

# **Road Surface Quality Inspection System**

Developed For

**(AMOGH TECHNOPRENEURES LLP, Ahmedabad)**

Report Part- I (Sem – V)

Submitted For

The Partial Fulfilment Towards

The Degree of

**Bachelor of Computer Applications (BCA)**

By

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**Faculty of Computer Applications & IT**  
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## AMOGH TECHNOPRENEURES LLP

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Letter No: ATL/PROJ/STU/GLS/CERTI/2019/02

Date: 18/09/2019

This is to certify that Mr.Himanshu Joshi, Ms. Niharika Srivastava and Ms. Isha Mishra are students of FCAIT (BCA Programme), GLS University, Ahmedabad being mentored by us.

They have successfully completed their first phase of Software Development Project (SDP) titled as “**Road Surface Quality Inspection System**”.  
In the first phase of SDP they have accomplished following tasks under our guidance.

- System Analysis
- UML Diagrams
- Data Dictionary
- Initial Screen Layouts

During this phase we have found them sincere, hardworking and dedicated in achieving the milestones.

Yours Sincerely,



Amit Finaviya

Director- Administration  
Amogh Technopreneures LLP

GLS UNIVERSITY  
Faculty of Computer Applications & IT, BCA Programme  
Ahmedabad

**CERTIFICATE**

This is to certify that

- 1) Himanshu Joshi
- 2) Niharika Srivastava
- 3) Isha Mishra

Students of Semester-V (TYBCA), FCAIT, GLS University have successfully completed the System Development Project Part-1, System Analysis work on “Road Surface Quality Inspection System” as a partial fulfilment of the study of Third year Semester-V, Bachelor of Computer Applications (BCA).

Date of Submission: 16/9/19

**Prof. (Poonam Dang)**  
Project Guide

**Prof. Tripti Dodiya**  
Project Co-Ordinator

# **ACKNOWLEDGEMENT**

We would like to express our sincere gratitude to our **Dean, Faculty of Computer Applications and IT, R.P. Soni** sir and our **Project Head, Dr. Ankit Bhavsar** sir for providing us constant support and mentoring from the institute. We are very thankful to our **Project Guide Prof. Poonam Dang** mam for her encouragement and constant support during the research and development conducted during this project. This project would have not been successful without their guidance and mentoring.

We would also like to thank Faculty of Computer Applications and IT for giving us this opportunity to explore a new field of research and provide essential resources for the same.

Also, we are very thankful to our external guide **Director (Administration), Amogh Technopreneurs LLP, Mr. Amit Finaviya** for supporting and guiding us always.

Through this project we learnt teamwork, new technologies, programming languages, hardware and also discovered a new domain in the field of computer applications.

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Date: 18/09/2019

## Company Profile

Amogh Technopreneures LLP is an innovation driven Startup Company based in Ahmedabad and actively working in the field of electronics, embedded systems and computer applications-based solutions to the society.

We possess our own multidisciplinary R&D laboratory and design and develop completely indigenous technologies in India with our domain expertise in the field of advance physics, optics, scientific and commercial electronics. We are working in close association with the Academia for the trainings and development of new technologies. We also provide a technical consultancy to technological based startups and industrial companies.

We are a manufacturer of LED decorative lighting products in the consumer electronics segment and are promoting Make in India program of our Prime Minister to save energy and transforming innovations into employment opportunities for sustenance and Nation Building.

Our Dream and moto are self-reliant development in India which is excelling in all fields with completely indigenous innovations.



Amit Finaviya

Director- Administration

Amogh Technopreneures LLP

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# **Project Profile**

**Title-** Road Surface Quality Inspection System

## **Objective-**

To develop an integrated cost-effective device (to be installed on vehicles) having the capability to determine the bad surface quality roads (rough surface roads, rough speed bumps, potholes...etc) and give this information along with the location and video proof to the organization. This will help the organization to recognize bad quality roads easily and then they can take appropriate actions for improving them.

## **Project Description-**

- i) Our device enables to accurately detect and record information about particular bad surface roads during a journey. It estimates the road surface quality by recognizing the bumps a vehicle faces while travelling with the help of an accelerometer sensor which works by getting values from its 3 axis (X,Y,Z).
- ii) Also, it has a GPS module installed within which gives the exact coordinates of a place where a road problem is detected.
- iii) A camera would be recording the entire journey and the video file which would be created would be stored inside a memory card attached to the microcontroller.
- iv) At the end of the journey, the memory card would have to be removed from our device and the information read from it would be fed into our web application and a video trimming software by the admin. The result would be displayed on our website which will show all the roads having problem in the entire road journey through pins on a google map and also video proof of each particular location mentioned on the map.
- v) An android application will also be available for construction workers where they would get details of the place allotted to them by the organization to work on and they will also have the facility to click photos and shoot videos of the progress of their work. This proof will be available on the web application enabling the organization to track the progress on a regular basis.
- vi) The android application would also be available to the general public for registering complaints and uploading proofs of bad roads in order to report additional information to the organization.

## **Tools and Technologies used (Module-wise)-**

### **i) Single Board Computer-**

A single board computer (Raspberry Pi) would be used which would consist of the accelerometer sensor, GPS module, camera, memory card...etc. All these components would be integrated to build the device for accurate detection of bad surface roads.

The 3 axis-accelerometer sensor would accurately detect the difference between smooth roads and rough surfaced roads by its change in values obtained by different axis (X, Y, Z). The organization can then get to know the difference between different surface of roads.

### **ii) Admin-**

Web-application: for viewing the information obtained during the road journey. As well as viewing and monitoring all the progress uploaded by workers and complaints registered by general public.

**Technologies to be used-** MD Bootstrap, Express server.

Admin panel: for uploading, deleting and maintaining data of different roads where problem was detected during the journey.

### **iii) User-**

Mobile-based application:

Admin- The main admin will assign places to different team of workers where they have to work, upload important notification and monitor regular progress of work.

User- The workers will have the facility to get information about the particular location (based on coordinates on a map) they have to work in, know important updates and upload regular progress. The application would also be used by general public to register complaints.

**Technology to be used-** Android Studio, MySQL, Heroku.

## **Future Scope-**

To add Artificial Intelligence for automating the process of analysis of bad surface roads without any human interference.

