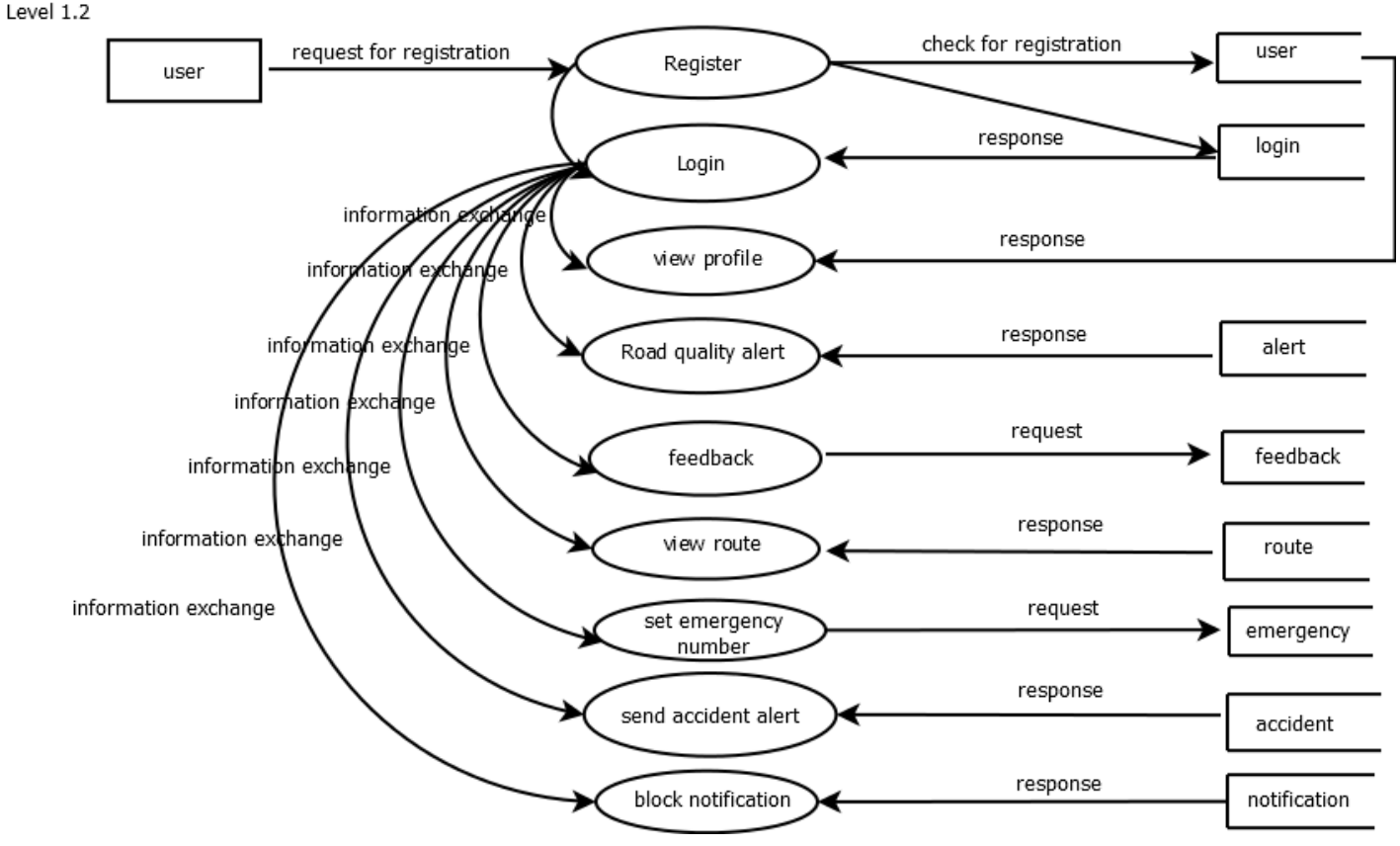
MODULES

1. **Admin**
   - Login
   - View users details
   - Add notification
   - View feedback
   - Track user
   - Add and manage routs
   - Add and manage police
2. **User**
   - Register
   - Login
   - View profile
   - Road quality alert
   - feedback
   - View rout
   - Set emergency number
   - Block notification
   - Send accident alert
3. **Police**
   - Login
   - View notification
   - View Accident alert

