# WEB BASED SOLUTION FOR ROAD MANAGEMENT AND PUBLIC COMPLAINT REGISTRY

**A PROJECT REPORT**

***Submitted by***


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## BONAFIDE CERTIFICATE

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## ABSTRACT

The web application aims to provide a comprehensive solution for road maintenance and management. It will allow users to report road issues such as potholes, cracks, and other damages, and track the status of their requests. Additionally, the application will provide a platform for road inspectors to schedule and conduct maintenance activities, as well as generate reports on road conditions and maintenance efforts. The system will also incorporate features for budget tracking, resource allocation, and performance evaluation. Overall, this web application will improve communication and efficiency in road maintenance and management, leading to safer and more reliable road infrastructure. The web application for road maintenance and management system is designed to streamline the process of managing road infrastructure. It provides a centralized platform for all stakeholders involved in the maintenance process, including citizens, road inspectors, and government agencies. In addition to the citizen reporting system, the web application also provides a platform for road inspectors to schedule and track maintenance activities. This includes creating work orders, assigning resources, and tracking progress. The application can also generate reports on road conditions and maintenance efforts, providing valuable data for decision making and resource allocation. Overall, this web application for road maintenance and management system aims to improve the efficiency and transparency of the road maintenance process, leading to better road infrastructure and safer roads for all.

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| | |
|---|---|
| API | Application Programming Interface |
| CRATER | Crowd Sensing Application To Estimate Road conditions |
| GIS | Geographic Information System |
| GPS | Global Positioning System |
| IP | Internet Protocol |
| J2EE | Java 2 Platform Enterprise Edition |
| PCI | Pavement Condition Index |
| RMMS | Road Maintenance and Management System |
| SDE | Spatial Database Engine |
| TCP | Transmission Control Protocol |
| UML | Unified Modeling language |

# CHAPTER 1

# INTRODUCTION

## 1.1 OVERVIEW

The system is designed to streamline and simplify the process of maintaining and managing the roads in your community. Our goal is to provide a centralized platform that makes it easy to report road problems, track progress, and collaborate with relevant stakeholders. Whether you're a resident, road maintenance worker, or local government official, this application provides the tools need to keep our roads safe and well-maintained. With real-time updates and notifications, can stay informed and up-to-date on the status of road maintenance projects. It help to maintain and manage your roads these issues by providing a centralized platform for all stakeholders involved in the road maintenance process. Citizens can easily report road issues, and road inspectors can efficiently schedule and conduct maintenance activities. Additionally, government agencies can use the data provided by the application to make informed decisions about budget allocation and resource management. The process of managing road infrastructure. Road maintenance is a crucial aspect of transportation infrastructure, as it ensures the safety and reliability of the roads for both pedestrians and vehicles. However, the current system for managing road maintenance can be disjointed and inefficient, with citizens having limited means of reporting issues and government agencies struggling to manage their resources and prioritize repairs. The efficient management of road networks is crucial for ensuring the safety of road users and promoting economic development. However, road maintenance and management can be a daunting task, especially for government agencies responsible for large road networks. Road maintenance and management involves a range of activities, including assessing road conditions, identifying maintenance needs, planning maintenance activities, and monitoring their implementation. To support these activities, a web application that streamlines the road maintenance and management process can be an invaluable tool. This document provides an introduction to the

proposed road maintenance and management web application. Road maintenance and management are essential components of transportation infrastructure management. The quality of road infrastructure affects the economy, environment, and social wellbeing of communities. Poorly maintained roads can cause accidents, increase travel time, reduce fuel efficiency, and negatively impact the environment. Therefore, it is crucial to adopt a proactive approach to road maintenance and management to ensure the safety and wellbeing of road users. Traditionally, road maintenance and management were paper-based and time-consuming, making it difficult to keep track of maintenance needs and plan activities effectively. However, advances in technology have made it possible to develop web applications that can simplify road maintenance and management. The proposed web application aims to provide an integrated solution that streamlines the road maintenance and management process, enhances data collection and analysis, and promotes collaboration among stakeholders. One of the main features of this web application is the ability for citizens to report road issues directly through the application. This includes identifying the location of the problem and providing details of the issue. Once the report is submitted, road inspectors can schedule and conduct inspections to assess the severity of the issue and prioritize repairs accordingly.

## 1.2 OBJECTIVE

The Road maintenance and management web application is to efficiently manage and maintain roads by monitoring and tracking their condition, prioritizing maintenance activities, managing work orders for repairs, and providing reporting and analytics to facilitate decision-making and collaboration between departments involved in road maintenance and management. By achieving these objectives, the web application aims to improve road conditions and enhance the safety of drivers and pedestrians.

# CHAPTER 2

# LITERATURE SURVEY

## 2.1 DEVELOPMENT OF ROAD MAINTENANCE MANAGEMENT SYSTEM BASED ON WEBGIS

**Authors: Feng Xiao , Zhou Hongyu , YuCaixia**

### Abstract

Based on an analysis of the current research and application of Road maintenance, geographic information system (WebGIS) and ArcGIS Server, the platform overhead construction for Road maintenance development is studied and the key issues are presented, including the organization and design of spatial data on the basis of the geodatabase technology, middleware technology, tiles cache index technology and dynamic segmentation of WebGIS. Road maintenance geographic information platform is put forward through the researching ideas of analysis of the system design. The design and application of WebGIS system are discussed on the basis of a case study of BaNan district of Chongqing highway maintenance management .The feasibility of the theories and methods are validated through the system.

### Introduction

In India infrastructure plays important role which include highways, dams, bridges, flyovers, airports, sea-links . by using road network achieved a very important position in the overall transportation sector in India. India has 2nd largest road network in the world in which the part of rural road network is large. Population growthrate of the country is high so the percentage of road user's increases. The road traffic is tremendously increasing, 60% of all goods and 85% of all passengers' are transported by using road network. So more importance is now given to rural road network to make the main cities and rural area well connected In a developing country like India, transportation projects are undertaken upon the basis of initial cost of construction owing to the negligence of future costs (i.e. M & O costs)

incurred in the entire life of the project. This has been done because of lack of funds from the government than the required in the development of infrastructure. Such decisions had led most of the infrastructure projects throughout the country in deteriorating condition or failure since underestimate the necessary future uncertainties associated in the project. Road projects are one of the infrastructure projects that are facing such situation in recent era. Lots of funds have been accrued for such projects yet still the cost of maintenance and operation over weights the initial construction costs So for the safe traveling there is a need of well-maintained road network. The cost of reconstruction of a road is high as compared to maintenance work so maintenance is mostly preferred in developing countries. So there is need to develop technical approach to know the actual requirements of rehabilitation and maintenance work for pavement.This is actual need to develop proper maintenance management system for existing roads. The PMMS will help in the assessment of financial need, to develop a maintenance strategy, and also help to give priority to the maintenance work. In this situation, development of an effective PMMS would provide proper information, helpful analysis and most cost-effective decisions which will help in the preservation of the road networks. PMMS is a tool which will help to take management decisions. pavement section. This project aim is to develop the PMMS which will be based on following parameters such as material management, inspection of the road network, condition assessment of road network, condition analysis against the distresses, maintenance work planning. This entirely adds in creating an effective PMMS to which project planners can refer to the design of project.

## Methodology

### A. Organization of Spatial and Attribute data

Classify the spatial data of geographical information platform for highway maintenance into roads, bridges, washout data and base map layers based on the characteristics of the highway maintenance data. Road condition information includes routes information, checked information of road condition and washout

management, meanwhile there is management information, checked information and statistical information for the bridges management information and washout management information includes basic information, statistical information of washout. The base map layers provide the basis geographic information, such as administrative districts, roads, railways, rivers, lakes and so on, resulting in a data integrity, visualize and agility of electronic map for highway maintenance. Attribute data include the attributes of special data, interrelated files, administrative documents and pictures of special data.

**B.Middleware Technology**

SDE is a middleware technology and in the intermediate state between application programs and relational database management system for storing and managing complex spatial geography data, which carries on spatial relation computation and spatial analyze, meanwhile, solves the problem of interface between relational database and application program. Users can access the spatial geography data transparently, and not have to concerned about data format, storage location and mode, data structure and so on[8]. In this open Client/Server Architecture of ArcSDE. TCP/IP connection is established to receive the data requests from the client applications. Data transferring adopts asynchronous buffer mechanism between server and clients.

**C.Space Dynamic Segmentation Technique**

Dynamic segmentation is process that calculates the location of the events along the path. Path is a linear element with linear measurement systems of the storage geometric features such as roads and rivers. Events are linear referencing data that happen along the path such as the area of pavement breakage, traffic accidents along the highways. Position of linear referencing data is deviation distance or the distance from known points, such as milepost reference that decide mileage point from the mileage starting point along the highway. Dynamic segmentation process links the events with the path, so the event can be displayed and analysis with other geo-referenced data. The built-in measuring system of the path should be set up to use.

**D.Quick Access Mechanism Based on Quadtree Ttile**

At present, most maps controls based on WebGIS application are all used stepless zoom technology. After client sends a request to access that processed by the GIS server, small-capacity map data format (. Pag) will be returned to the client in real-time. Stepless zoom technology can be used in small amount of data and the Web of a single client group. For the maintenance of spatial information publishment, there are ordinary users, also professional who are from different industry, IIS must try to reduce the burden of GIS server considering the multi-user concurrent access to the load balancing problem.

**Merits**

**Improved efficiency:**

A RMMS based on WebGIS can automate many of the tasks involved in road maintenance management. For example, it can automatically schedule maintenance activities, allocate resources, and track progress. This can save time and reduce the workload of maintenance staff, leading to improved efficiency.

**Better data management:**

WebGIS can provide a centralized system for storing and managing road maintenance data. This can make it easier to track the condition of roads, identify areas that require maintenance, and monitor the effectiveness of maintenance activities.

**Enhanced decision-making:**

A RMMS based on WebGIS can provide managers with access to real-time information about road conditions and maintenance activities.

This can help them make informed decisions about resource allocation, scheduling, and prioritization.

**Increased transparency:**

WebGIS can make road maintenance information accessible to the public, allowing citizens to see how their tax dollars are being spent on maintaining roads.

This can increase transparency and accountability, which can lead to greater public trust and support.

**Cost savings**:

By automating many of the tasks involved in road maintenance management and improving decision-making, a RMMS based on WebGIS can help reduce costs associated with maintenance activities. Additionally, it can help identify areas where preventative maintenance can be performed, reducing the need for costly repairs later on.

**Demerits**

**Technical expertise:**

Building and maintaining a RMMS based on WebGIS requires a high level of technical expertise, which can be difficult to find and retain.

**Connectivity issues:**

Access to reliable internet connectivity is crucial for the proper functioning of a RMMS based on WebGIS. If internet connectivity is lost, the system may become inaccessible and data may be lost.

**Security risks:**

A RMMS based on WebGIS may be vulnerable to cyber attacks and data breaches, which can compromise the system's integrity and the confidentiality of sensitive data.

**Training and adoption:**

Introducing a new RMMS based on WebGIS may require significant training and adoption efforts, especially if users are not familiar with the technology. This can lead to slower adoption rates, which can negatively impact the system.

## 2.2 DESIGN AND APPLICATION OF RURAL ROAD LIFECYCLE MANAGEMENT INFORMATION SYSTEM

**Authors: Zhenhua Liu, Liuyang Liu, Wentao Fan**

**Abstract**

Rural road development is an important part of China's current strategy to fight poverty. Rural roads construction has a large total scale, but each single project is small. And rural roads are usually located in remote areas. So the management of rural roads is far more difficult than that of large transportation infrastructures. Considering the needs of rural road management at present, we designed an information system, which covers planning, bidding, progress management, funds management, project acceptance, road maintenance and other business to realize the life cycle management of rural road. We applied modern information technology such as GIS, remote sensing image processing, mobile internet in the system. the rural road maintenance management information system has been studied and applied which can improve the efficiency and accuracy of maintenance decision-making It has been applied in some provinces and achieved good results which show that it can provide an effective technical means for rural road management.

**Introduction**

Rural road is an important part of China's road network and one of the most important infrastructures to ensure rural economic and social development. In 2014, Chinese government put forward a new strategy for the development of rural road concerning its constructing, managing, maintaining and operating. Rural road is different from other transportation infrastructures, and has its distinct characteristics including large scale, small single project, wide coverage and remote location. These characteristics determine that the management of rural road is very difficult. At present, rural road management in China is generally extensive. Some well-done provinces construct information systems to management some fields of rural road development but not all the fields. For example, a rural road construction plan management information system scheme is proposed to manage the rural road

construction plan in Hubei province. It can be applied by multi-level management departments and has the functions of plan data producing, receiving, reporting, storing, inquiring, statistical analysis and so on. In some provinces, the rural road maintenance management information system has been studied and applied which can improve the efficiency and accuracy of maintenance decision-making . Project life cycle management originates from product life cycle management, which requires strict management in all steps of the project including surveying, designing, constructing, maintaining and so on. At present, life cycle management has been applied in engineering managementand many advanced management methods have evolved from it . In transportation field, life cycle management combining with modern information technology has been applied in some major transportation infrastructures. For example in the paper “Preliminary Study of Integrated Arch Bridge Construction Simulation”, a new management concept has been put forward, which applies the building information modeling and the product life cycle management. It can quickly and accurately model the whole life cycle of bridge, manage the progress, calculate and simulate in real time, and dynamically display the construction equipment . In order to improve the rural road management, we design a rural road life cycle management information system referring to the idea and practice of project life cycle management. The system covers the whole life cycle of rural road including planning, constructing, bidding, progress control, fund application and payment, quality management, safety supervision, inspection, acceptance, maintenance and so on. Application proves that the system can significantly improve the rural road management, such as enhancing the efficiency of rural road management, and timely discovering the problems in various stages of rural road development.

