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Road Health Tracker – A Comprehensive Approach to Enhanced Road Condition Monitoring and Improvement

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Abstract: A healthy road network plays a significant role in the socio-economic development of any country. It has been observed that real-time road condition monitoring can drastically reduce road and vehicle maintenance expenses. Everyday 1374 road traffic accidents (RTAs) and 400 deaths take place in India. The number of deaths in RTAs would increase to 662 persons per day in 2030 and will not begin to decline until 2042, which is a serious public health concern. There are various methods to analyze road health, but most are either expensive, costly, time-consuming, labor-intensive, or imprecise. In this user can send their live location i.e., longitude and latitude to the selected municipal with photo and feedback. Then user can check last feedback. It concludes that user can directly send their feedback to municipal directly by this system.

IndexTerms **- Road Health, rht, Web Application, Database**

I. INTRODUCTION

Introducing Road Health Tracker, a ground-breaking platform that empowers communities to actively improve their roads. With us, users can easily share pictures of road issues, from potholes to dangerous conditions. We act as a link between concerned citizens and local authorities, guaranteeing safer and smoother travels for everyone. Our goal is straightforward: to promote a culture of road safety and quality enhancement. By uniting citizens' efforts, we're instigating change step by step through images. We seamlessly connect with government teams, promptly notifying them about areas that need attention. Join us in the movement for better roads, where each upload sparks transformation. Together, we're establishing a network of empowered citizens and responsive governance, reshaping our streets for a brighter, safer future. Begin making a positive impact today with Road Health Tracker - because better roads begin with you.

Our vision at Road Health Tracker is to create safer, more connected communities through the power of collective action. We envision a future where citizens and local governments work hand in hand to proactively address road-related challenges, ultimately leading to more efficient, reliable, and secure transportation networks.

II. MOTIVATION

As per Indian government record every year approximately 1.5 lakh people dies on Indian roads which translate on an average, into 1130 accidents and 422 deaths every day or 47 accidents and 18 deaths every hour. In India there are accidents happening due to road conditions like slippery also there are have heavy turns because of these many lives are went. Also, as per observation accidents can impact on social diversity, economics and vehicle maintenance. So, because we cannot raise complaint against directly to municipal so due to this, we can send complaint with photo, location. Our motto is to provide information about road to needy people (user) and also to municipal.

III. LITERATURE REVIEW

"Road Accidents in India 2021" published by Ministry of Road Transport and Highways Government of India (Research Wing). In the Section-2 of journal it describes the number of accidents happening as per roads category. Totally, 17% death rate is increased because of the accidents in India. In the year 2021 4,12,432 accidents are happened in India from those 1,53,972 peoples are killed. As per record, 45.4% accidents are happened on the other roads i.e., undeveloped and has under the municipal. Also as compared to last year of 2021 in the year 2021 the ratio of accidents on others roads are increased.[1].

"Low-Cost Road Health Monitoring System: A Case of Flexible Pavements" published on 14 September 2021. An automized sensor-based system is developed to assist the road sections for repair and rehabilitation. The proposed system is mounted in a vehicle and the data have been collected for a more than 1000 km road network. The data have been processed using SPSS, and it shows that the proposed system is adequate for detecting the road quality. It is concluded that the proposed system can identify the vulnerable

sections to add to the pavement maintenance plan. It requires camera mounted on vehicle to scan the quality of road. This system provide accuracy of 80%.[2]

"Spatio-temporal analysis of road traffic accidents in Indian large cities." Published on 14 January 2019. Present paper attempts to analyze the trends and patterns of RTAs in India during the year 2000–2015, and the patterns in the year 2015 in cities with population size 2 million or more. The exponential growth rate curve of the number of RTAs shows upward trend during 2000–2015 in India. The spatial analysis of severity shows that there is no direct link between the number of accidents and the severity. The city-wise analysis of RTAs by the vehicle involved, age of the persons, cite, and timing of accidents shows a varying pattern across the cities. In this the analysis is done with major cities such as Ahmedabad, Bengaluru, Chennai, Delhi, Hyderabad, Jaipur, Kanpur, Kolkata, Lucknow, Mumbai, Nagpur, Pune, and Surat.[3]