DATA FLOW DIAGRAM



DATA FLOW DIAGRAM



DATA FLOW DIAGRAM

Level 1.3

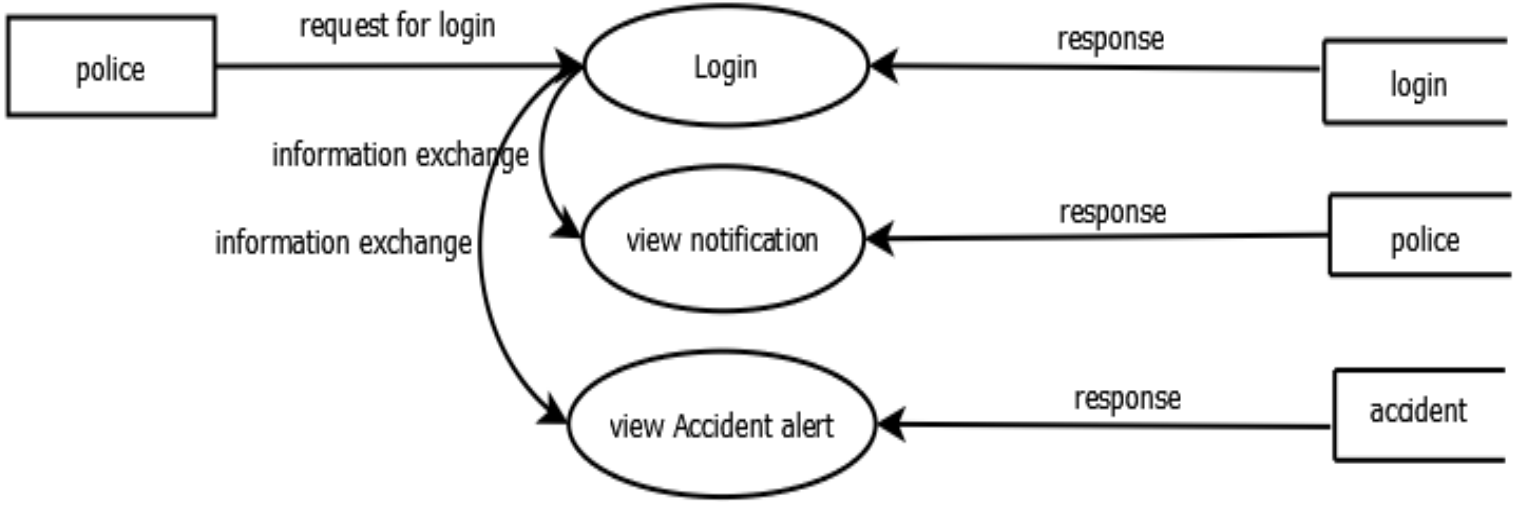


TABLE DESIGN

login

	Field Name	Datatype	Len	Default	PK?	Not Null?	Unsigned?	Auto Incr?	Zerofill?	Charset	Collation	Comment
*	id	int	11		☑	☑	☐	☑	☐			
	username	varchar	54		☐	☐	☐	☐	☐	latin1	latin1_swedish_ci	
	password	varchar	54		☐	☐	☐	☐	☐	latin1	latin1_swedish_ci	
	usertype	varchar	54		☐	☐	☐	☐	☐	latin1	latin1_swedish_ci	
					☐	☐	☐	☐	☐			

user

	Field Name	Datatype	Len	Default	PK?	Not Null?	Unsigned?	Auto Incr?	Zerofill?	Charset	Collation	Comment
*	uid	int	11		☑	☑	☐	☑	☐			
	user_lid	int	11		☐	☐	☐	☐	☐			
	fname	varchar	55		☐	☐	☐	☐	☐	latin1	latin1_swedish_ci	
	lname	varchar	33		☐	☐	☐	☐	☐	latin1	latin1_swedish_ci	
	place	varchar	44		☐	☐	☐	☐	☐	latin1	latin1_swedish_ci	
	phone	varchar	45		☐	☐	☐	☐	☐	latin1	latin1_swedish_ci	
	email	varchar	45		☐	☐	☐	☐	☐	latin1	latin1_swedish_ci	
					☐	☐	☐	☐	☐			