## Methodology

### A. Application of Mobile Platform

Rural road management will use a large number of basic geographic data and special data which includes spatial data and attribute data. Basic geographic data

can be obtained directly, but thematic data need to be collected, maintained and updated by transportation departments themselves. Rural road projects are large in number, wide in coverage and remote in location. So using professional surveying and mapping technology to collect rural road data is complex and costly. Data collecting has been a major difficulty in rural road management for a long time. At present, some industries have begun to use mobile geographic information technology to collect field information. For example, based on Android platform, Tsinghua University has developed a field data collecting APP using mobile geographic information system which has achieved good results in the investigation of reserve cultivated land resources[5].The application of mobile geographic information technology in agriculture has been mature. It is mainly used to precisely locate the crops and collect real-time attribute information such as the distribution area of crops, pests and diseases, so as to obtain agricultural production information efficiently and accurately. It plays an important role in promoting the development of informationization of agricultural data collection. Learning from the above practices, we propose a solution which integrates software and hardware, for data collection and business management of rural roads. That is, based on Android mobile application technology, mobile GIS development technology and J2EE architecture, a mobile development platform is developed. Meanwhile, based on web service technology, various business interactions between mobile APP, construction inspection platform and electronic map service systems are realized.

**B. Remote Sensing Image Assisting Management**

As an important spatial information technology, remote sensing has many advantages, such as wide coverage, easy updating, low cost, objectivity and authenticity of information. In recent years, with the rapid development of civil remote sensing satellite image technology at home and abroad, the application of high resolution satellite remote sensing image is more and more extensive. At present, the application of remote sensing images in agriculture has been relatively mature, such as the use of remote sensing images to monitor agricultural conditions.

With the launching of US Landsat-8 satellite, European Sentinel-2 satellite and Sentinel-1 radar satellite agricultural monitoring and research based on these latest satellite data have developed rapidly, which has greatly promoted the application of international agricultural remote sensing data. For example, the National Bureau of Agricultural Statistics of the United States carried out remote sensing monitoring of agricultural situation, and dynamically monitored a variety of agricultural conditions including area, yield, disasters, etc. In China, the Ministry of Agriculture and Rural Affairs applied remote sensing monitoring technology to build an agricultural drought monitoring system, which has improved the monitoring and early warning capabilities of the agricultural drought.The application of remote sensing data in the field of transportation has also begun.Some domestic scientific research institutions and technology companies have made breakthroughs in road network extraction, bridge health status identification, road health identification and other fields based on multi-source and high-resolution remote sensing data.

**Merits**

**Improved road maintenance**:

RRMIS can help local governments and rural communities to identify road defects and maintenance needs in a timely manner.

**Effective decision-making:**

RRMIS provides reliable and that can inform decision-making for road maintenance and rehabilitation. This can help local governments and rural communities to allocate resources effectively and make informed decisions.

**Increased efficiency:**

RRMIS can help local governments and rural communities to streamline their road maintenance processes by reducing paperwork and manual processes. This can lead to faster response times and increased efficiency.

**Enhanced community participation**:

RRMIS can provide a platform for community members to report road defects and maintenance needs.

This can enhance community participation and promote a sense of ownership of the rural road network.

**Improved transparency:**

Road maintenance activities, costs, and timelines. This can improve trust between local governments and rural communities and increase transparency.

## Demerits

**Data accuracy and reliability:**

A RRMIS relies heavily on accurate and reliable data to make informed decisions about road maintenance and management. If the data is inaccurate or unreliable, the system's effectiveness may be compromised.

**Cost:**

Building and implementing a RRMIS can be expensive, especially if custom software development is required. Additionally, ongoing maintenance and upgrades can also be costly.

**Limited resources:**

Rural areas may have limited resources and infrastructure, which can make it difficult to implement and maintain a RRMIS.

For example, rural areas may lack the necessary hardware or software to support the system.

**User adoption:**

Even if the technical infrastructure and data quality are good, a RRMIS may not be effective if users do not adopt it or use it consistently. This may be due to resistance to change, lack of understanding of the system's benefits, or other factors.

**Privacy concerns:**

A RRMIS may collect and store sensitive data, such as information about road users or property owners. This can raise privacy concerns if the data is not properly secured or if it is used inappropriately.

## 2.3 EYES ON ROADS COLLECTING AND MANAGING DATA - ABOUT ROADS' INFRASTRUCTURE

**Authors: D. Piovarci and T. Kovacik**

**Abstract**

In cooperation with Public Roads Administration of Trnava self-governing region (SUC TTSK) a web application has been created which aims on reporting. collecting and displaying data about roads' and their accessories' defects (defects in later text). This project enables public to participate in public space improvement via crowdsourcing data acquiring process, thus e.g. students of schools can be attracted to their bigger civic engagement. The web application also enables management of SUC TTSK to allocate human resources to reported defects on roads in administration of SUC TTSK which have been reported by public.There are two main goals we've marked out in our project. The first goal is to design and develop a web application to get overview about the defects by collecting notifications about them from people-public. The second goal of the project is to create a system which helps administration person to manage workers' groups effectively in order to realize repairs of roads' defects and defects of roads' accessories which have been reported by public.Received data is collected and subsequently reviewed by roads administration. Afterwards reported problem is assigned to specific worker which should repair it. Also future work on the project can bring effective semi- automatic planning of work of workers.

**Introduction**

One of the many problems, which Public administrations must deal with are roads and their accessories defects like potholes, damaged roads, broken road signs, blind traffic signs, overgrown trees and greens, corrupted crash barriers etc. There have been different projects developed and used by foreign companies for transportation and navigation field .Therefore, Public Roads Administration of Tmava self- govenming region (SUC TTSK) decided to engage citizens to help them identify these defects on roads and its' infrastructure by collecting data and monitoring their repairs. This method is called crowdsourcing and is well suitable

also for purpose of attracting youth and students into their bigger civic engagement. Students can be motivated by their desire to better their neighboroughood also in this area of public life.The web application has been created in cooperation with SUC TTSK that allows citizens to report roads" defects by creating Road Defect Report. Administration workers of SUC TTSK collect and analyze data that helps them to effectively manage processes of maintenance and repairs of reported defects.

**Methodology**

Determine what specific aspects of road infrastructure want to collect data on, such as road condition, traffic patterns, or signage.Depending on the scope of the project, may need to use a variety of data collection methods, such as manual surveys, sensor networks, or satellite imagery.This should include a detailed description of the data collection methods, the locations and frequency of data collection, and any necessary equipment or personnel.This is typically the most time-consuming and resource-intensive part of the process. It's important to ensure that data is collected consistently and accurately, and that any necessary quality control measures are in place.Once you've collected the data, you'll need to process and analyze it to identify any patterns or trends. This may involve using specialized software or statistical methods.It's important to have a robust data management system in place to ensure that the data is easily accessible, secure, and up-to-date. Considering that large amount of data which need to be collected, analyzed, processed and stored, importance of well-designed database is crucial. Therefore, detailed database model was developed to determine the logical structure of the database. The architecture of model was designed in UML.this characteristics As the article structure is quite purpose of large, for we just mention the main a road problem is central element of the database problem is tied to an employee who is assigned to solve the problem a vehicle is also assigned to the problem a problem has its state assigned to it and a photo of current state a problem is put in appropriate category a problem is tied to a road, to a road section, to a territorial region, to a

cadastral area and to a municipality commentary can be added to the problem. MySQL (version 8.0), the open-source relational database management system was selected for creation of our database Laravel framework (version 6.17) is used as architecture basis for web application and multi role authentication system is based on Laravel Authentication. Laravel's default ORM (object-relational mapper) called Eloquent is used for retrieving and storing data in the database. For usage of interactive maps, which can be customized and run on JavaScript we use maps provided by Google. Google Maps was one of the main requirement made by SUC TTSK because of popularity world wide by End- users. Javascript Frontend was developed by using php Laravel's blade engine and responsive web design is built on Bootstrap.

The application is serving for two user groups: End- user (registered and unregistered user) and SUC TTSK office workers, who are split into 3 roles (administrator, dispatcher, manager). Each group consists of different roles which are allowed to perform a specific set of actions, defined based on user's access rights.

End-users have a sign-in option. Authenticated End- user can create Road Defect Report and has access to all reports he has created with the possibility to check their progress status at a given time (Received, In progress, Finalized, Suspended). Non-authenticated End- users can only create the Road Defect Report and like authenticated End-user can see current state of defects which have been reported to the system. This functionality is based as homepage of web application and is available for all users who interact with application. Homepage consists of interactive map provided by Google, where every reported defect is visualized by a red marker. After left click on the marker the infowindow pops up with all detailed information about selected problem. All users (including SUC TTSK office workers) are allowed to create Road Defect Report. The web application provides users with interactive map from Google into which a user can insert a marker and report a defect.

**Merits**

- Collecting and managing data about road infrastructure is crucial to ensure that roads are safe and efficient for drivers and pedestrians. One important aspect of collecting data about roads is to keep an eye on road safety, especially when it comes to reducing accidents caused by distracted driving.
- One of the most effective ways to do this is by installing cameras and sensors on roads that can capture data about the behavior of drivers, the condition of roads, and the environment around them. This data can be used to identify areas that are prone to accidents and prioritize safety improvements.
- In addition to safety, collecting data about roads can also help identify areas where the infrastructure needs to be improved. For example, by using sensors to monitor traffic flow, local authorities can identify areas where congestion is a problem and plan road improvements accordingly.
- When managing data about road infrastructure, it's important to ensure that the data is accurate, up-to-date, and accessible to those who need it. This can be achieved by using advanced data management systems and technologies, such as cloud computing and big data analytics, which can process large amounts of data and provide insights that are useful for planning and decision-making.

**Demerits**

- Collecting data about road users and infrastructure can raise privacy concerns if the data is not properly secured or if it is used inappropriately. This can be particularly important if the data is sensitive or personally identifiable.
- Implementing an "Eyes on Roads" system can be expensive, especially if custom hardware and software development is required. Additionally, ongoing maintenance and upgrades can also be costly.
- Eyes on Roads systems may face technical challenges, such as sensor malfunctions, connectivity issues, or software bugs. These issues can compromise the system's effectiveness and require significant technical expertise to resolve.

- The accuracy and reliability of data collected by "Eyes on Roads" systems can be influenced by a variety of factors, including weather conditions, sensor calibration, and data transmission quality. If the data is inaccurate or unreliable, the system's effectiveness may be compromised.
- Eyes on Roads systems require ongoing maintenance and support to ensure their long-term sustainability. This can be challenging if resources are limited or if there is a lack of technical expertise.
- Eyes on Roads systems can generate large amounts of data, which can be difficult to manage and analyze effectively. This can lead to data overload, which can make it difficult to identify patterns or trends in the data.

## 2.4 A CROWD SENSING APPLICATION TO ESTIMATE ROAD CONDITIONS

**Authors: Faria Kalim, Jaehoon (Paul) Jeong, and Muhammad U. Ilyas**

**Abstract**

CRATER, a Crowd Sensing Application To Estimate Road conditions. CRATER is a smartphone application that opportunistically measures acceleration when it finds itself on the road in order to map and measure the locations of potholes and speedbumps. It does not require input from users and reports detected potholes and speedbumps to a cloud-hosted application engine which stores partially processed data received from smartphones of participating users and jointly processes it to obtain a better estimate of road conditions. The information is published in map form on the web. The maps allow citizens and municipal authorities alike to spot potholes, road segments in need of repair, and imbalances in infrastructure maintenance efforts across cities. Road tests demonstrate that CRATER succeeds at correctly detecting roughly 90% of potholes and 95% of speedbumps, while generating false alarms only about 10% and 5% of the time, respectively.

## Introduction

Road conditions in Pakistan vary from excellent to dilapidated. Urban infrastructure funds are limited and are spent without giving the public any visibility. Every year, the monsoon season brings torrential rain which pushes bad conditions to worse, and sometimes, to intolerable levels. Some governments try to improve the road network through efforts to build new roads, flyovers and underpasses; such efforts are limited to urban areas and the major cities of Pakistan. Furthermore, these efforts generally involve ripping up the old most-frequented routes and cordoning off these sections of the road network until the repair work is finished.On occasions that authorities are held accountable for poor road conditions in residential areas or in a small locality, their response often is that citizens need to report locations so that the municipality can act. In addition to suffering from disrepair, people sometimes construct illegal speedbumps on public roads to slow down traffic near their homes and businesses. Lack of reporting means that sometimes it can be years before such speedbumps are actually removed. If the municipality has data of legally constructed speedbumps, it is able to identify all others as illegally constructed. Municipalities can use this information to allocate more funds to areas that are desperately in need of repair. Conversely, the public can keep an eye on how efficiently the authorities work to repair road across the cityAt the same time, Pakistan is a country with a growing population. The number of cars in urban areas has increased manifold over the last decade and unfortunately, the road network has not grown at the same rate. A study by the Texas A&M Transportation Institute estimates that congestion and rough roads will cost the average Texas household a year in wasted fuel, vehicle repairs, and time lost sitting in traffic between now and 2035. Given the scale of this problem in the US, in the absence of similar studies in developing countries, we can only guess what the state of disrepair of roads is costing citizens there.Mapping and measuring road conditions season after season is not a trivial problem it requires extensive resources including expertise, manpower, time and transportation. To suggest that the

government alone should appoint people to monitor the state of our roads is not a viable solution. By the time a team surveys an area, conditions may have already changed.Mapping and measuring road conditions in developing countries is not a trivial problem. Not only do major segments of the road network require immediate repair, but the state of roads needs to be updated regularly to maintain a certain level of quality year-round.Natıve solutions such as creating government departments to handle the situation are expensive and are not sustainable.