**Technology to be used-** TensorFlow/FastAPI.



## **Existing System -**

- For inspecting the road quality of national and state highways, local roads agencies like NHAI (National Highway Authority of India), State agencies, Municipal bodies. etc are deputing surveyors and road inspectors which personally inspect and report the quality and need for resurfacing upon the roads.
- These are done manually and cannot be accurately documented due to varying wear and tear in different parts of the road on any long stretch because of different traffic volumes, road service conditions, climatic factors and terrains.
- These inspectors physically travel in inspection patrol vehicles which may or may not have proper shock absorbers and travel at varying speeds which reduces the probability of identifying potholes properly.

## **Proposed System –**

- Our proposed system will not spare any pothole or rough-surface roads and mark all the potholes with accurate geo-tagging. This system will provide automated data logging by the actual road surface scan measured by rolling wheels without any use of shock absorbers.
- For this, accelerometers are used as basic sensors which detect the minute changes in Gforce experienced by the moving platform. The measurement of vibration or shock measured by the accelerometers are augmented with video footage collection for every triggering event beyond a pre-set allowable shocking/jerk value.
- Along with the video footage, real time GPS location with 6 digits in fraction for both latitude and longitude in which the last digit corresponds to  $1/10^{\text{th}}$  of a meter in accuracy.
- The speed of acquiring and logging data in the database shall be normalized with the vehicle speed which is not constant, and which otherwise shall tend to add errors at data acquired at higher speeds.
- This compensation shall also be incorporated in the data while logging. This system will rapidly provide data and enable the managers to distribute the work among available ground staff to complete the task with proper sharing.

# **UML Diagrams**

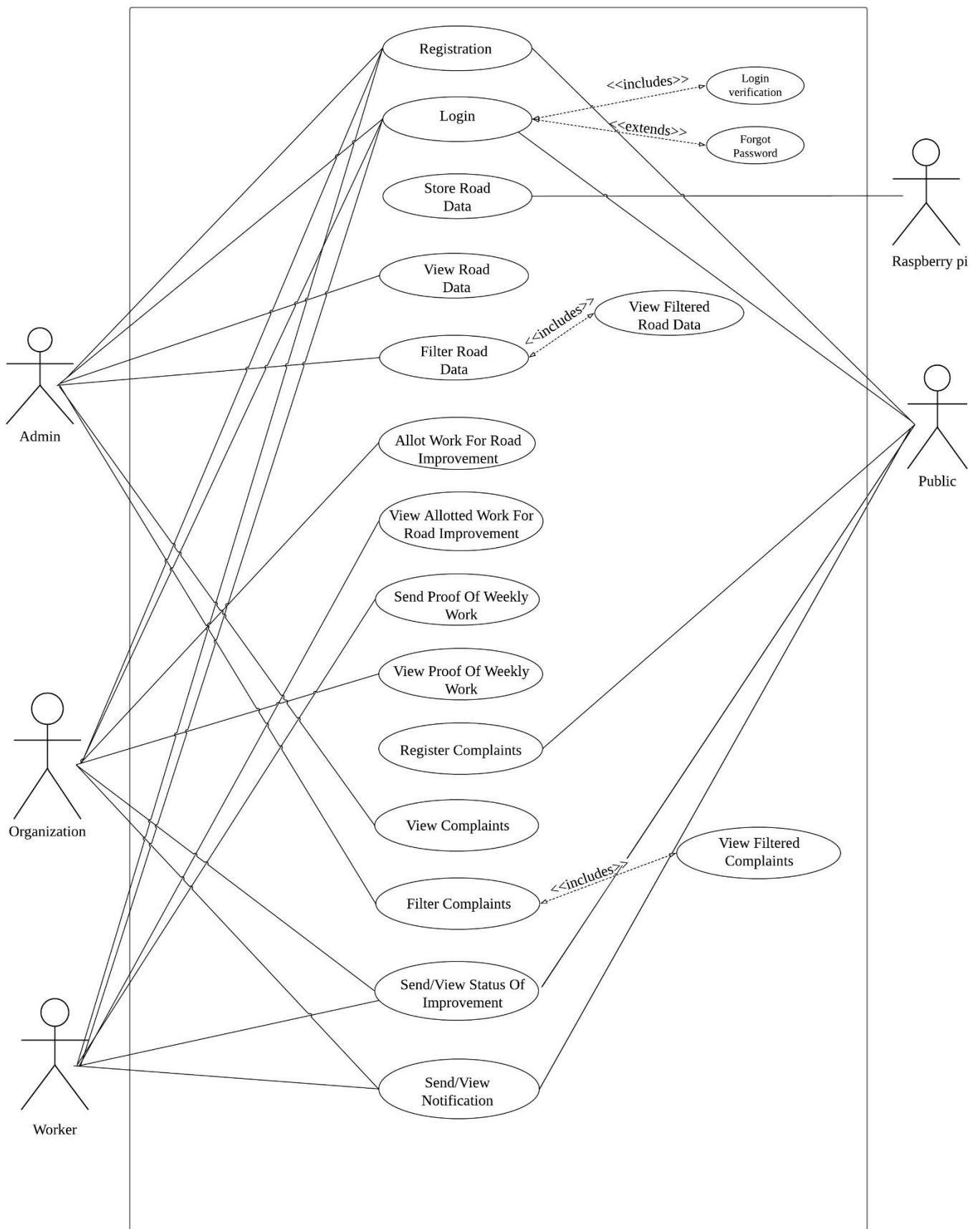
## **1. Use-Case Diagram:**

The Use-Case Diagram capture the function requirements of the system and elaborates the relationship of different users and their interactions with the system. It describes the set of sequence of actions (use cases) which are performed by each actor.

First of all, the admin requests to retrieve road data from Raspberry Pi (hardware). Then Raspberry Pi fetches the road data (GPS coordinates, video file, accelerometer sensor reading) and after that the admin accesses it. Then, the admin filters the road data and discards the unwanted data (e.g. Wrongly captured speed bumps as visible in the video file). This filtered data is provided to the organization in the form of pin locations on a map and video proof of each pin location on the website made for the organization.

The organization in turn evaluates the results and decides to take action on the bad roads. It allocates work to workers which is visible on the mobile application for workers where each worker can see his allotted work location and receive important notifications from the organization. The worker can also send weekly proof of work completed by uploading photos or videos on their mobile application which will be then visible to the organization on their website.