TABLE DESIGN

alert

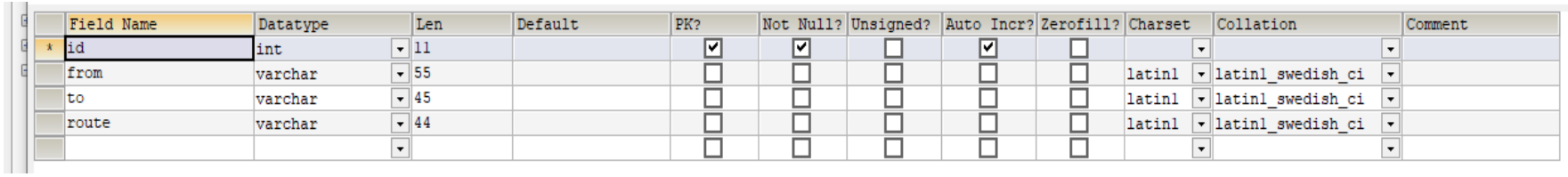
	Field Name	Datatype	Len	Default	PK?	Not Null?	Unsigned?	Auto Incr?	Zerofill?	Charset	Collation	Comment
*	id	int	11		☑	☑	☐	☑	☐			
	imei	varchar	43		☐	☐	☐	☐	☐	latin1	latin1_swedish_ci	
	lattitude	varchar	43		☐	☐	☐	☐	☐	latin1	latin1_swedish_ci	
	longitude	varchar	43		☐	☐	☐	☐	☐	latin1	latin1_swedish_ci	
	image	varchar	43		☐	☐	☐	☐	☐	latin1	latin1_swedish_ci	
	result	varchar	34		☐	☐	☐	☐	☐	latin1	latin1_swedish_ci	
	datetime	varchar	43		☐	☐	☐	☐	☐	latin1	latin1_swedish_ci	
					☐	☐	☐	☐	☐			

track

	Field Name	Datatype	Len	Default	PK?	Not Null?	Unsigned?	Auto Incr?	Zerofill?	Charset	Collation	Comment
*	id	int	11		☑	☑	☐	☑	☐			
	user_lid	int	11		☐	☐	☐	☐	☐			
	lattitude	varchar	54		☐	☐	☐	☐	☐	latin1	latin1_swedish_ci	
	longitude	varchar	54		☐	☐	☐	☐	☐	latin1	latin1_swedish_ci	
					☐	☐	☐	☐	☐			