## Methodology

### A. Training Set and Pre-processing

We employed a supervised learning approach to develop the in-app classifier. This necessitated the collection of a labeled training set, which in turn required the development of a separate Android app, which we will refer to as the data collection app. This data collection app was designed with simplicity in mind. It lets a user start and stop collecting data by the press of a button. Specifically, the app stores readings from the three accelerometers and GPS in the background the moment it was switched on, and periodically writes them to a file. In addition, it provides two buttons to let the user mark the moment the vehicle goes over a speedbump or through a pothole. At the button press the timestamp and location of the user is stored in a file. Note that data gathered from sensors cannot be used directly for feature extraction and classification without pre-processing first. Recall that we do not require the phone to be placed in a particular (calibrated) position during data collection, only that it not be in use. Therefore, we rotate the axes of the accelerometer sensors to realign them in a standard direction. Axes reorientation aligns the direction of greatest variance in accelerometer readings with the ’z-axis’, which points downwards at the ground (due to the acceleration due to gravity). The direction of second largest variance of accelerometer readings orthogonal to the z-axis is aligned with the ’y-axis,’ which is usually the direction of forward motion of the vehicle. With the directions of the z and y-axes determined, the ’xaxis’ is aligns with the only remaining orthogonal direction, usually sideways to the direction of a

forward moving vehicle. As subsequent exploration showed, it is primarily features of the reoriented z-axis, and to a lesser degree the y-axis, that provide useful features for detecting speedbumps and potholes.

**B. Labeled Data**

Ground truth gathering involved some field work – moving over the city in a car with the data collection app turned on and collecting data while marking the locations of potholes/speedbumps, as described earlier. Figure 4 is a photograph of a once paved road that is currently in a state of disrepair outside our campus that we used, among other roads, to collect data for use in the development phase.

**C. Feature Extraction**

The pothole and speedbump detectors in the app execute at one second intervals. Each time either detector executes it uses accelerometer readings collected in the preceding 12sec, i.e. the detectors execute on a sliding window of accelerometer samples. Figure 5b and Figure 5a are plots of accelerometer readings along x, y and z-axes against time, after performing the coordinate system rotation described in the preceding section, for a vehicle driving over a speedbump and through a pothole, respectively. As these figures show, without any further processing, this signal is quite noisy, with significant high-frequency components. We discovered during data collection that this high-frequency noise in signals is caused by two different sources.

**Merits**

**Real-time data:**

A crowd sensing application can provide real-time data about road conditions, which can help drivers make informed decisions about their routes and driving behavior. This can reduce the risk of accidents caused by poor road conditions, such as potholes, ice, or debris.

**Cost-effective:**

A crowd sensing application is a cost-effective way to collect data about road conditions, as it does not require expensive equipment or infrastructure.

Instead, it relies on the power of crowdsourcing, where users share their data voluntarily.

**Accurate and detailed data:**

A crowd sensing application can provide accurate and detailed data about road conditions, such as the location and severity of potholes, the level of congestion, or the presence of road hazards. This can help local authorities prioritize road repairs and maintenance and make more informed decisions about road infrastructure investments.

**Increased civic engagement:**

A crowd sensing application can increase civic engagement and empower citizens to take an active role in improving their communities. By sharing their data about road conditions, users can contribute to the common good and help make their cities safer and more livable.

**Scalable and adaptable:**

A crowd sensing application can be scaled and adapted to different contexts and needs. For example, it can be used to monitor road conditions in rural areas or to track the impact of weather events on road safety.

**Demerits**

**Accuracy and reliability of data:**

The accuracy and reliability of data collected through crowd sensing can be influenced by a variety of factors, including the quality of the data source and the degree of participation from the crowd. This can compromise the system's effectiveness if the data collected is inaccurate or unreliable.

**Privacy concerns:**

Collecting data through a crowd sensing application can raise privacy concerns if the data is not properly secured or if it is used inappropriately. This can be particularly important if the data is sensitive or personally identifiable.

**Bias and sampling errors:**

Crowd sensing data can be subject to bias and sampling errors, which can limit

the system's effectiveness. For example, certain groups of users may be overrepresented in the data, while others may be underrepresented.

**Data overload:**

Crowd sensing applications can generate large amounts of data, which can be difficult to manage and analyze effectively. This can lead to data overload, which can make it difficult to identify patterns or trends in the data.

**Ethical concerns:**

Collecting data through a crowd sensing application can raise ethical concerns if the data is collected without the consent or awareness of the users, or if the data is used for purposes other than those for which it was originally collected.

## 2.5 ROAD MAINTENANCE MANAGEMENT SYSTEM

**Authors: Ms. Priyanka D Lad , Ms. Yogita Fulse**

**Abstract**

Pavement management system predicts the future deterioration of pavement due to traffic, weather and recommends maintenance and repair plan according to severity of distress in pavement section. This project aim is to develop pavement management system is based on following parameters Pavement Inspection, Condition Assessment, Condition Prediction, Condition Analysis and Work Planning.

**Introduction**

In India infrastructure plays important role which include highways, dams, bridges, flyovers, airports, sea-links . by using road network achieved a very important position in the overall transportation sector in India. India has 2nd largest road network in the world in which the part of rural road network is large. Population growthrate of the country is high so the percentage of road user's increases. The road traffic is tremendously increasing, 60% of all goods and 85% of all passengers' are transported by using road network. So more importance is now given to rural road network to make the main cities and rural area well connected.In a developing

country like India, transportation projects are undertaken upon the basis of initial cost of construction owing to the negligence of future costs (i.e. M & O costs) incurred in the entire life of the project. This has been done because of lack of funds from the government than the required in the development of infrastructure. Such decisions had led most of the infrastructure projects throughout the country in deteriorating condition or failure since underestimate the necessary future uncertainties associated in the project. Road projects are one of the infrastructure projects that are facing such situation in recent era. Lots of funds have been accrued for such projects yet still the cost of maintenance and operation over weights the initial construction costs So for the is a need of well-maintained road network. The cost of reconstruction of a road is high as compared to maintenance work so maintenance is mostly preferred in developing countries. So there is need to develop technical approach to know the actual requirements of rehabilitation and maintenance work for pavement. This is actual need to develop proper maintenance management system for existing roads.The PMMS will help in the assessment of financial need, to develop a maintenance strategy, and also help to give priority to the maintenance work. In this situation, development of an effective PMMS would provide proper information, helpful analysis and most cost- effective decisions which will help in the preservation of the road networks. PMMS is a tool which will help to take management decisions. pavement section. It aims is develop the PMMS which will be based on following parameters such as material management, condition analysis against the distresses, maintenance work planning. This entirely adds in creating an effective PMMS to which project planners can refer to the design of project.

**Methodology**

The work undertaken for the study includes detection of distresses in flexible pavement by physical inspection. The condition analysis of pavement is done by finding pavement condition index for the particular section of pavement.

Overall condition assessment is Done and rating is give to the pavement. Distress analysis and severity of the distress is measure according to American society

**Pavement distress:**

These are types distresses in pavement 1)Alligator cracking 2) Bleeding 3) Block cracking 4) Bumps and sag 5) Corrugation 6) Depression 7) Edge cracking 8) Joint reflection crack 9) Lane/shoulder drop off 10) Long. And trans. Crack 11) Patching.

Pavement condition Pavement condition index is determined by the ratio of total distress area to total patch area. Also distress quantity, severity, types of distress helps to determine the pavement condition index.

**Pavement condition:**

Pavement condition index is determined by the ratio of total distress area to total patch area. Also distress quantity, severity, types of distress helps to determine the pavement condition index.

**Pavement condition index sample calculation:**

For patch first from Kasegaon to Nerla

Pavement Condition Index = total distress area / total area of the patch X 100

= 1289/ 9184 X 100

= 13.8

**Field Survey Work For National Highway Road Sections:**

The actual survey of the National highway ,Major district road and village road in Kolhapur district was carried out. By visual inspection of the sections, it was found that there are some few alligator cracking of medium and high severity, a few edge cracks of high severity, some medium severity potholes and a few low- to medium severity longitudinal and transverse cracks. The survey and distress identification procedures were carried out as per the references mentioned for the national highway,major district road and village road table no 3 shows the condition survey data sheet for National highway, which shows that the sample has PCI = 13.8 and a rating of very poor Table no 3 also tells us that the distresses in the sample are high-severity edge cracks. Like these values of all selected sections of the national

highway,major district road and village road inspected according to pavement condition index formula and by measuring distress and suggest maintenance priority based on distress severity.

**Merits**

**Efficient resource allocation:**

An RMMS can help local authorities allocate their resources efficiently by prioritizing maintenance activities based on the condition and importance of the roads. This can ensure that resources are allocated to the areas where are needed the most, reducing the risk of accidents and improving the overall condition of the roads.

**Improved planning and scheduling:**

An RMMS can help local authorities plan and schedule maintenance activities more effectively by providing them with accurate and up-to-date information about the condition of the roads. This can help ensure that maintenance activities are carried out at the right time, reducing the risk of delays and disruptions.

**Reduced costs:**

An RMMS can help local authorities reduce the costs of road maintenance by identifying cost-effective solutions and reducing the need for emergency repairs. This can help local authorities optimize their maintenance budgets and allocate their resources more effectively.

**Enhanced collaboration:**

An RMMS can help enhance collaboration between different stakeholders involved in road maintenance activities, such as local authorities, contractors, and road users. This can help ensure that maintenance activities are carried out in a coordinated and effective manner, reducing the risk of delays and disruptions.

**Improved transparency and accountability:**

An RMMS can help improve the transparency and accountability of road maintenance activities by providing stakeholders with access to accurate and up-to-date information about the condition of the roads and the status of maintenances.

**Demerits**

**Complexity:** Implementing a road maintenance management system can be complex and time-consuming, especially if custom software development is required. This can also be expensive, as ongoing maintenance and upgrades may be necessary to keep the system up-to-date and functioning properly.

**Technical challenges:** A road maintenance management system may face technical challenges, such as compatibility issues with existing hardware or software, connectivity issues, or software bugs. These issues can compromise the system's effectiveness and require significant technical expertise to resolve.

**Training and education:** A road maintenance management system requires proper training and education of users to ensure effective use. This can be challenging if users are not familiar with the system or if there is a high staff turnover rate.

**Maintenance and sustainability:** A road maintenance management system requires ongoing maintenance and support to ensure its long-term sustainability.

**Limited scope:** A road maintenance management system may have a limited scope, focusing only on certain aspects of road maintenance activities. This can limit its effectiveness in addressing broader issues related to road infrastructure.

# CHAPTER 3

# SYSTEM ANALYSIS

## 3.1 EXISTING SYSTEM

The first step in developing a RMMS is to define the scope of the system and identify the requirements that it must meet. This will involve assessing the current system, identifying any gaps or deficiencies, and determining the types of data and functionalities that are needed to support road maintenance activities. Integrate with other systems: RMMS based on WebGIS is typically part of a larger ecosystem of systems, including asset management systems, work order management systems, and financial management systems. It is essential to ensure that the RMMS can integrate with these systems seamlessly.

Once the system has been tested and approved, it can be implemented. This involves installing the system on the appropriate hardware and ensuring that all necessary data has been migrated. After implementation, the system will need to be maintained. This includes providing ongoing technical support, updating the system to address bugs and security issues, and making any necessary enhancements to improve its functionality.

The sensors are selected, the next step is to install them on the road network. This will involve selecting the appropriate locations for the sensors and installing them on the road surface or adjacent infrastructure.This data can be used to estimate road conditions and provide road authorities with valuable information for maintenance and planning purposes. To collect data, the crowd sensing application will need to recruit users. This can be done through social media, online advertising, or other means. Users should be incentivized to participate, such as by offering rewards or prizes. such as identifying areas that require maintenance or determining optimal traffic flow patterns.The system should have a comprehensive asset management module that allows road authorities to track and manage all road network assets, such as roads, bridges, tunnels, and signage. he system should have

a preventative maintenance scheduling module that allows road authorities to schedule routine maintenance activities, such as road sweeping or line painting, to ensure that are done regularly and on time.

### 3.1.1 Demerits

**Dependence on internet connectivity:**

A WebGIS-based RMMS requires internet connectivity to function effectively. This can be a problem in areas with limited or unreliable internet access.

**Security risks:**

A System may be vulnerable to cyberattacks, particularly if it contains sensitive information such as road network layouts or maintenance schedules.

**Cost:**

The development and maintenance of an System can be costly, particularly for smaller road authorities with limited budgets.

**Inability to account for unforeseen events:**

A Systen is designed to manage routine maintenance activities. It may not be able to account for unforeseen events, such as natural disasters or accidents, which may require urgent repairs.

**Dependence on accurate data:**

The success of a road management and maintenance system depends on the accuracy of the data it contains. If data is incomplete, outdated, or inaccurate, the system may not provide the desired benefits.

**Technical expertise required:**

Developing and maintaining a road management and maintenance system requires technical expertise in GIS, database management, and web development. Road authorities may need to invest in training or hire external consultants to develop and maintain system.