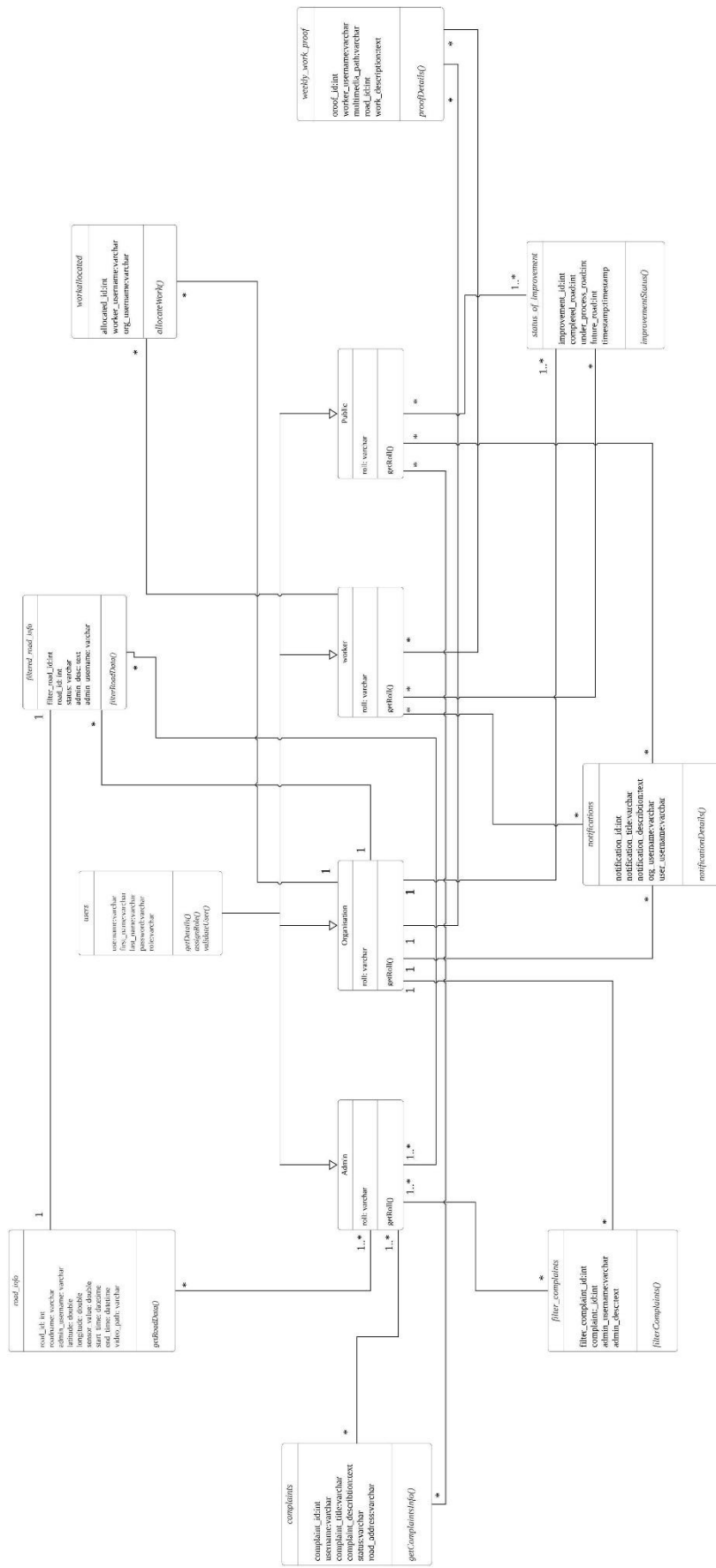
The mobile application is also available for general public on which they will have the facility to register complaints regarding bad roads. These complaints will be first reviewed by the admin and irrelevant complaints will be discarded by him/her. The filtered complaints would then be sent to the organization and they can decide to take action on it further. Also, the organization can update the status of improvement of roads for both the workers and the general public to see.



## 2. Class Diagram:

The Class Diagram captures the static structure of the system by showing the system's classes, their attributes, operations (or methods), and the relationships among objects. Our system uses 9 main classes interrelated to each other. They are:

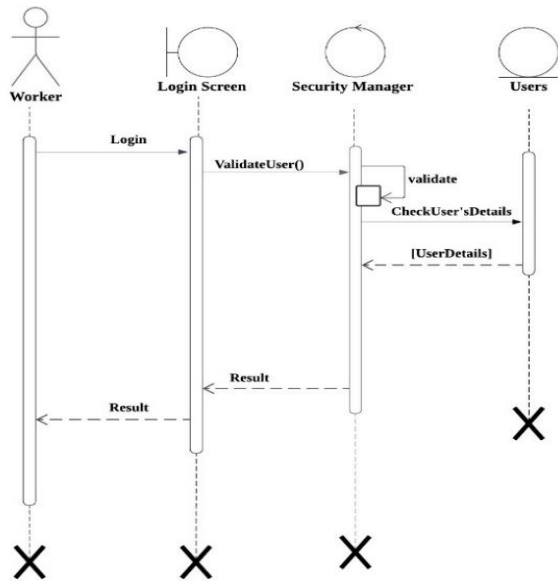
- i) users-** The users class stores the information of all the users who have registered to the system. It also stores the role of each user – admin/organization/worker/public.
- ii) road\_info-** The road\_info class stores the raw road data fetched by the hardware and delivered to the admin initially.
- iii) filtered\_road\_info-** The filtered\_road\_info class stores the filtered road data which has been filtered by the admin for the organization to view.
- iv) workallocated-** The workallocated class stores all the information of the work that the organization allocated to the workers.
- v) weekly\_work\_proof-** The weekly\_work\_proof class stores all the proof details that a worker uploads for the organization to see.
- vi) complaints-** The complaints class stores the complaint details that the general public registers on the mobile application.
- vii) filter\_complaints-** The filter\_complaints class stores the relevant complaints that are filtered by the admin for the organization to see.
- viii) notifications-** The notifications class stores all details regarding the notifications that the organization send for the workers and the general public.
- ix) status\_of\_improvement-** The status\_of\_improvement class stores all details regarding the improvement status of particular roads(completed\_road/under\_process\_road/future\_road) that the organization send for the workers and the general public.