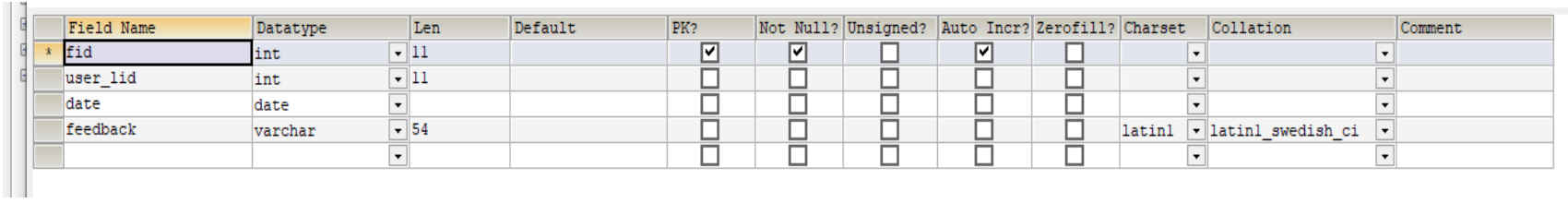
TABLE DESIGN

route



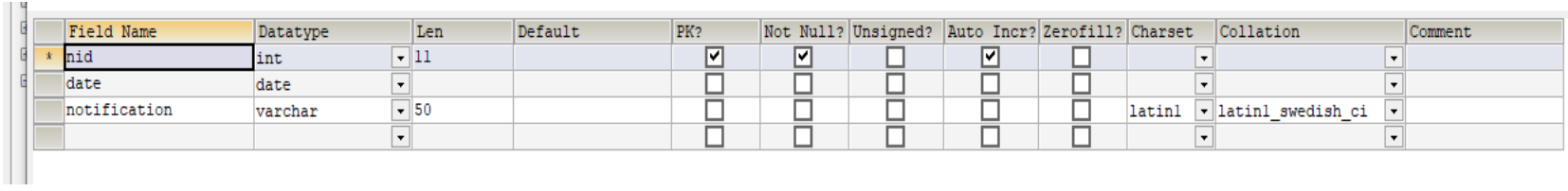
Field Name	Datatype	Len	Default	PK?	Not Null?	Unsigned?	Auto Incr?	Zerofill?	Charset	Collation	Comment
id	int	11		☑	☑	☐	☑	☐			
from	varchar	55		☐	☐	☐	☐	☐	latin1	latin1_swedish_ci	
to	varchar	45		☐	☐	☐	☐	☐	latin1	latin1_swedish_ci	
route	varchar	44		☐	☐	☐	☐	☐	latin1	latin1_swedish_ci	
				☐	☐	☐	☐	☐			

feedback



Field Name	Datatype	Len	Default	PK?	Not Null?	Unsigned?	Auto Incr?	Zerofill?	Charset	Collation	Comment
fid	int	11		☑	☑	☐	☑	☐			
user_lid	int	11		☐	☐	☐	☐	☐			
date	date			☐	☐	☐	☐	☐			
feedback	varchar	54		☐	☐	☐	☐	☐	latin1	latin1_swedish_ci	
				☐	☐	☐	☐	☐			

notification



Field Name	Datatype	Len	Default	PK?	Not Null?	Unsigned?	Auto Incr?	Zerofill?	Charset	Collation	Comment
nid	int	11		☑	☑	☐	☑	☐			
date	date			☐	☐	☐	☐	☐			
notification	varchar	50		☐	☐	☐	☐	☐	latin1	latin1_swedish_ci	
				☐	☐	☐	☐	☐			

TABLE DESIGN

Accident

	Field Name	Datatype	Len	Default	PK?	Not Null?	Unsigned?	Auto Incr?	Zerofill?	Charset	Collation	Comment
*	id	int	11		☑	☑	☐	☑	☐			
	user_id	int	11		☐	☐	☐	☐	☐			
	lattitude	int	11		☐	☐	☐	☐	☐			
	longitude	int	11		☐	☐	☐	☐	☐			
	date	date			☐	☐	☐	☐	☐			
	speed	float			☐	☐	☐	☐	☐			
					☐	☐	☐	☐	☐			

Emergency

	Field Name	Datatype	Len	Default	PK?	Not Null?	Unsigned?	Auto Incr?	Zerofill?	Charset	Collation	Comment
*	ea_id	bigint	20		☐	☐	☐	☐	☐			
	uid	bigint	20		☐	☐	☐	☐	☐			
	latitude	bigint	20		☐	☐	☐	☐	☐			
	longitude	bigint	20		☐	☐	☐	☐	☐			
	description	varchar	50		☐	☐	☐	☐	☐	latin1	latin1_swedish_ci	
	status	varchar	60		☐	☐	☐	☐	☐	latin1	latin1_swedish_ci	
					☐	☐	☐	☐	☐			

Location

	Field Name	Datatype	Len	Default	PK?	Not Null?	Unsigned?	Auto Incr?	Zerofill?	Charset	Collation	Comment
*	uid	bigint	20		☑	☑	☐	☑	☐			
	latitude	bigint	20		☐	☐	☐	☐	☐			
	longitude	bigint	20		☐	☐	☐	☐	☐			
					☐	☐	☐	☐	☐			

DEVELOPING ENVIRONMENT

- OPERATING SYSTEM : WINDOWS 10
- FRONT END : HTML, CSS, JAVASCRIPT
- BACK END : Mysql
- SOFTWARES USED : Jetbrains Pycharm , Android Studio
- TECHNOLOGY USED : python,java
- FRAME WORK USED : Flask

FUTURE ENHANCEMENT

- Provides alert to PWD for repair roads.
- The proposed system deals with the detection of the accidents. But this can be extended by providing medication to the victims at the accident spot.