## 3.2 PROPOSED SYSTEM

A proposed solution for road management and maintenance could include a public complaint registry system. This system would allow the public to report issues related to road conditions, such as potholes, cracks, or other damage. The system could be web-based or accessible through a mobile application, making it easy for the public to report issues from their smartphones or computers.Once a complaint is registered, the system would automatically generate a work order for the road authority responsible for maintaining that particular road. The work order would include the location of the reported issue, a description of the problem, and the priority level based on the severity of the issue. The system could also include a status update feature, which would allow the public to track the progress of their complaint.

### 3.2.1 Merits

**User Management:**

The system should have an efficient user management module to manage the users, their roles and permissions. This module should be able to handle multiple types of users such as administrators, engineers, contractors, and general public.

**Road Inventory:**

A comprehensive road inventory should be maintained in the system to keep track of all the roads, their length, width, type, location, and other relevant details. This information can be used for road maintenance planning and budgeting.

**Maintenance Planning:**

The system should provide an interface for maintenance planning and scheduling, allowing administrators to plan and schedule road maintenance activities, allocate resources, and set deadlines for completion.

**Work Order Management:**

The system should have a work order management module to manage the maintenance work orders, including the creation, allocation, and tracking of work.

**Reporting and Analytics:**

The system should provide various reports and analytics tools to help administrators, engineers, and contractors to better understand the road maintenance activities, budget, and performance.

**Public Complaint Registry:**

A public complaint module for a road management system is a software system that allows members of the public to report issues with roads and other transportation infrastructure to the relevant authorities.

The module typically provides an online platform where users can submit complaints, which are then forwarded to the appropriate department or agency for action.

The module typically includes a user-friendly interface that guides users through the complaint submission process. Users can typically provide details about the location and nature of the problem, such as potholes, damaged signage, or road closures. It may also be able to upload photos to support their complaint.

# CHAPTER 4

# SYSTEM REQUIREMENTS

## 4.1 HARDWARE REQUIREMENTS

Hard disk : 100GB

Processor : Core i3 2.4GHz

System type : 32 bit/64 bit

RAM : 2GB

## 4.2 SOFTWARE REQUIEMENTS

Operating system : Windows 7/8/8.1/10

Front End : HTML ,CSS, BOOTSTRAP

Back End: PHP

Database: MYSQL

Browser : Google Chrome

# CHAPTER 5

# SYSTEM DESIGN

## 5.1 SYSTEM ARCHITECTURE

**Data Collection:**

The system would need to gather data on road conditions, such as potholes, damaged pavements, and broken sidewalks. This information can be gathered through various methods, including manual surveys or sensors embedded in the road.

**Data Analysis:**

Once data is collected, it would be analyzed to identify patterns and trends in road conditions and public complaints. Data analysis could include things like identifying the most common types of road damage or the most frequent causes of public complaints.

**Reporting:**

The system would need to provide reports on road conditions and public complaints to relevant stakeholders, such as government agencies responsible for road maintenance or community groups.

**Communication:**

The system would need to provide a way for the public to report road conditions or complaints, such as a web portal or mobile app. It would also need to provide a way for the public to receive updates on the status of their complaints, such as automated email notifications.

**Database:**

The database is responsible for storing all data related to the road management system. This includes data on traffic flow, road infrastructure, and maintenance schedules. It handling large amounts of data and should be designed to ensure data

.

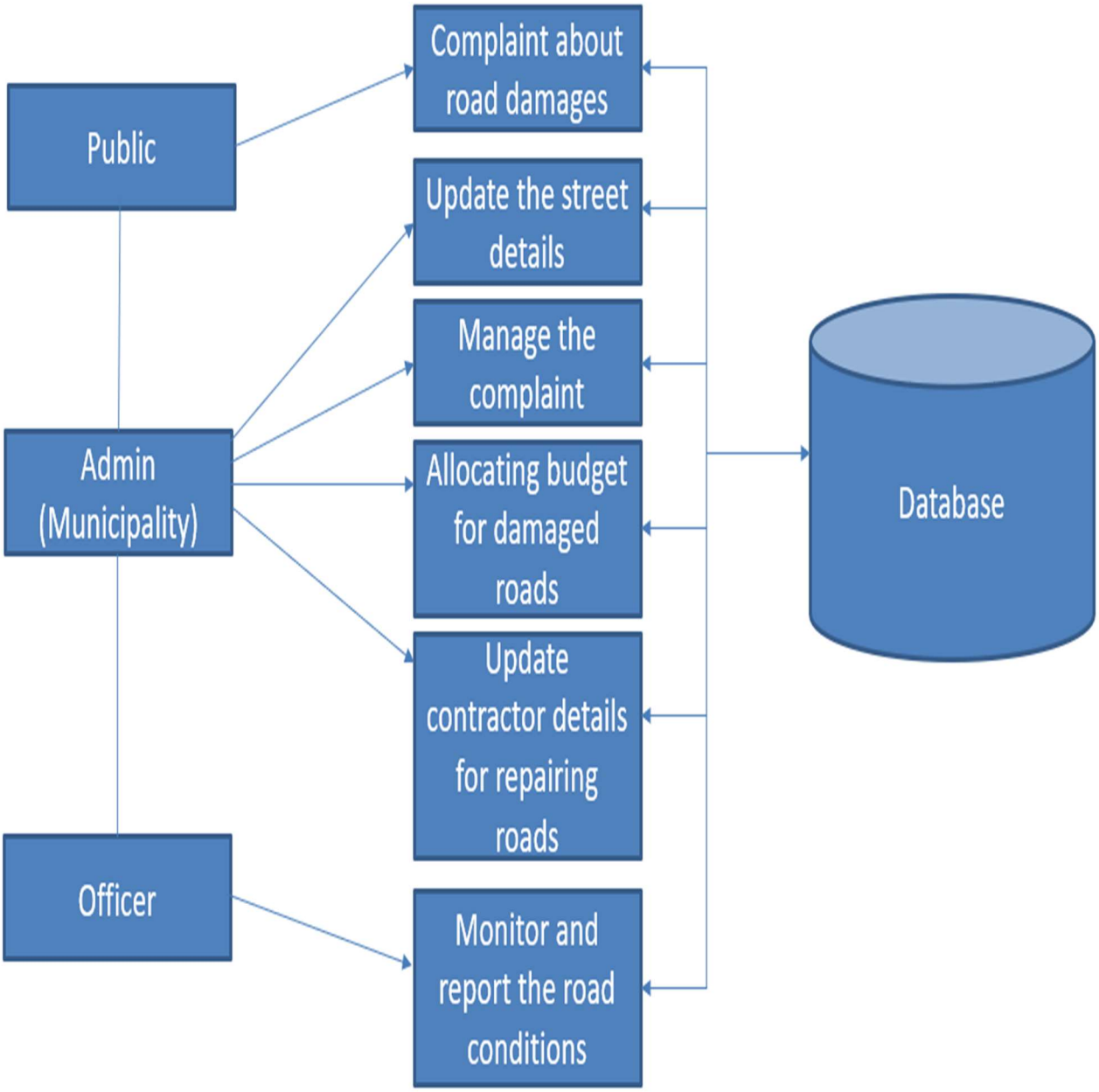



**Fig.No. 5.1 Block Diagram**

# CHAPTER 6

# IMPLEMENTATION

The implementation of proposed work is carried in below mentioned steps

- Login Module
- Public complaint Module
- Inspection Module
- Maintenance Planning and Scheduling Module
- Admin Module

## 6.1 Login Module

The login module for a road management system would require users to enter their username and password to access the system. The login module would typically check the user's credentials against the information stored in the system's database and grant access to the user if the credentials match. If the user enters an incorrect username or password, the login module would display an error message and prompt the user to try again. Additionally, the login module might have features such as password recovery, two-factor authentication, or captcha verification to enhance security and prevent unauthorized access to the system.

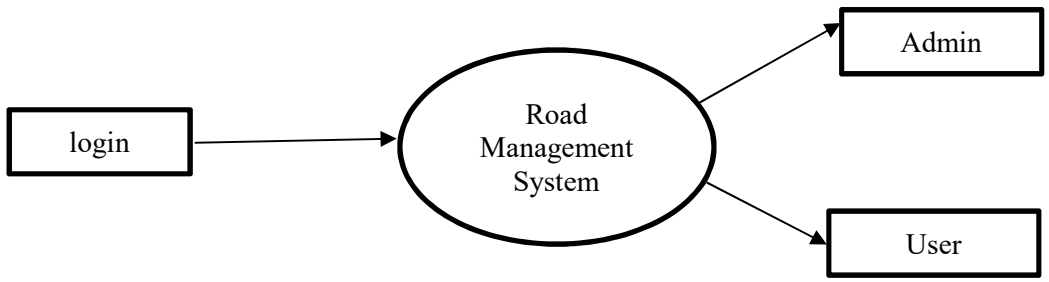



**Fig.No. 6.1 Login for user and admin**

**Page header:** The page header should include the name and logo of the road management system for branding purposes.

**Login form:** The login form should include fields for the user's username and password, along with a "Remember Me" checkbox to allow users to stay logged in on future visits. There should also be a "Sign In" button to initiate the login process.

**Password recovery options:** Below the login form, there should be links to options for users who have forgotten their password or username. These links should direct users to pages where  can enter their email address or answer security questions to reset their login credentials.

**Footer:** The page footer should include links to the system's privacy policy and terms of use, along with any copyright or contact information.

**User Dashboard:**

**Page header:** The page header should again include the name and logo of the road management system.

**User profile summary:** The user dashboard should display a summary of the user's profile information, including their name, email address, and other relevant details.

**Recent activity feed:** Below the user profile summary, there should be a feed displaying the user's recent activity within the system, such as tasks completed or notifications received.

**Pending tasks:** If the system includes tasks or assignments for users to complete, the user dashboard should display a list of pending tasks that the user needs to complete.

**Upcoming events:** The dashboard could also display a calendar or list of upcoming events relevant to the user's role within the road management system.

**Navigation menu:** The user dashboard should include a navigation menu with links to other pages and sections within the system.

**Admin Console:**

**Page header:** Again, the page header should include the name and logo of the road management system.

**Admin login form:** The admin login page should include a separate login form for administrators, with fields for an admin username and password. The form should also include a "Remember Me" checkbox and a "Sign In" button.

**Navigation menu:** Once logged in, the admin console should display a navigation menu with links to various administrative features and settings, such as user management, system configuration, and data analytics.

**User management:** The user management page should allow administrators to view, create, edit, and delete user accounts within the system, as well as manage user roles and permissions.

**System configuration:** This page should allow administrators to configure various settings and preferences within the system, such as email notifications, security options, and customization options.

**Data analytics:** The data analytics page could provide administrators with charts, graphs, and other visualizations to help them track and analyze various aspects of road management, such as traffic patterns, accident rates, and maintenance costs.

### 6.2 Public complaint Module:

A public complaint module for a road management system is a software system that allows members of the public to report issues with roads and other transportation infrastructure to the relevant authorities. The module typically provides an online platform where users can submit complaints, which are then forwarded to the appropriate department or agency for action**.** The module typically includes a user-friendly interface that guides users through the complaint submission process. Users can typically provide details about the location and nature of the problem, such as potholes, damaged signage, or road closures. It may also be able to upload photos to support their complaint.

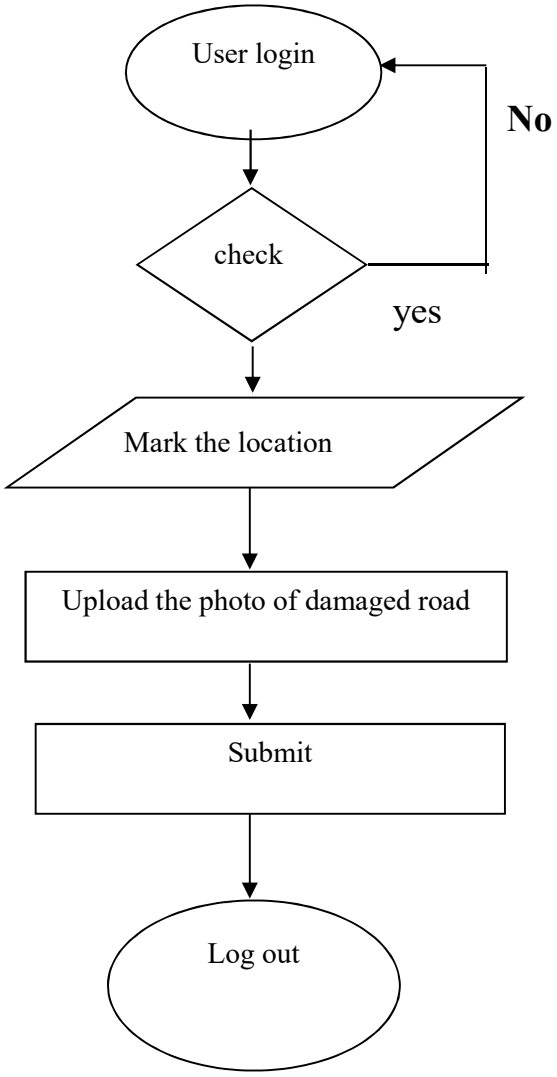



**Fig.No. 6.2 Public Complaint Module Workflow**

**Complaint Submission Page:** This page allows members of the public to submit complaints or reports about issues have encountered on roads, such as potholes, damaged sidewalks, or malfunctioning traffic signals.

**Complaint Status Page:** After submitting a complaint, members of the public may want to check the status of their complaint to see if any action has been taken. This page would provide an update on the complaint status and any actions taken by the road management system to address the issue.