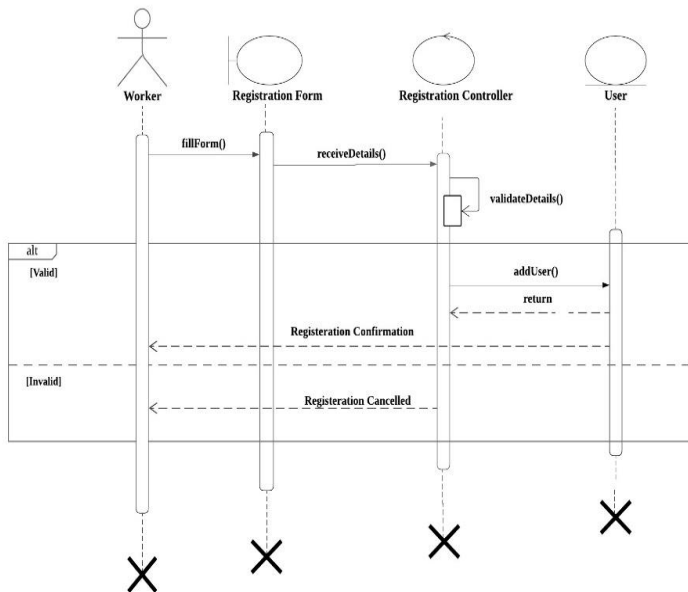
### 3. Sequence Diagram:

The Sequence Diagram depicts interaction between objects in a sequential order i.e. the order in which these interactions take place. It represents individual use cases.