"Accident risk of road and weather conditions on different road types" published on 29 October 2018. This study was designed to investigate the relative accident risk of different road weather conditions and combinations of conditions. This paper includes the speed of the traffic and thus, the paper examines accident risk in relation to the time spent on the road segment in certain conditions. The hour-level weather and road condition data per segment were obtained from nearby road weather stations. The relative accident risks were increased for poor road weather conditions; however, they were highest for icy rain and slippery and very slippery road conditions. The objective of this study was to investigate the frequency and relative accident risk of different weather and road conditions from the drivers' point of view, both overall and differentiated by road type and accident type.[4]

"The identification of patterns of interurban road accident frequency and severity using road geometry and traffic indicators" published on April 2016. This paper is focused on the effect of road geometry, and other accident-causing conditions, on the binary response variable road accident severity. The data is collected from two interurban routes in Spain (Madrid-Irun and Barcelona-Almeria) and covers a 3-year period (2010-2012). The road geometry design is found to have a significant impact on the different accident types. Among the most important variables the main lane widths, superelevation and slope were found to affect the severity rate for all accident types. narrow main lane, shoulder lane, median lane and slow lane, might increase the accident severity. [5]

"Road Funds: A Case Study of Sustainable Road Maintenance In India" published in 2005. India is confidently meeting the challenge of upgrading and expanding the existing road network and its maintenance. In this journal describes study about four states world network in India such that Kerala, Madhya Pradesh, Karnataka and Uttar Pradesh. It states fund given to those states as per records for maintenance of road per year officially. Also describes why roads health are decreasing like oil transportation via road. Each state given a fund from central government to keep road quality high as well as state government provide their fund to maintain a road. And also provide extra fund to increase road network in rural area.[6]

IV. ANALYSIS

Table 1.1: Accidents, Persons killed and Injuries by Road Feature

Road feature	Number of accidents			Persons killed			Persons injured		
	2020	2021	%age change	2020	2021	%age change	2020	2021	%age change
Straight road	2,37,943	2,78,218	16.9	85,032	1,02,623	20.7	2,26,651	2,59,402	14.4
Curved road	47,772	49,581	3.8	16,746	19,120	14.2	48,213	48,888	1.4
Bridge	12,836	12,709	-1.0	5,049	5,337	5.7	12,211	11,546	-5.4
Culvert	6,724	6,663	-0.9	2,762	2,960	7.2	6,017	6,029	0.2
Potholes	3,564	3,625	1.7	1,471	1,481	0.7	3,064	3,103	1.3
Steep grade	4,244	3,967	-6.5	1,604	1,635	1.9	3,977	3,398	-14.6
Ongoing road works/ Under construction	9,173	9,075	-1.1	3,894	4,014	3.1	8,005	7,539	-5.8
Others	43,882	48,594	10.7	15,157	16,802	10.9	40,141	44,543	11.0
Total	**3,66,138**	**4,12,432**	**12.6**	**1,31,714**	**1,53,972**	**16.9**	**3,48,279**	**3,84,448**	**10.4**

Table 1.2 Accidents by Type of Road Junction at the All India (2020-21)

Junction Type	Number of accidents			Persons killed			Persons injured		
	2020	2021	%age change	2020	2021	%age change	2020	2021	%age change
T-Junction	36,471	37,020	1.5	11,091	11,783	6.2	33,735	34,092	1.1
Share in Total	10.0	9.0		8.4	7.7		9.7	8.9	
Y-Junction	16,438	15,527	-5.5	5,501	5,384	-2.1	14,729	13,671	-7.2
Share in Total	4.5	3.8		4.2	3.5		4.2	3.6	
Four arm Junction	17,611	18,703	6.2	5,368	5,739	6.9	15,206	16,216	6.6
Share in Total	4.8	4.5		4.1	3.7		4.4	4.2	
Staggered Junction	18,713	14,111	-24.6	6,204	5,160	-16.8	16,539	12,678	-23.3
Share in Total	5.1	3.2		4.7	3.0		4.7	3.2	
Round about Junction	11,161	13,210	18.4	3,990	4,603	15.4	10,083	12,147	20.5
Share in Total	3.0	3.2		3.0	3.0		2.9	3.2	
Others*	2,65,744	3,13,861	18.1	99,560	1,21,303	21.8	2,57,987	2,95,644	14.6
Share in Total	72.6	76.1		75.6	78.8		74.1	76.9	
Total	**3,66,138**	**4,12,432**	**12.6**	**1,31,714**	**1,53,972**	**16.9**	**3,48,279**	**3,84,448**	**10.4**