**Feedback and Review Page:** This page provides an opportunity for members of the public to provide feedback and review the road management system based on their experience with submitting a complaint. This feedback could be used to improve the system's complaint management process and overall user experience.

**Complaint Submission Page:**

**Page header:** The page header should include the name and logo of the road maintenance and management system.

**Complaint form:** The complaint form should include fields for the user to enter their contact information, a description of the issue or complaint, and any relevant attachments such as photos or videos. The form may also include dropdown menus or checkboxes to help categorize and prioritize the issue.

**Submit button:** Once the user has filled out the complaint form, should be able to submit the complaint by clicking a "Submit" button.

**Confirmation message:** After submitting the complaint, the user should receive a confirmation message thanking them for their submission and providing an estimated timeframe for when can expect a response.

**Complaint Status Page:**

**Page header:** The page header should again include the name and logo of the road maintenance and management system.

**Complaint status lookup form:** The page should include a form where users can enter a unique complaint ID number, which was provided to them when submitted the complaint. Alternatively, users may be able to search for their complaint by entering their contact information or other details.

**Complaint status display:** After the user has entered their information, the page should display the current status of their complaint, along with any updates or notes from the road management system. If the issue has been resolved, the page may also include a confirmation message and instructions for what to do next if the user is still experiencing problems.

**Feedback and Review Page:**

**Page header:** Once again, the page header should include the name and logo of the road maintenance and management system.

**Feedback form:** The feedback form should include fields for the user to rate their experience submitting a complaint and provide any comments or suggestions for

improvement. The form may also include questions about the user's overall satisfaction with the road management system and its response to their complaint.

**Submit button:** Once the user has filled out the feedback form, should be able to submit their feedback by clicking a "Submit" button.

**Thank you message:** After submitting the feedback, the user should receive a thank you message acknowledging their feedback and expressing appreciation for their participation in improving the road management system.

**6.3 Inspection Module:**

The Inspection Module is a component of a road management system that focuses on the inspection of the physical condition of the road network. The module provides standardized forms that inspectors can use to record the condition of the road network during inspections. These forms may include fields for recording the location of defects, the type and severity of defects, and any other relevant information.

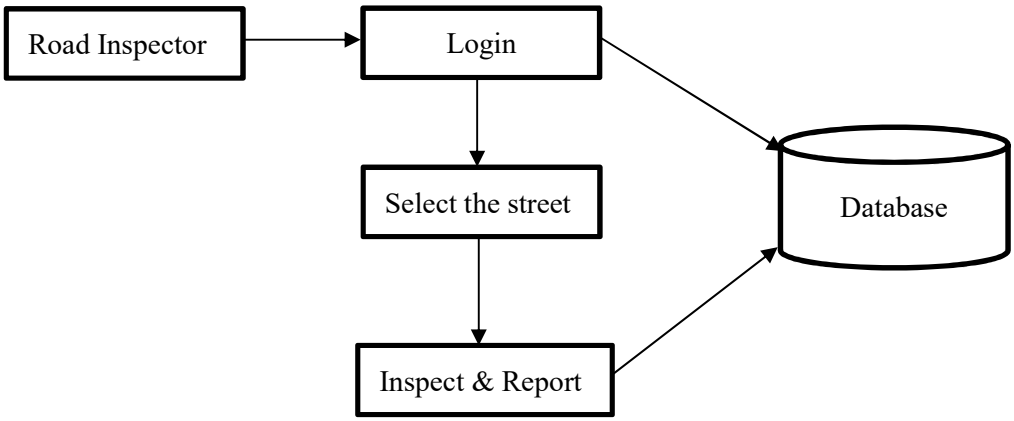



**Fig.No. 6.3 Inspection Module Workflow**

**Inspection Scheduling Page:** This page allows the road maintenance team to schedule inspections for different sections of roads or highways that require maintenance or repair work.

**Inspection Report Page:** After an inspection has been carried out, the inspection report page allows the road maintenance team to record and review details of the inspection, including any issues or defects that were identified.

**Maintenance Planning Page:** Based on the inspection report, the maintenance

planning page allows the road maintenance team to plan and schedule maintenance and repair work to be carried out on the road infrastructure.

**Inspection Scheduling Page:**

**Page header:** The page header should include the name and logo of the road maintenance and management web application.

**Inspection scheduling form:** The inspection scheduling form should include fields for the user to enter the details of the inspection, such as the location and date of the inspection, the type of inspection required, and the members of the inspection team.

**Submit button:** Once the user has filled out the inspection scheduling form, It should be able to schedule the inspection by clicking a "Submit" button.

**Confirmation message:** After scheduling the inspection, the user should receive a confirmation message with the details of the inspection and a reminder of the scheduled date and time.

**Inspection Report Page:**

**Page header:** The page header should include the name and logo of the road maintenance and management web application.

**Inspection report form:** The inspection report form should include fields for the user to enter details of the inspection, such as the date and location of the inspection, weather conditions, and a summary of the issues or defects identified. The form may also include fields for the user to attach photos or videos of the inspection.

**Submit button:** Once the user has filled out the inspection report form, It should be able to submit the report by clicking a "Submit" button.

**Review and approval:** The inspection report may need to be reviewed and approved by a supervisor or manager before any maintenance or repair work can be carried out. The page may include a status update indicating the progress of the review and approval process.

**Maintenance Planning Page:**

**Page header:** The page header should include the name and logo of the road maintenance and management web application.

**Maintenance planning form:** The maintenance planning form should include fields for the user to enter details of the maintenance and repair work required, such as the location of the work, the type of work required, and the estimated timeline for completion.

**Submit button:** Once the user has filled out the maintenance planning form, It should be able to submit the maintenance plan by clicking a "Submit" button.

**Confirmation message:** After submitting the maintenance plan, the user should receive a confirmation message with the details of the plan and a reminder of the scheduled start and end dates for the work. The page may also include a status update indicating the progress of the maintenance and repair work.

### 6.4 Maintenance Planning and Scheduling Module

Maintenance planning and scheduling module is an essential component of a road management system, which helps to optimize the maintenance activities and ensure the safe and efficient operation of the road network. This module involves various processes, such as planning, scheduling, and tracking of maintenance activities to ensure that are performed in a timely and cost-effective manner.Once the maintenance plan is developed, the scheduling module is used to create a maintenance schedule that assigns specific maintenance activities to specific maintenance crews or contractors. This schedule takes into account factors such as the priority of the maintenance activity, the availability of resources, and any constraints that may impact the schedule.

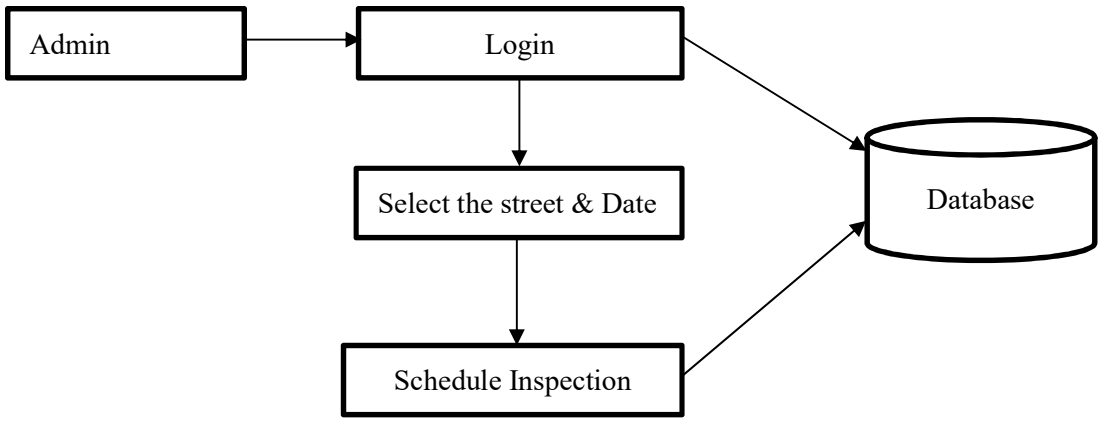



**Fig.No. 6.4 Planning Module Workflow**

**Maintenance Planning Page:** This page allows the road maintenance team to plan and schedule maintenance and repair work to be carried out on the road infrastructure.

**Maintenance Scheduling Page:** Once the maintenance plan has been created, the maintenance scheduling page allows the road maintenance team to schedule the work with details on resources required, cost estimates, and timelines.

**Maintenance Progress Tracking Page:** After the maintenance work has started, this page allows the road maintenance team to track progress, update the status of the work, and make necessary adjustments to the maintenance plan.

**Maintenance Planning Page:**

**Page header:** The page header should include the name and logo of the road maintenance and management web application.

**Maintenance planning form:** The maintenance planning form should include fields for the user to enter details of the maintenance and repair work required, such as the location of the work, the type of work required, and the estimated timeline for completion.

**Resource allocation:** Based on the maintenance plan, the page should display the resources required for each task, such as equipment, materials, and labor.

**Cost estimates:** The page should display an estimate of the costs associated with each task, such as the cost of materials, labor, and equipment rental.

**Approval process:** The maintenance plan may need to be reviewed and approved by a supervisor or manager before any work can be carried out. The page may include a status update indicating the progress of the review and approval process.

**Maintenance Scheduling Page:**

**Page header:** The page header should include the name and logo of the road maintenance and management web application.

**Maintenance scheduling form:** The maintenance scheduling form should include fields for the user to enter details of the maintenance work, such as the start and end dates, the location of the work, and the resources required.

**Resource availability:** The page should display the availability of resources, such as equipment and labor, to help the user schedule the maintenance work efficiently.

**Conflict resolution:** The page may include a feature to detect and resolve any conflicts, such as overlapping schedules or unavailable resources, that may affect the maintenance work schedule.

**Confirmation message:** After scheduling the maintenance work, the user should receive a confirmation message with the details of the work and a reminder of the scheduled start and end dates.

**Maintenance Progress Tracking Page:**

**Page header:** The page header should include the name and logo of the road maintenance and management web application.

**Maintenance progress form:** The maintenance progress form should include fields for the user to update the status of the maintenance work, such as the percentage of completion and any issues or delays encountered.

**Resource tracking:** The page should display the usage and availability of resources in real-time, such as equipment and labor, to help the user monitor progress and make necessary adjustments to the maintenance plan.

**Adjustment feature:** The page may include a feature to adjust the maintenance plan if necessary, such as rescheduling work or allocating additional resources.

**Completion notification:** Once the maintenance work is completed, the user should receive a notification indicating that the work has been completed, and the maintenance plan has been successfully executed.

### 6.5 Admin Module

The admin module of a road maintenance and management web application provides an interface for authorized personnel to manage and oversee the system's operations. It includes various features that allow the admin to manage user accounts, configure settings, and monitor the application's performance.

**Citizen complaint submission:** The module allows citizens to submit complaints about road-related issues through a web-based interface or mobile application.

**Complaint tracking:** The module enables authorized personnel to track and manage complaints, including assigning them to relevant departments for resolution and tracking their status.

**Communication:** The module facilitates communication between the transportation authority and the citizen regarding the status of the complaint.

**Reporting:** The module generates reports on complaint statistics, resolution times, and other relevant metrics.

**Integration:** The module can be integrated with other systems, such as a API system, to enhance its functionality.

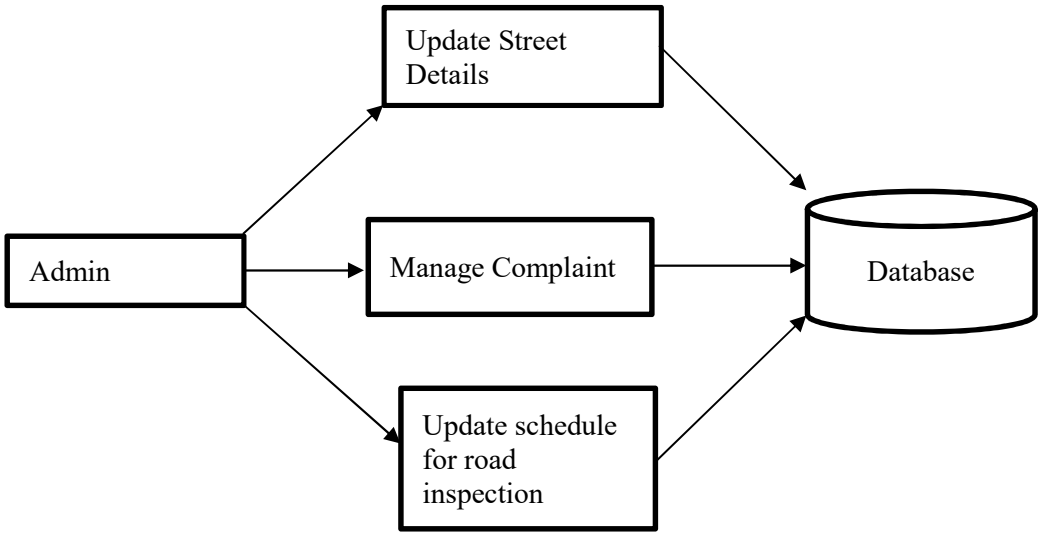



**Fig 6.5 Admin Module Workflow**

# CHAPTER 7

# CONCLUSION AND FUTURE ENHANCEMENT

## 7.1 CONCLUSION

Road maintenance and management system is a comprehensive solution that helps transportation authorities and public works departments to manage and maintain their road infrastructure. The system consists of various modules, including inspection and assessment, maintenance planning and scheduling, public communication, and mobile app integration. By using this system, transportation authorities and public works departments can improve the efficiency and effectiveness of their road maintenance activities, reduce costs, enhance public safety and satisfaction, and ensure compliance with regulatory requirements.