USER STORY

User Story ID	As a type of User	I want to <perform some task>	So that I can < Achieve Some Goal>
1	Admin	Login	login successful with correct username and password
2	Admin	View User details	Can view registered users
3	Admin	Add& manage notification	Insert ,view & remove notification
4	Admin	View feedback	Can view feedbacks from user
5	Admin	Track user	Track users who are travelling
6	Admin	Add and manage route	Can add and manage route
7	Admin	Add and manage police	Can add and manage police
8	User	Register	Can users register
9	User	Login	Registered users can login with correct username and password
10	User	View profile	View users profile in application
11	User	Road quality alert	Can get alert while travelling
12	User	Feedback	Can provide feedback
13	User	View route	Can view route in application
14	user	Set Emergency number	Can set emergency number
15	user	Block notification	Can get notification even if a block occur
16	user	Send accident alert	Send alert to emergency number
17	police	Login	Police can login
18	police	View notification	Can view the notification from admin
19	police	View accident alert	Can view the accident alert

PROJECT PLAN

User Story ID	Task Name	Start Date	End Date	Hours	Status
7	Sprint 1	20/04/2022	25/04/2022	10	completed
14		27/04/2022	07/05/2022		completed
16	Sprint 2	08/05/2022	20/05/2022	8	Completed
17	Sprint 3	21/05/2022	23/05/2022	17	Completed
18		24/05/2022	28/05/2022		Completed
19		30/05/2022	05/06/2022		completed
19	Sprint 4				planned
15					planned

PRODUCT BACKLOG

User Story ID	Priority <High/Medium/Low>	Size (Hours)	Sprint <#>	Status <Planned/In progress/Completed>	Release Date	Release Goal
1	Medium	5	1	Completed	25/04/2022	Form design
2	High	5		Completed	07/05/2022	coding
3	High	8	2	Completed	20/05/2022	Dataset creation,preprocessing and training
5	High	6	3	Completed	23/05/2022	Sensor value colllection
6	medium	6		Completed	28/05/2022	Server communication
7	High	5		completed	05/06/2022	Prediction and send sms
7	Medium		4	planned		Traffic prediction
8	High			planned		Output generation

SPRINT BACKLOG

Backlog Item	Status And Completion Date	Original Estimation in Hours	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14
UserStory#1,#2,#3			hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs
Form Designing	25/04/2022	5	0	0	1	1	1	0	0	0	1	0	0	1	0	0
Coding	07/05/2022	5	0	0	0	0	0	1	1	1	1	1	0	0	0	0
UserStory#4, #5																
Dataset creation	20/05/2022	8	0	0	1	0	0	1	0	1	1	1	1	1	1	0
UserStory#6,#7																
Sensor value collection	23/05/2022	6	1	1	1	0	1	1	1	0	0	0	0	0	0	0
Server communication	28/05/2022	6	0	0	0	0	0	0	1	1	1	1	1	1	0	0
SMS alert	05/06/2022	5	0	0	0	0	1	1	0	1	0	1	1	0	0	0
UserStory#8,#9																
Traffic prediction																
OutputGenaration																
Total																

ACTUAL SPRINT

Backlog Item	Status And Completion Date	Original Estimation in Hours	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14
UserStory#1,#2,#3			hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs
Form Designing	25/04/2022	5	0	0	1	1	1	0	0	0	1	0	0	1	0	0
Coding	07/05/2022	5	0	0	0	0	0	1	1	1	1	1	0	0	0	0
UserStory#4, #5																
Dataset creation	20/05/2022	8	0	0	1	0	0	1	0	1	1	1	1	1	1	0
UserStory#6,#7																
Sensor value collection	23/05/2022	6	1	1	1	0	1	1	1	0	0	0	0	0	0	0
Server communication	28/05/2022	6	0	0	0	0	0	0	1	1	1	1	1	1	0	0
SMS alert	05/06/2022	5	0	0	0	0	1	1	0	1	0	1	1	0	0	0
UserStory#8,#9																
Traffic prediction																
OutputGenaration																
Total																


Thank
you