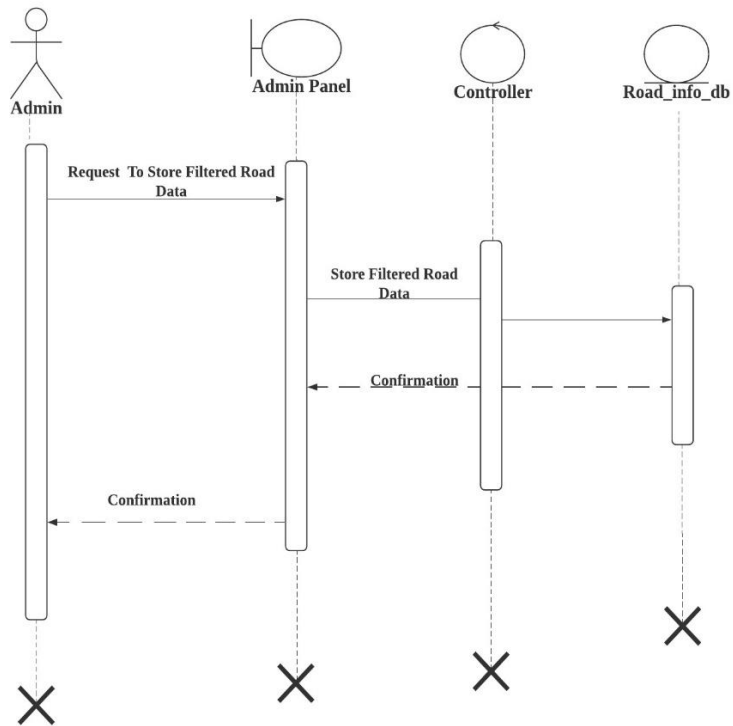
#### i) Login Sequence Diagram-



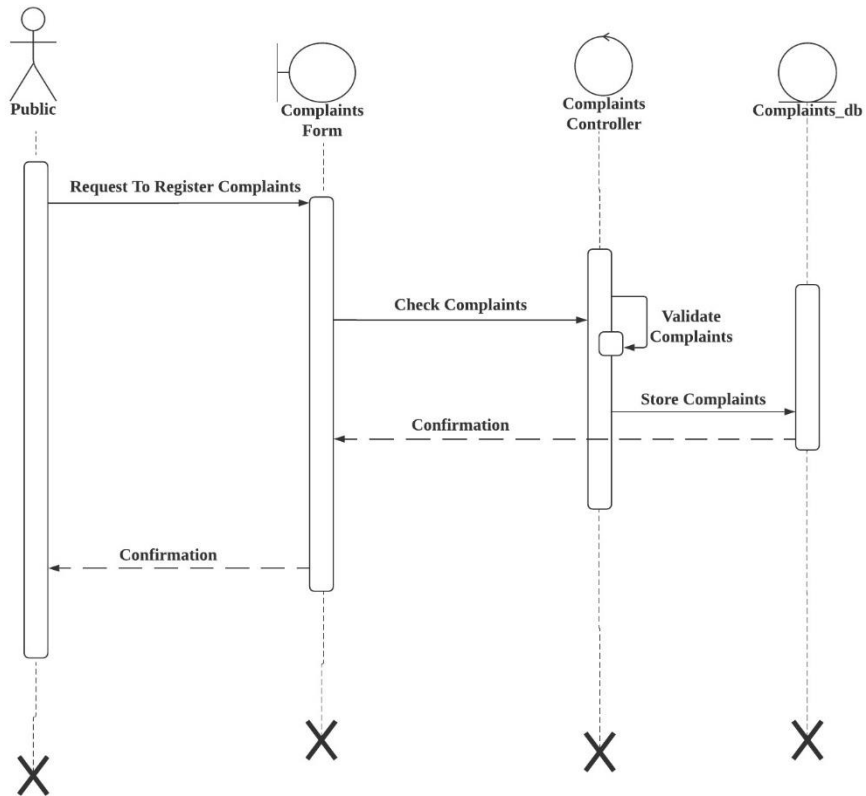
#### ii) Registration Sequence Diagram-



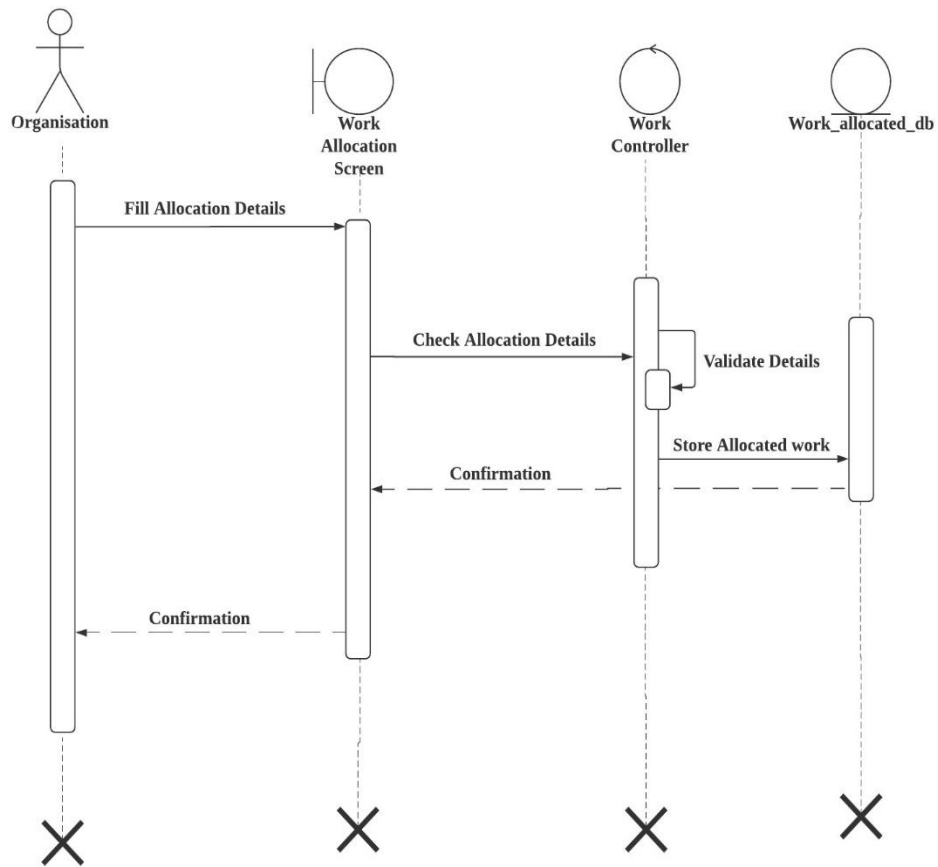
### iii) Admin Storing Filtered Road Data Sequence Diagram-



### iv) Public Storing Complaints Sequence Diagram-



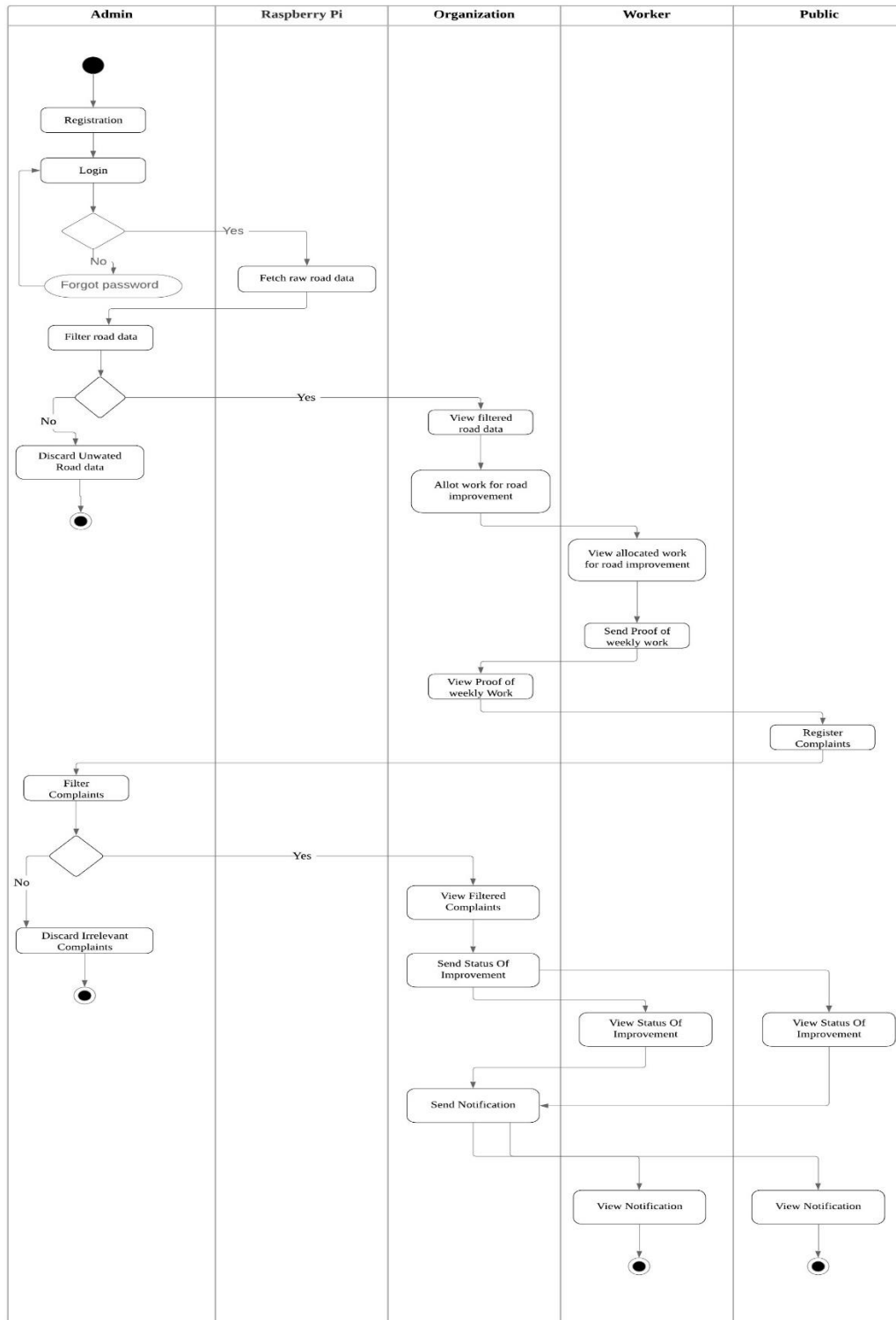
v) Organization Doing Work Allocation Sequence Diagram-