## 7.2 FUTURE ENHANCEMENT

**Real-time updates:**

One possible enhancement is to integrate real-time data feeds into the application, such as traffic data, weather data, and road closure information. This could help road crews prioritize their work and respond more quickly to changing conditions.

**Predictive analytics:**

Another enhancement could be to use machine learning algorithms to analyze historical data and predict future road maintenance needs. For example, the application could use data on traffic volume, road age, and weather patterns to predict when certain sections of road are likely to need repairs.

# APPENDICES

## A.SAMPLE CODE

Pcr.php

```
<?php
   session_start();
// connect to the database
$servername = "localhost";
$username = "root";
$password = "";
$dbname = "road";
$conn = mysqli_connect($servername, $username, $password, $dbname);
// check connection
if (!$conn) {
   die("Connection failed: " . mysqli_connect_error());
}
  ?>
<!DOCTYPE html>
<html>
<head>
   <meta charset='utf-8' />
   <title>Public complaint registry</title>
   <meta name='viewport' content='initial-scale=1,maximum-scale=1,user-scalable=no' />
   <script src='https://api.mapbox.com/mapbox-gl-js/v2.5.0/mapbox-gl.js'></script>
   <link href='https://api.mapbox.com/mapbox-gl-js/v2.5.0/mapbox-gl.css' rel='stylesheet' />
   <link rel='stylesheet' href='https://cdnjs.cloudflare.com/ajax/libs/font-awesome/4.7.0/css/font-awesome.min.css'>
   <link rel="stylesheet" type="text/css" href="stylehome.css">
   <style>
      #map {
         width: 100%;
         height: 300px;
```

```
        }
        #submit{
  background-color: #1a941f; /* Green */
  border: none;
  color: white;
  padding: 15px 32px;
  text-align: center;
  text-decoration: none;
  display: inline-block;
  font-size: 16px;
        }
        #cancel{
  background-color: #e72727; /* Green */
  border: none;
  color: white;
  padding: 15px 32px;
  text-align: center;
  text-decoration: none;
  display: inline-block;
  font-size: 16px;
        }
        input[type=text] {
  width: 100%;
  padding: 12px 20px;
  margin: 8px 0;
  box-sizing: border-box;
}
#complaint {
  width: 100%;
  padding: 12px 20px;
  margin: 8px 0;
  box-sizing: border-box;
}
#rep{
    margin-left: 17%;
}
.dashboard {
```

```
    display: flex;
    flex-direction: column;
    min-height: 100vh;
  }
  .header {
  background-color: #372cd6;
  color: #fff;
  display: flex;
  justify-content: space-between;
  align-items: center;
  padding: 0px;
  position: relative; /* Add position relative for user-profile absolute positioning */
  margin-left: 17%;
}
.user-profile {
  position: absolute;
  top: 20px;
  right: 20px;
  display: flex;
  align-items: center;
}
.user-profile img {
  width: 50px;
  height: 50px;
  border-radius: 50%;
  margin-right: 10px;
}
.user-profile .username {
  font-size: 18px;
  font-weight: bold;
  margin-right: 10px;
}
.logout-button {
  background-color: #e72727;
  border: none;
  color: white;
  padding: 10px 20px;
```

```
  text-align: center;
  text-decoration: none;
  display: inline-block;
  font-size: 16px;
  border-radius: 5px;
}
  </style>
</head>
<body><div class="fix">
   <div class="dashboard" id="das">
      <div class="header">
         <h1>Road management system</h1>
         <div class="user-profile">
         <i class='fa fa-user-circle' style='font-size: 34px;'></i><br><br>
          <?php
         if(isset($_SESSION["username"])) {
          echo "<b style='font-size: larger;'>Hello, {$_SESSION['username']}
</b><br>";
        }else{
           echo "error";
        }
        ?>
          <button class="logout-button" onclick="logout()">Logout</button>
<script>
function logout() {
  window.location.href = "card.html";
}
</script>
         </div>
        </div>
   <div class="sidebar">
      <a class="active" href="finalmap.html">Complaint</a>
      <a href="status.php">Status of Complaint</a>
      <a href="#contact">Contact</a>
      <a href="#about">About</a>
    </div>
   <div class="container-sm" id="rep">
```

```
    <!-- <h2>Road management system</h2>  -->
    <form action="fm.php" method="post" enctype="multipart/form-data">
<div id='map'></div><br>
<label>Name</label><br>
<input id='nam' type='text' name="nam" placeholder='Enter your name' /><br>
<label>Address</label><br>
<input id='address' type='text' name="address" placeholder='Address' /><br><br>
<label for="img">Select image of Damaged roads</label><br>
  <input type="file" id="img" name="img" ><br><br>
<label>Complaint</label><br>
<textarea id='complaint' rows='5' cols='50' name="complaint" placeholder='Enter
your complaint here'></textarea><br>
<button id='submit' type='submit' name="submit">Submit</button>
<button id='cancel' type='reset'>Cancel</button>
</form></div>
<script>
    mapboxgl.accessToken =
'pk.eyJ1IjoiZ2FuZXNoa3VtYXIwNyIsImEiOiJjbGV3b2I2bGcwZ3J1M29rYzFrb
XlmZGhyIn0.gYgMNNKuAyw3ia7ekZmIWA';
    var map = new mapboxgl.Map({
        container: 'map',
        style: 'mapbox://styles/mapbox/streets-v11',
        center: [78.82970181043784, 10.752463368605982],
        zoom: 12
    });
    var marker = new mapboxgl.Marker({
        draggable: true
    }).setLngLat([78.82970181043784, 10.752463368605982]).addTo(map);
    function onDragEnd() {
        var lngLat = marker.getLngLat();
        var url = 'https://api.mapbox.com/geocoding/v5/mapbox.places/' + lngLat.lng
+ ',' + lngLat.lat + '.json?access_token=' + mapboxgl.accessToken;
        fetch(url)
            .then(function (response) {
                return response.json();
            })
            .then(function (data) {
```

```
            var address = data.features[0].place_name;
            document.getElementById('address').value = address;
        });
    }
    marker.on('dragend', onDragEnd);
    document.getElementById('submit').addEventListener('click', function() {
        var complaint = document.getElementById('complaint').value;
        var address = document.getElementById('address').value;
        // alert('Complaint: ' + complaint + '\nAddress: ' + address);
    });
map.setZoom(12);
    });
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>Admin Dashboard - Road Management System</title>
  <!-- <link rel="stylesheet" href="dashboars1.css"> -->
  <link
href="https://cdn.jsdelivr.net/npm/bootstrap@5.2.3/dist/css/bootstrap.min.css"
rel="stylesheet" integrity="sha384-
rbsA2VBKQhggwzxH7pPCaAqO46MgnOM80zW1RWuH61DGLwZJEdK2Kad
q2F9CUG65" crossorigin="anonymous">
<script
src="https://cdn.jsdelivr.net/npm/bootstrap@5.2.3/dist/js/bootstrap.bundle.min.js"
integrity="sha384-
kenU1KFdBIe4zVF0s0G1M5b4hcpxyD9F7jL+jjXkk+Q2h455rYXK/7HAuoJl+0I
4" crossorigin="anonymous"></script>
<style>
table {
  font-family: arial, sans-serif;
  border-collapse: collapse;
  width: 100%;
}
td, th {
  border: 1px solid #dddddd;
  text-align: left;
```

```
  padding: 8px;
}
tr:nth-child(even) {
  background-color: #dddddd;
}
.btn {
  width: 80px;
}
</style>
</head>
</html>
<?php
require_once('adash.php');
require_once('connection.php');
// check if delete button was clicked
if(isset($_POST['delete'])) {
    $id = $_POST['id'];
    $sql = "DELETE FROM complaints WHERE id = '$id'";
    $result = mysqli_query($conn, $sql);
    if ($result) {
        echo "Record deleted successfully";
    } else {
        echo "Error deleting record: " . mysqli_error($conn);
    }
}
if(isset($_POST['accepted'])) {
  $id = $_POST['id'];
  $sql = "UPDATE complaints SET status = 'Accepted' WHERE id = '$id'";
  $result = mysqli_query($conn, $sql);
  if ($result) {
      echo "Status updated successfully";
  } else {
      echo "Error updating status: " . mysqli_error($conn);
  }
}
```