Table 1.3: Road Accidents by Weather Condition (2020-21)

Weather condition	No of accidents			Persons killed			Persons injured		
	2020	2021	%age change	2020	2021	%age change	2020	2021	%age change
Sunny/clear	2,61,046	2,99,305	14.7	88,239	1,05,805	19.9	2,53,421	2,84,176	12.1
Rainy	36,161	36,432	0.7	13,283	14,455	8.8	34,552	33,416	-3.3
Foggy &misty	26,541	28,934	9.0	12,084	13,372	10.7	23,111	25,360	9.7
Hail/ sleet	4,752	3,911	-17.7	2,095	1,872	-10.6	4,074	3,296	-19.1
Others	37,638	43,850	16.5	16,013	18,468	15.3	33,121	38,200	15.3
Total	**3,66,138**	**4,12,432**	**12.6**	**1,31,714**	**1,53,972**	**16.9**	**3,48,279**	**3,84,448**	**10.4**

V. METHODOLOGY

In this System there are have two modules such user and municipal, In this firstly if user have to send complaint and feedback to municipal then it has to sign in first if user has not signed yet then it has to register then user select what he have to send so after selecting user can fill the complaint form or feedback form after filling it user can send form to nearest municipal. Then Municipal receives feedback or complaint give it to reply.

VI. MODULES

In this system requires mainly two modules i.e., 1) User 2) Municipal.

A. Module 1 User:

1. Register: User can register using their personal information.
2. Login: User can login with username and password.
3. Profile
    a. Personal Details
    b. Form Suggestions.
    c. Sent complaints/feedbacks

4. Extra Activities about Roads
5. Extra Information about road network

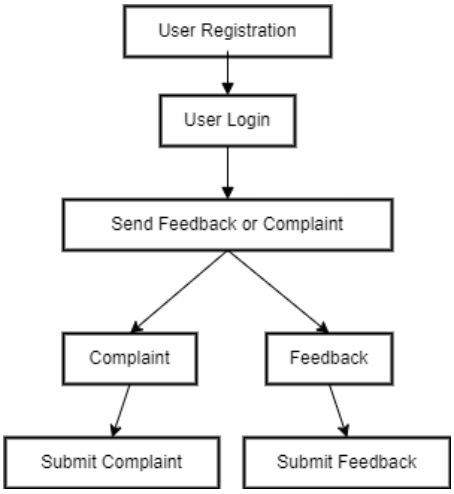

Fig 1: Module 1 User

B. Module 2 Municipal:

1.Login: Municipal can login with their username and password.
2.Received Complaints
   a. Completed Complaints
   b. New Complaints
3.Road Detail Page.