## 4. Activity Diagram:

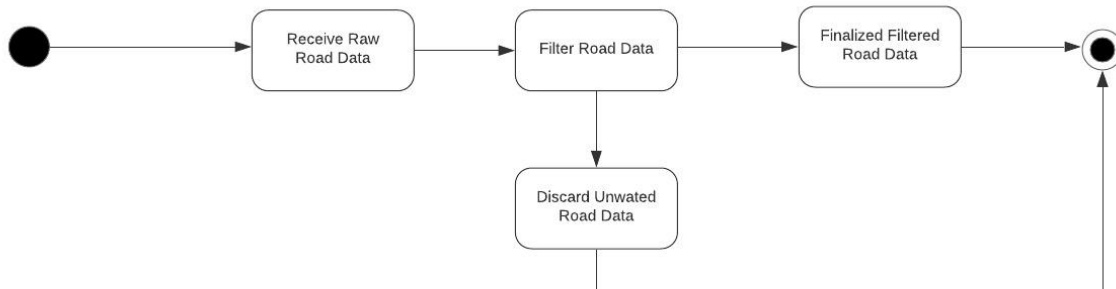
The Activity Diagram shows the dynamic aspect of the system. It is basically a flowchart to represent the flow from one activity to another activity. The activity can be described as an operation of the system. The control flow is drawn from one operation to another. Different users and roles are depicted by swimlanes.



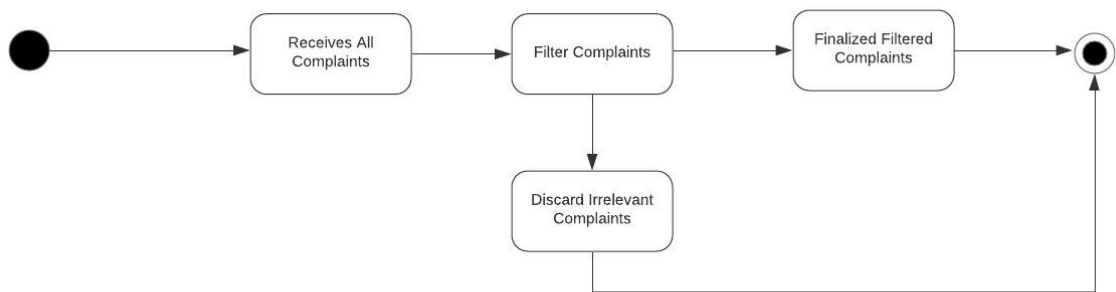
## 5. State Chart Diagram:

State Chart diagram defines the behavior of system and represents different states of an object during its lifetime. These states are changed by events. It is useful in capturing reactive systems.

i) Filter Road Data State Chart Diagram-



ii) Filter Complaints State Chart Diagram-



# Data Dictionary

- users:** This table contains the basic information regarding a user. It also distinguishes a user as an admin, organization, worker and public by accepting his/her role.

Column	Type	Null	Default	Links to	Comments	MIME
user_name (Primary)	varchar(20)	No			primary key of users table	
first_name	varchar(20)	Yes	NULL		first name of user	
last_name	varchar(20)	Yes	NULL		last name of user	
email	varchar(30)	No				
phone_number	varchar(30)	No				
password	varchar(30)	No			password of user	
role	varchar(20)	Yes	NULL		role of user (admin,workers,public,organisation,)	
timestamp	timestamp	No	current_timestamp()			

- road\_info:** This table receives all the raw data about different roads and their parameters from raspberry pi. The data in this table needs to be sent for further filtration.

Column	Type	Null	Default	Links to	Comments	MIME
road_id (Primary)	int(20)	No			primary key of road_info table	
roadname	varchar(100)	No			name of current road	
admin_username	varchar(20)	No		users -> user_name	admin userid who bring this information form raspberry pi	
latitude	double	No			latitude of road	
longitude	double	No			longitude of road	
sensor_value	double	No			proxy sensor data in format x,y,x	
starting_time	datetime	No			staring time of raspberry pi	
ending_time	datetime	No			ending time of raspberry pi	
video_path	varchar(30)	No			pi cam video file path	

- filtered\_road\_info:** This table stores the road data which has been filtered by the admin and it is used throughout the system.

Column	Type	Null	Default	Links to	Comments	MIME
filter_road_id (Primary)	int(11)	No			primary key of filtered road table	
road_id	int(11)	No		road_info -> road_id	foreign key of road_info table	
status	varchar(20)	No	work not started yet		filtered road status (under progress,completed,etc)	
admin_desc	text	No				
admin_username	varchar(20)	No		users -> user_name	userid of person who filtered this road	

- complaints:** It stores all the complaints registered by public which might require filtering by admin as some complaints might be vague or repetitive.

Column	Type	Null	Default	Links to	Comments	MIME
complaint_id (Primary)	int(11)	No			primary key of complaints table	
username	varchar(20)	No		users -> user_name	user id of person who send this complaint	
complaint_title	varchar(100)	No			Title of complaint	
complaint_description	text	No			Description of complaint	
status	varchar(30)	No			Current complaint status (active,not active)	
road_address	varchar(100)	No			full address of road	

- filtered\_complaints:** It stores all the complaints which have been filtered by the admin and are further forwarded to the organization for taking action upon.

Column	Type	Null	Default	Links to	Comments	MIME
filter_complain_id (Primary)	int(11)	No			primary key of filtered complain table	
complain_id	int(11)	No		complaints -> complaint_id	foreign key of complaints table	
admin_username	varchar(20)	No		users -> user_name	user id of person who filtered this complaints	
admin_desc	text	No				

6. **work\_allocated:** This table stores details of the work allocated by the organization to workers and links them together.

Column	Type	Null	Defaults	Links to	Comments	MIME
allocate_id(Primary)	int(11)	No			Primary key of work allocated table	
worker_username	varchar(20)	No		user->user_name	Foreign key of users table when work allocated by organization	
org_username	varchar(20)	No		user->user_name	Foreign key of users table who allocated work to worker	
road_id	int(11)	No		filtered_road_info>filter_road_id	Foreign key of filtered road table which is allocated for work	
work_description	text	No			description of work allocated	

7. **weekly\_work\_proof:** This table stores details of the proof of work which the worker sends to the organization on a weekly basis.

Column	Type	Null	Default	Links to	Comments	MIME
proof_id (Primary)	int(11)	No			primary key of weekly work proof table	
worker_username	varchar(20)	No		users -> user_name	foreign key of userid who send this proof and whose role is worker	
mutimedia_path	varchar(30)	No			full path of proof(image or video)	
road_id	int(11)	No		filtered_road_info -> filter_road_id	foreign key of filtered road table whose status is underprocess	
work_description	text	No			description of work that worker done up to date	

8. **status\_of\_improvement:** This table stores the status of improvement of roads which is updated by the organization regarding the roads whether they are under process, are completed or are to be considered in future for development.