## B.SCREENSHOTS

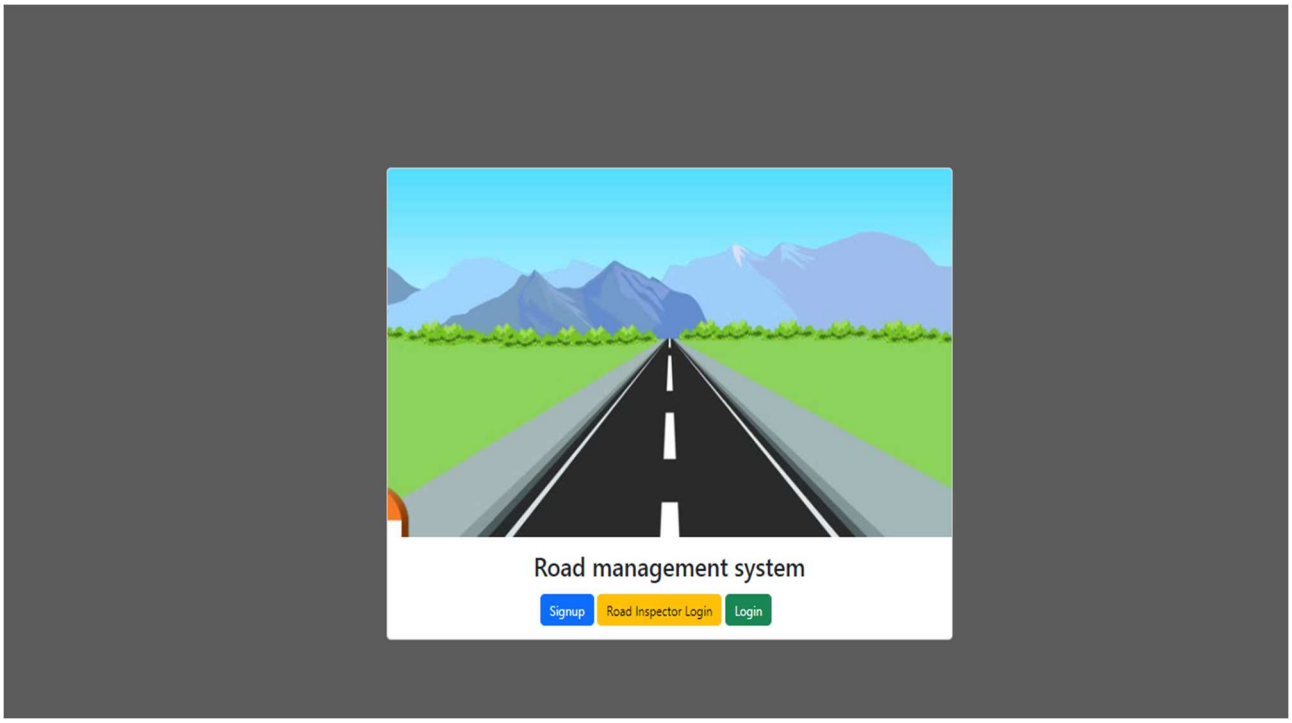



**Fig.No. B.1 Home Page**

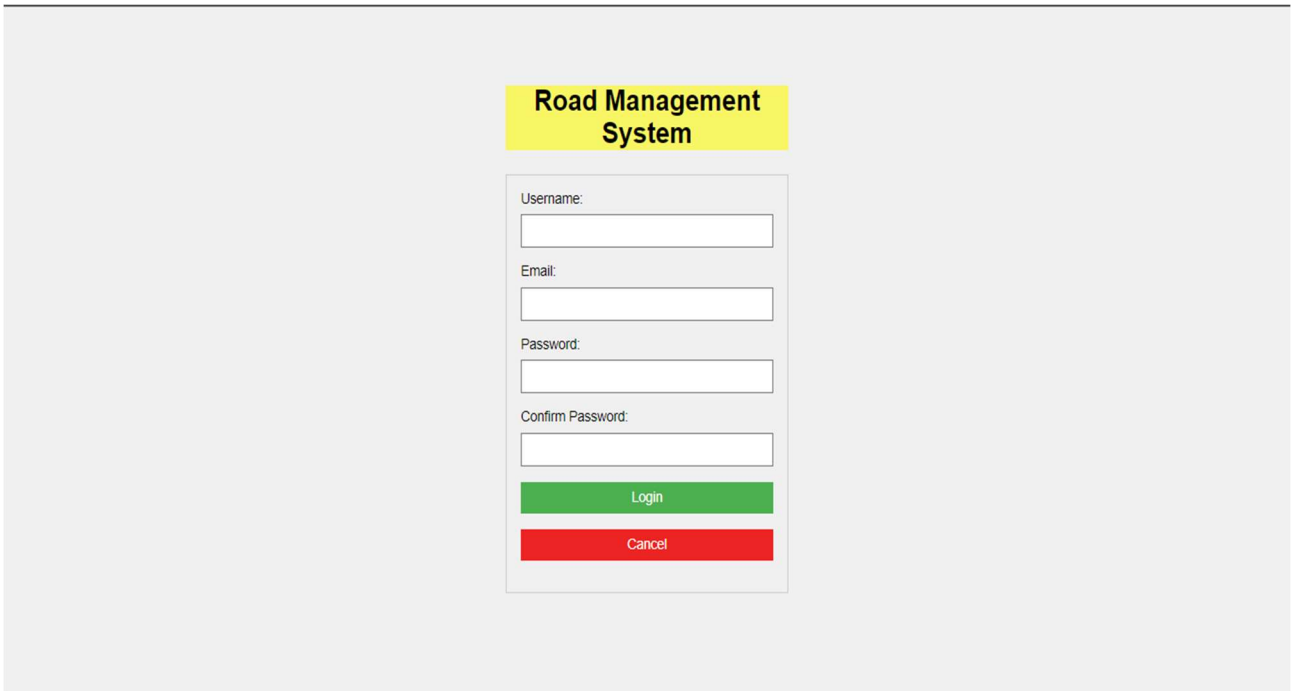



**Fig.No. B.2 Sign up page**

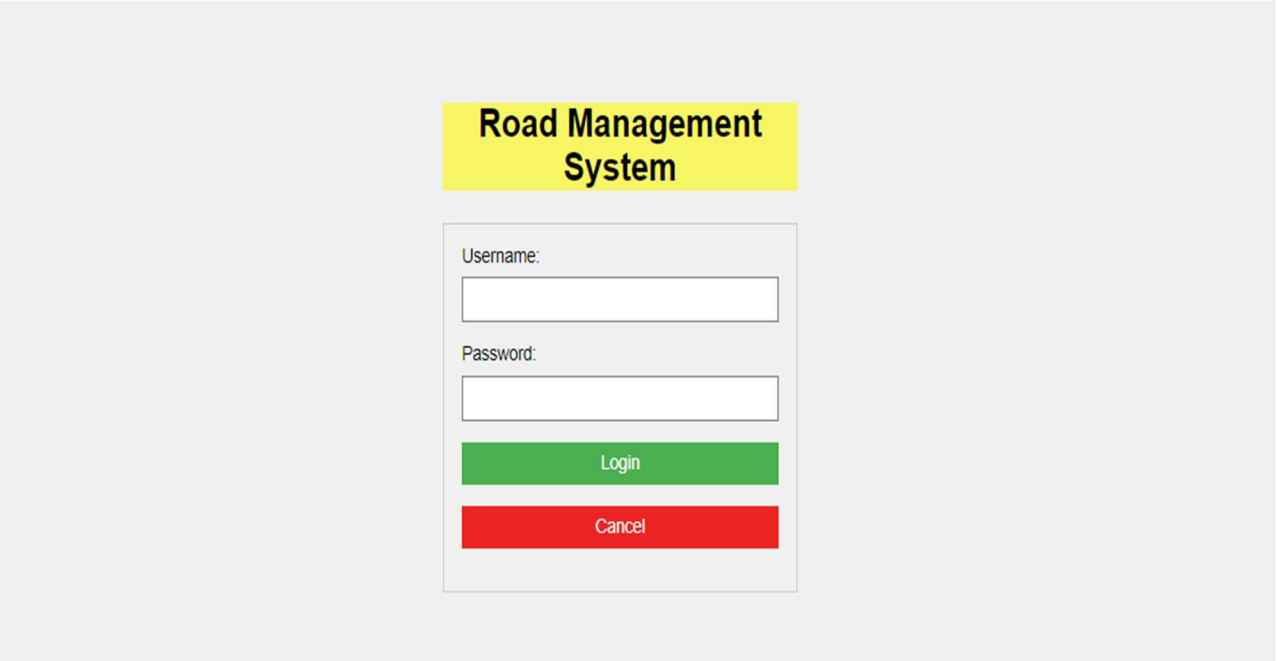



**Fig.No. B.3 Login Page**

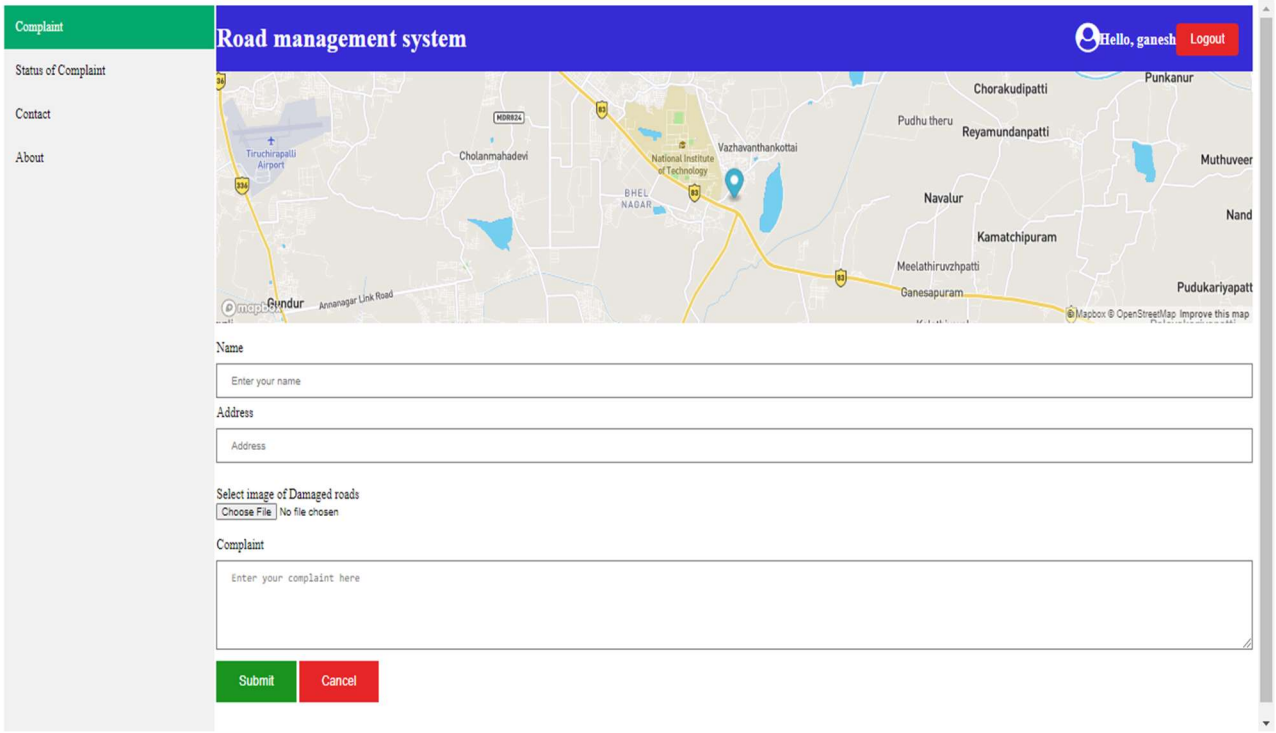



**Fig.No. B.4 Public complaint module**

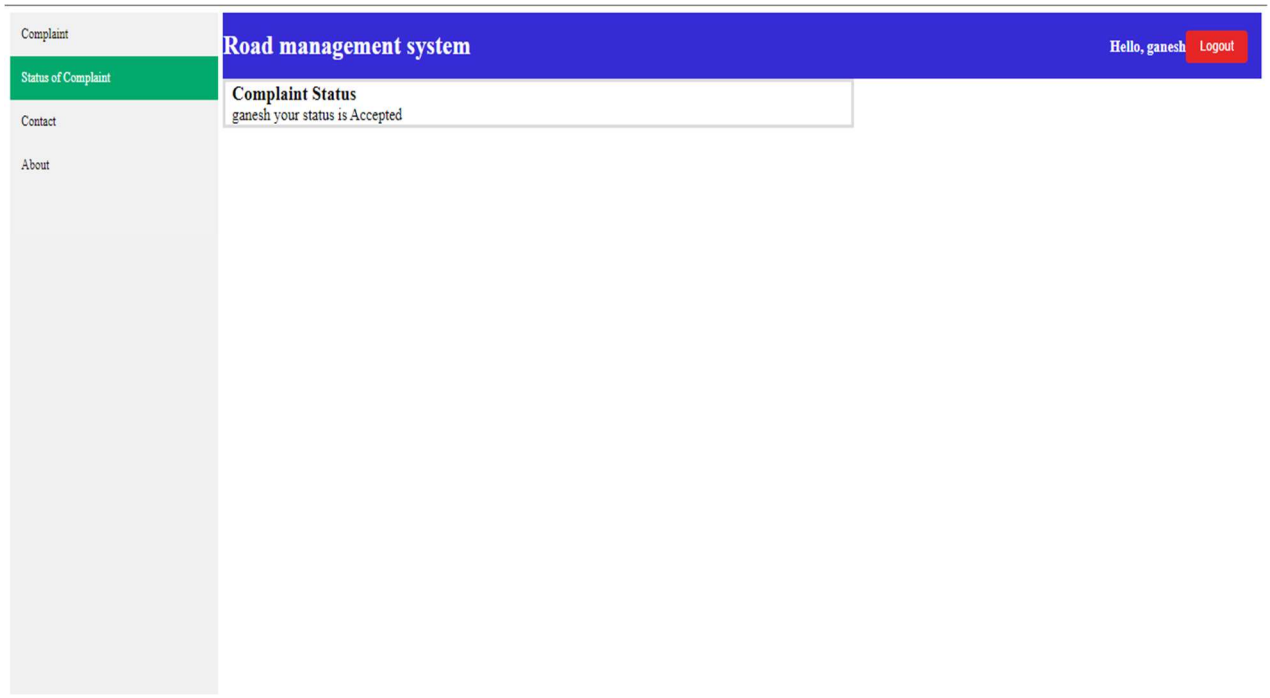



**Fig.No. B.5 Status of complaint**

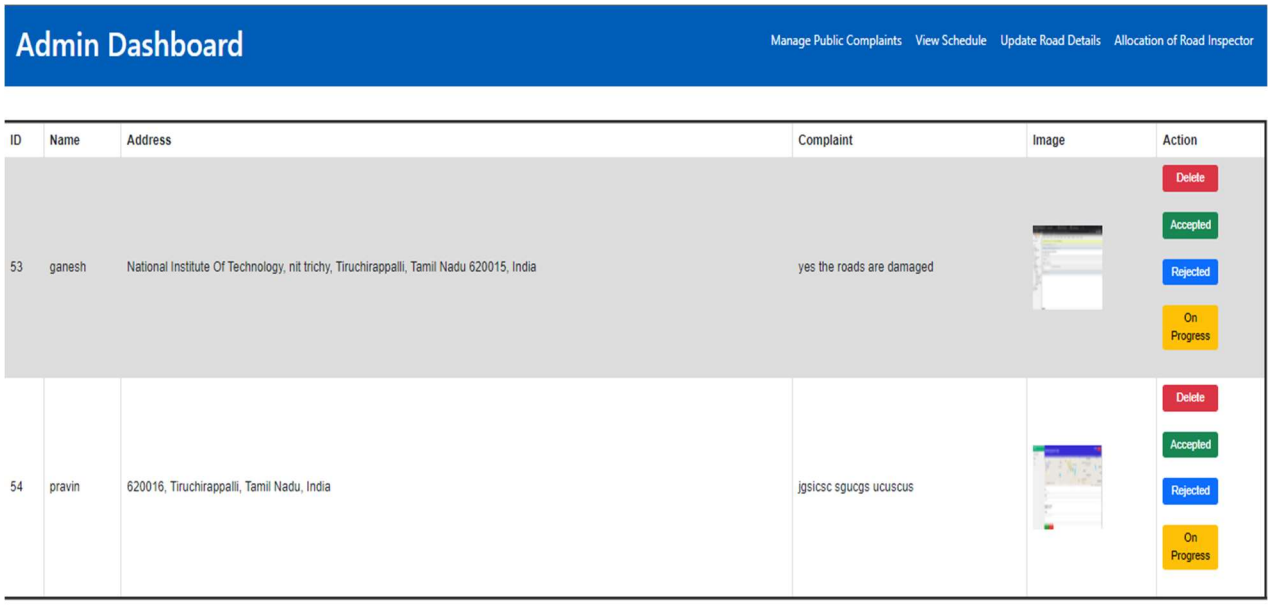



**Fig.No. B.6 Admin Dashboard**

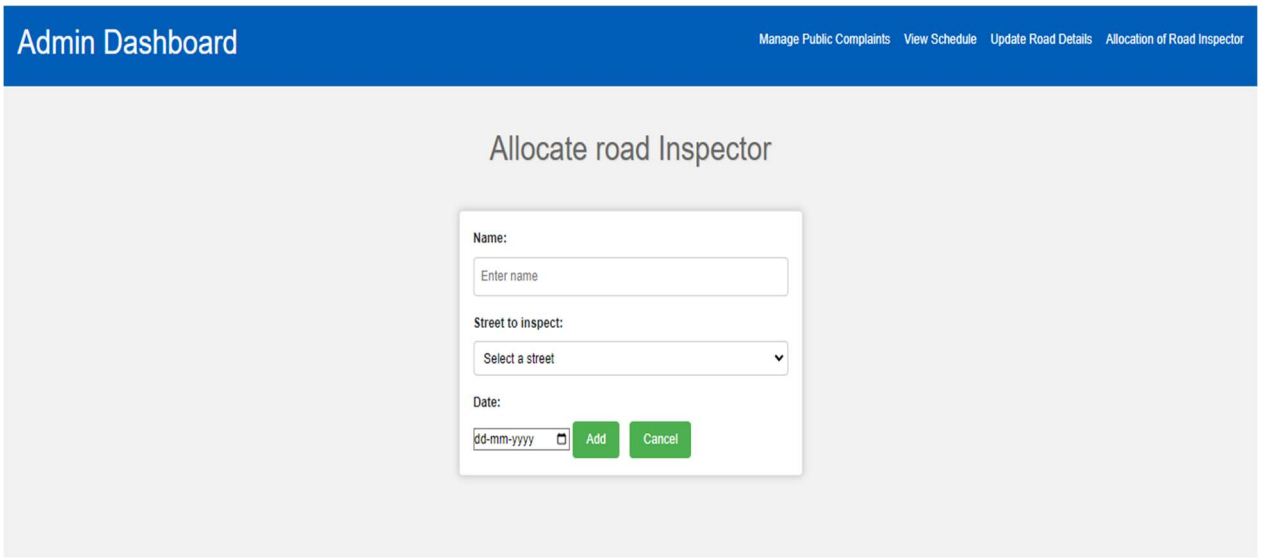



**Fig.No. B.7 Allocation of road inspector**

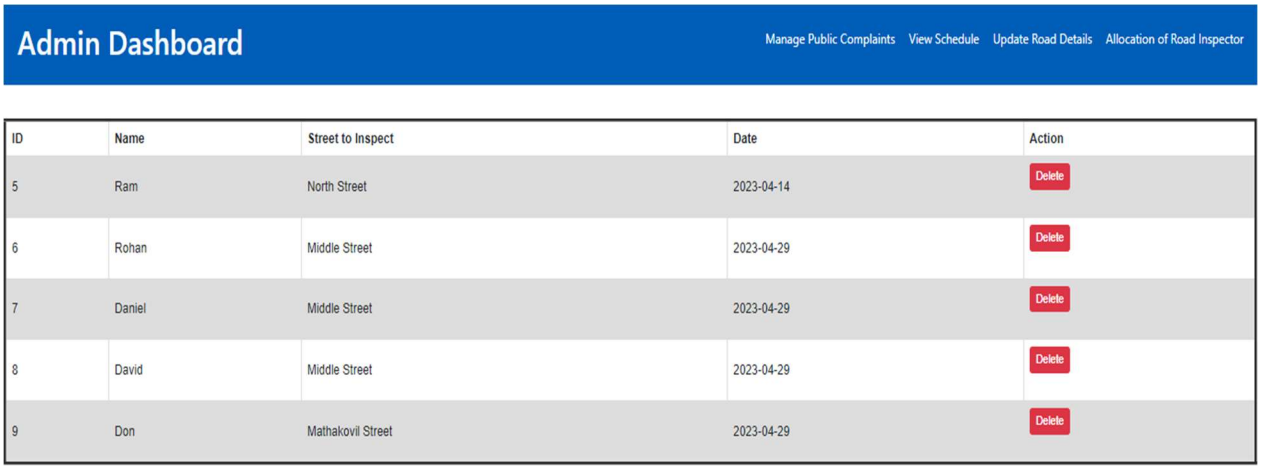



**Fig.No. B.8 Schedule**

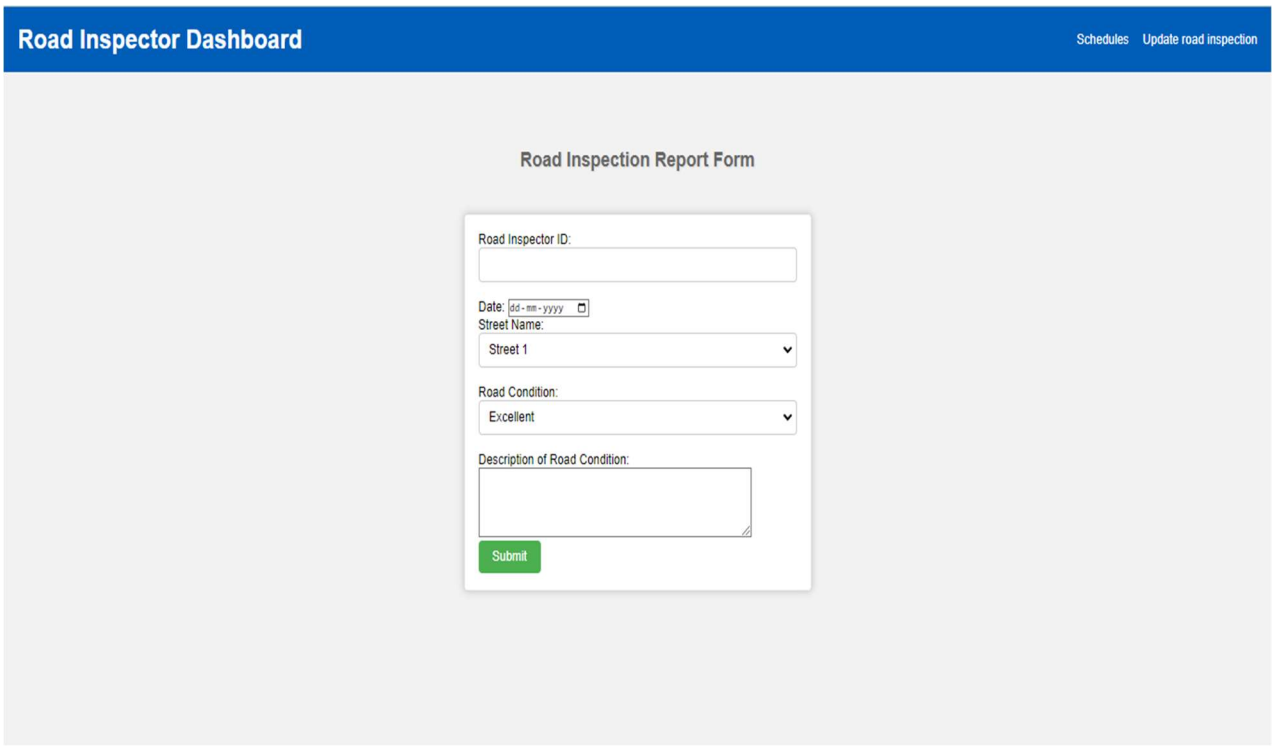
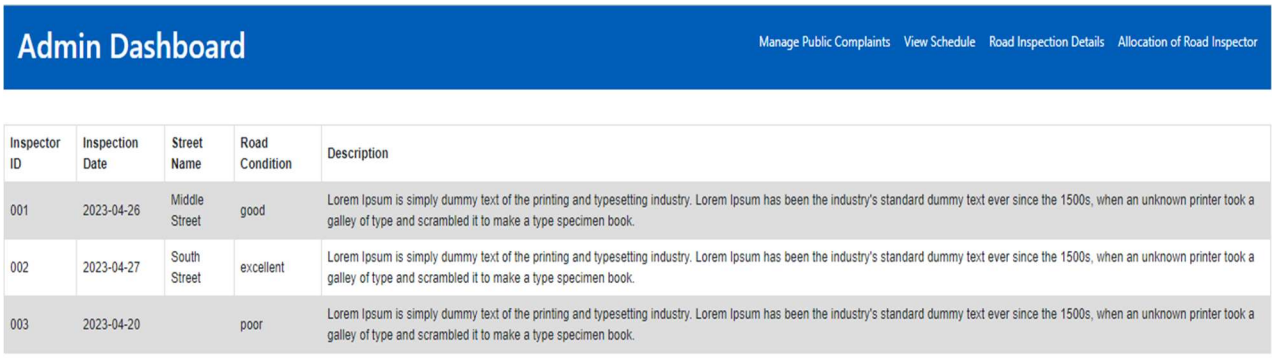



**Fig.No. B.9 Road Inspection report form**




| Inspector ID | Inspection Date | Street Name | Road Condition | Description |
|---|---|---|---|---|
| 001 | 2023-04-26 | Middle Street | good | Lorem Ipsum is simply dummy text of the printing and typesetting industry. Lorem Ipsum has been the industry's standard dummy text ever since the 1500s, when an unknown printer took a galley of type and scrambled it to make a type specimen book. |
| 002 | 2023-04-27 | South Street | excellent | Lorem Ipsum is simply dummy text of the printing and typesetting industry. Lorem Ipsum has been the industry's standard dummy text ever since the 1500s, when an unknown printer took a galley of type and scrambled it to make a type specimen book. |