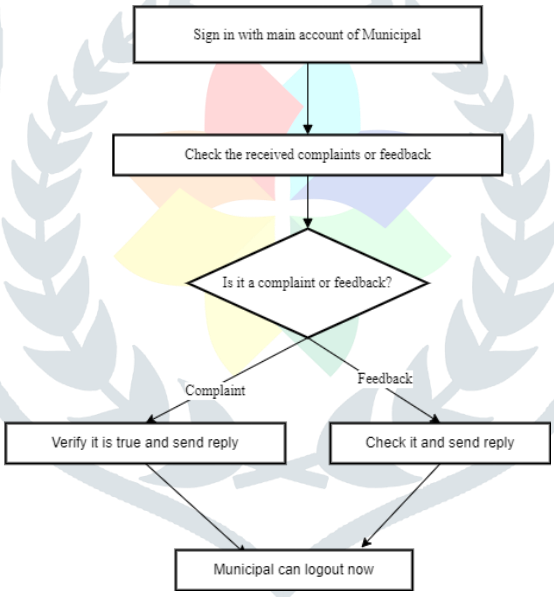

Fig 2: Module 2 Municipal

VII. ARCHITECTURE

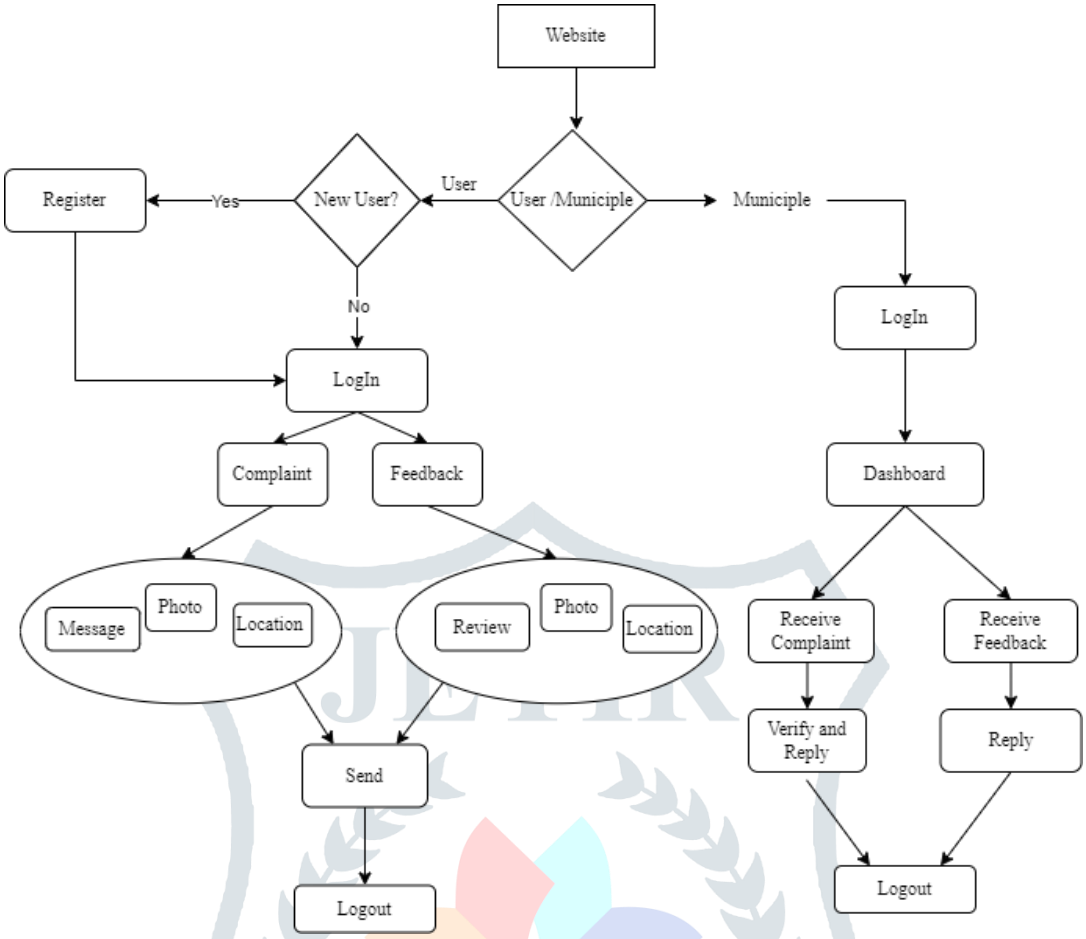

Fig 3: System Architecture

VIII. SCOPE

- AI/ML: By adding pit detection in project and sending that data to municipal and it will get improve the quality.
- Implementing this website on higher level will get helpful to improve the quality high level
- Adding the new technology using bots in ai will helpful in emergency situation.
- Improving pit detection quality using IOT based instruments.
- Adding map system that will get helpful to achieve correct location
- Alert system for user as per road conditions.

IX. CONCLUSION

In conclusion, it is clear that a well-kept road system is essential to the socioeconomic development of every country. Traditional methods of analyzing road health are often impractical due to their expenses, time requirements, or lack of accuracy. A realistic strategy for improving road upkeep and safety is the suggested approach, which would allow users to directly share their live location, images, and comments with local authorities. This method accelerates the feedback process so that people are able to engage more actively in road maintenance and allows relevant authorities to respond to issues more quickly. Therefore, the key to creating a transportation infrastructure that is safer and more robust in the future is to adopt new technologies for road condition monitoring and feedback mechanisms.

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