Column	Type	Null	Default	Links to	Comments	MIME
improvement_id (Primary)	int(11)	No			primary key of status of improvement table	
completed_road	int(11)	No		filtered_road_info -> filter_road_id	foreign key of filtered road info table where status is completed	
under_process_road	int(11)	No		filtered_road_info -> filter_road_id	foreign key of filtered road info table where status is under process	
future_road	int(11)	No		filtered_road_info -> filter_road_id	foreign key of filtered road info table where status is not active	
timestamp	timestamp	No	current_timestamp()			

9. **notification:** This table stores the status of improvement of roads which is updated by the organization regarding the roads whether they are under process, are completed or are to be considered in future for development.

Column	Type	Null	Default	Links to	Comments	MIME
notification_id (Primary)	int(11)	No			primary key of notification table	
notification_title	varchar(100)	No			Title of message	
notification_description	text	No			message	
org_username	varchar(20)	No		users -> user_name	sender user id	
user_username	varchar(20)	No		users -> user_name	receiver userid	

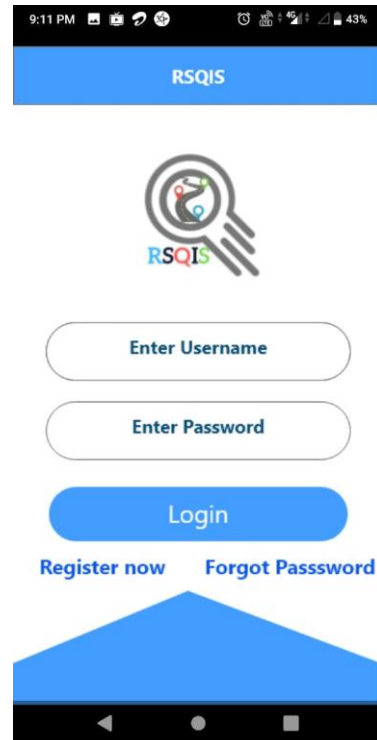
# Sample Screen Layouts

## 1. Mobile Application-

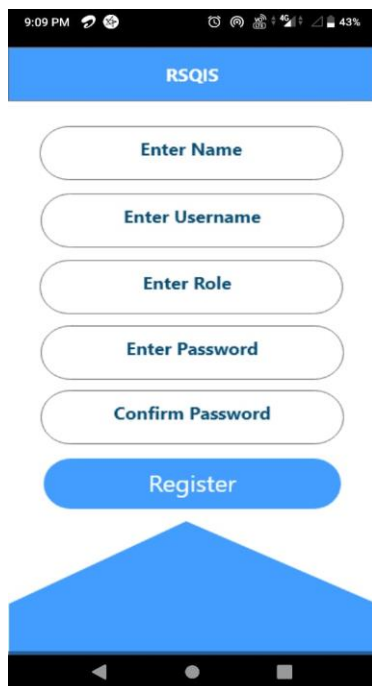
### i) Splash Screen



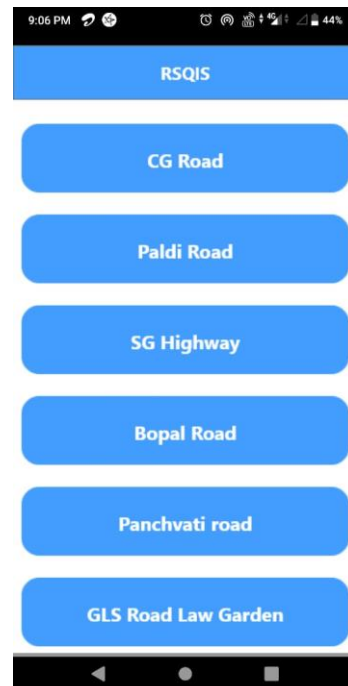
### ii) Login Screen



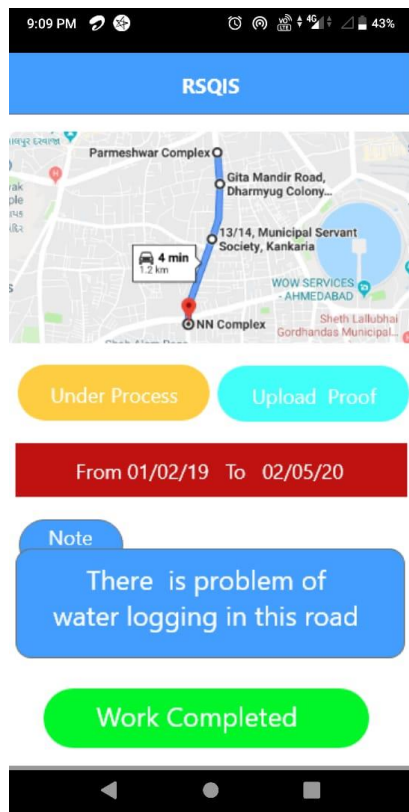
### iii) Registration Screen



### iv) Dashboard



## vi) Work Allocated Screen



## 2. Website-

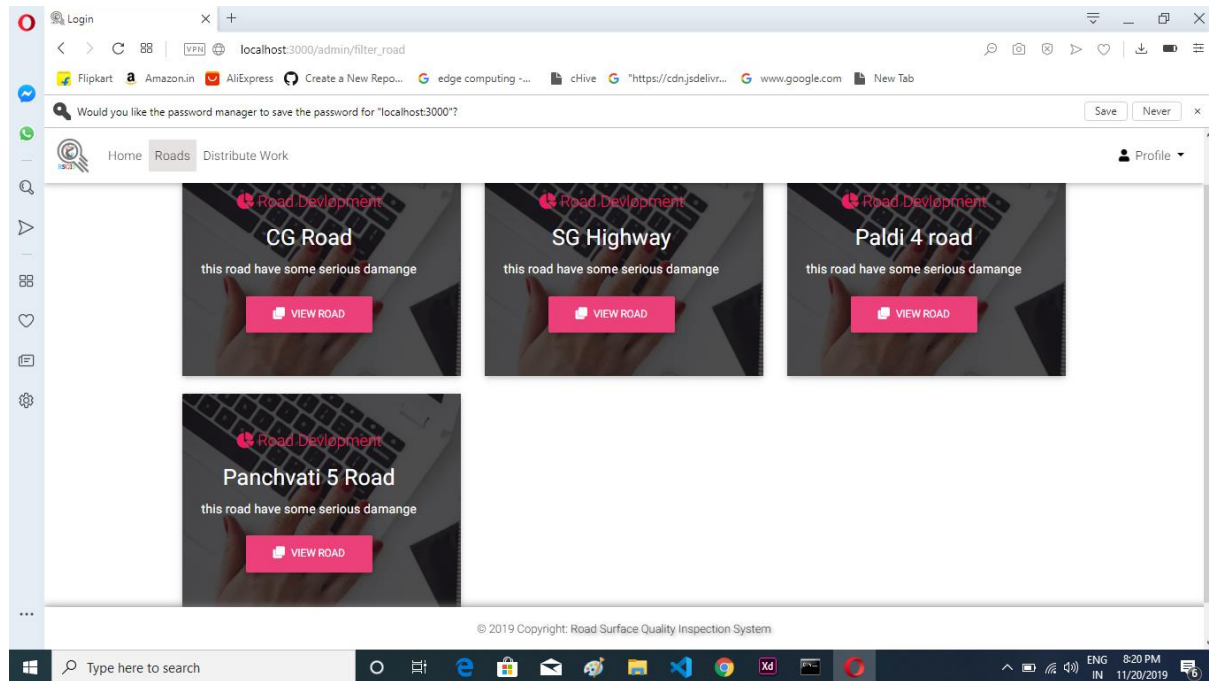
### i) Sign-in Screen

The screenshot shows a web browser window with the address bar displaying 'localhost:3000'. The page title is 'Login'. The main content area has a light yellow background and contains a 'Sign in' form. The form includes a 'username' input field, a password input field with masked characters '.....', a 'Forgot password?' link, a blue 'SIGN IN' button, and a 'Not a member? Register' link. The footer of the page reads '© 2019 Copyright: Road Surface Quality Inspection System'. The Windows taskbar at the bottom shows the system clock as 8:18 PM on 11/20/2019.