| 003 | 2023-04-20 | | poor | Lorem Ipsum is simply dummy text of the printing and typesetting industry. Lorem Ipsum has been the industry's standard dummy text ever since the 1500s, when an unknown printer took a galley of type and scrambled it to make a type specimen book. |

**Fig.No. B.10 Road Inspection Details**

## REFERENCES


1. Faria Kalim, Jaehoon (Paul) Jeong, and Muhammad U. Ilyas, Senior Member, IEEE “CRATER: A Crowd Sensing Application To Estimate Road Conditions”

2. Feng Xiao1 , Zhou Hongyu2 , YuCaixia 3 1 Professor of Chongqing Jiaotong University, Institute of Civil and Architecture Engineering, Chongqing, China 2,3 Postgraduate student of Chongqing Jiaotong University, Institute of Civil and Architecture Engineering, Chongqing, China.

3. D. Piovarci and T. KovacikSlovak University of Technology in Bratislava, Faculty of Informatics and Information Technologies, Bratislava, Slovakia.

4. Ms. Priyanka D Lad 1 , Ms. Yogita Fulse 2 1 M.tech Civil ( construction management). School of Engineering and Technology, Sandip University, Nashik 2 Yogita Fulse Assistant Professor Civil Engg Department School of Engineering and Technology, Sandip University, Nashik.

5. Zhenhua Liu, Liuyang Liu, Wentao Fan Transport Information Center China Academy of Transportation Sciences Beijing, China

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Co-ordinator

**Dr.K.M.Arunraja**
Organizing Secretary

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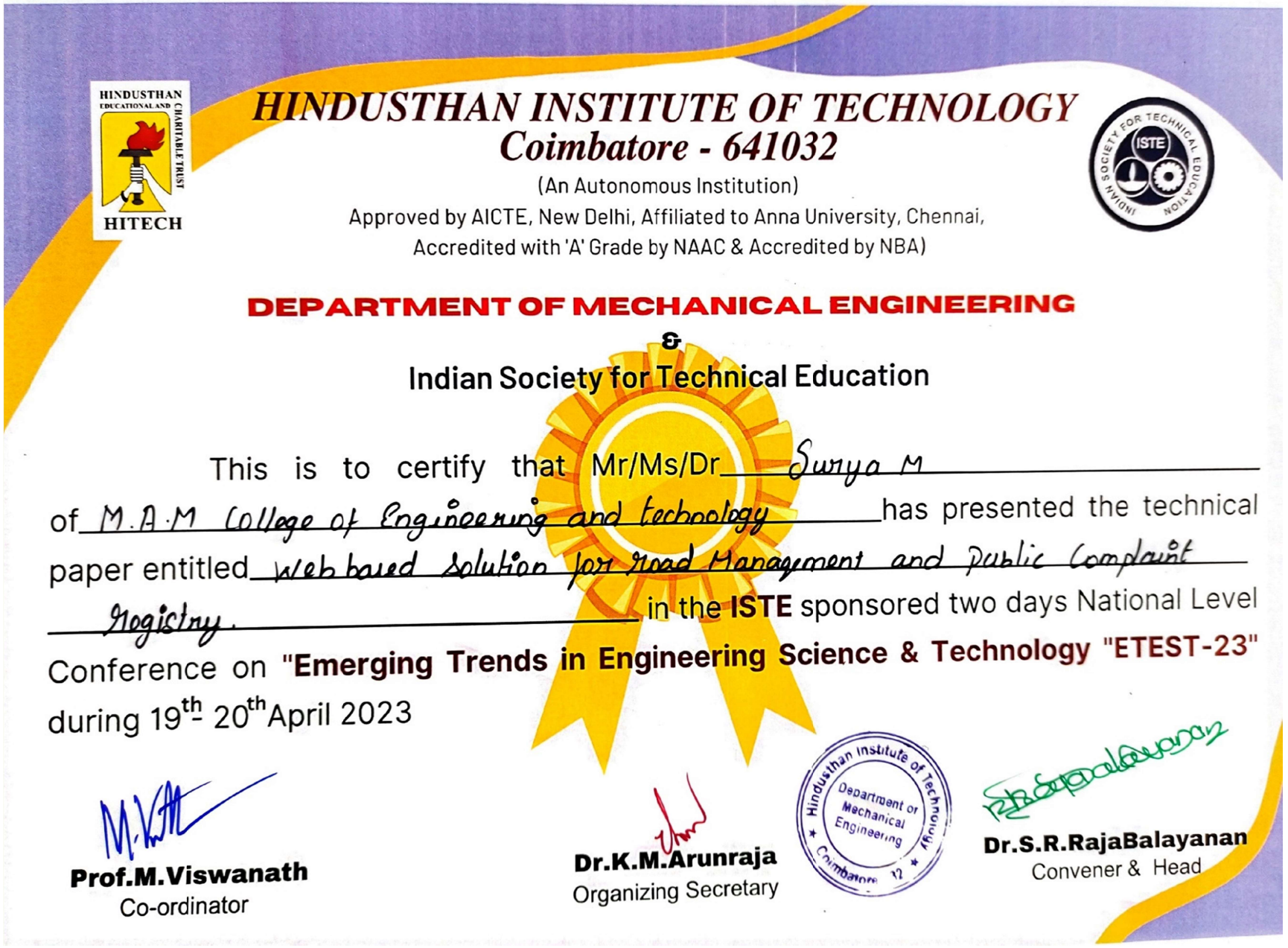

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