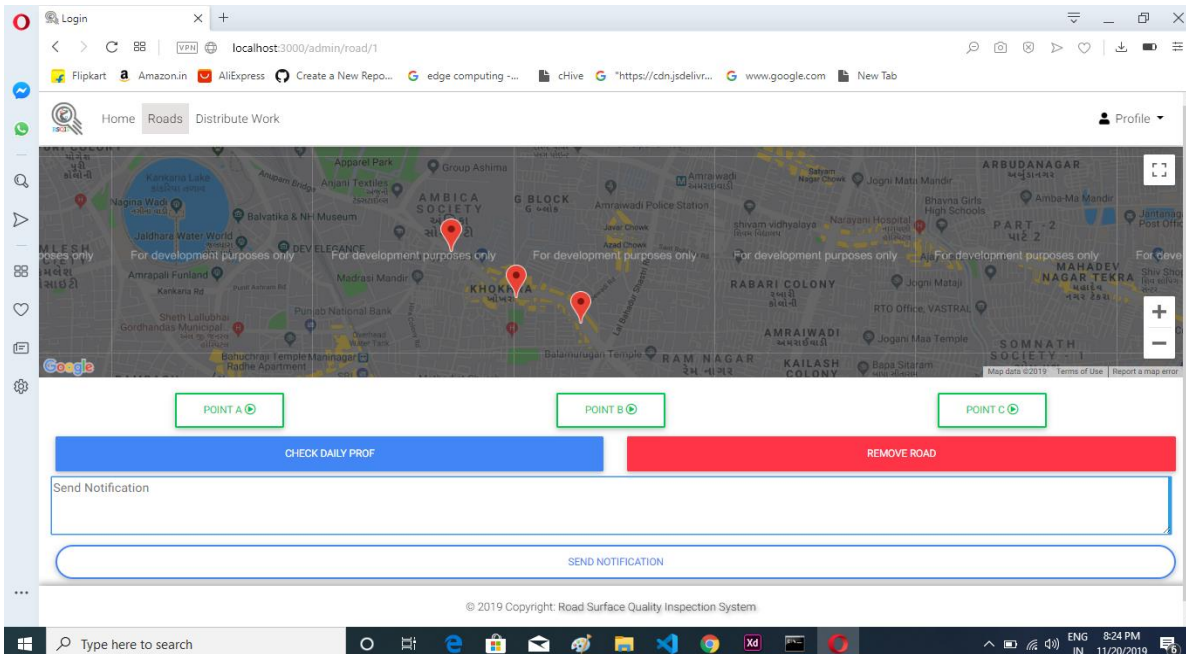
### ii) Sign-up Form

The screenshot shows a web browser window with the address bar displaying 'localhost:3000/register'. The page title is 'Register'. The main content area has a light yellow background and contains a 'Sign up' form. The form includes input fields for 'First name', 'Last name', 'E-mail', 'Password', and 'Phone number'. Below the 'Password' field is a note: 'At least 8 characters and 1 digit'. Below the 'Phone number' field is a note: 'Optional - for two step authentication'. A blue 'SIGN UP' button is at the bottom of the form. The footer of the page reads '© 2019 Copyright: Road Surface Quality Inspection System'. The Windows taskbar at the bottom shows the system clock as 8:26 PM on 11/20/2019.

### iii) Dashboard



### iv) Road Details





## **Conclusion**

The practical implementation of this system is necessary to manage large number of road maintenance activities needed on vast road networks that are maintained by different national, state and city agencies. This pilot project has proven its worth not only in rapid road inspection reporting but shall also facilitate the repairs to be undertaken precisely at the places they are required and help the managers to verify the completion of tasks in order to release payments to the contracting agencies. This instrument will prove its special ability to justify the road quality of express highways which are intended for high speed travel with safety and where even longer curves create bigger jerks on passengers travelling at high speeds. This system shall empower the road maintenance team to undertake proper re-surfacing of roads with regards to minor concave or convex surfaces which although are not visible by eyes but take a toll on passengers' comfort during their travel.

# **Bibliography**

- <https://github.com/>
- <https://stackoverflow.com/>
- <https://developer.android.com/>
- <https://www.lucidchart.com/pages/>
- <https://www.udemy.com>
- <https://www.youtube.com/>