IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 11, Issue 4, April 2024

DOI: 10.17148/IARJSET.2024.11474

"DETECTING LIVE POTHOLES BY NAVIGATION SYSTEM"

Prof. S. R. Baji, Ms. Sayali Ravindra Shardul, Ms. Purva Narendra Kohok,

Ms. Asmita Rakesh Shimpi, Ms. Anushri Sanjay Sonawane

Department of Computer Engineering, Late G. N. Sapkal College of Engineering

Abstract: Potholes are becoming a growing cause of concern, resulting in numerous road accidents across the country. To address this problem, a smart pothole reporting system has been developed that can report and address potholes as soon as they occur. The system ensures transparency and accountability between citizens and the government while being user-friendly. The smart system employs an image recognition-based method that uses machine learning techniques, such as the Classification Algorithm using TensorFlow, to identify potholes. The system collects data and uses it to represent areas with a higher density of potholes on a map. If the density of potholes in a certain area is high, the road appears red on the map. Conversely, if the potholes have been patched up or there are no potholes, the road appears green. Color codes are used to warn and alert drivers about the observed road conditions. The smart pothole reporting system enables prompt reporting and resolution of potholes by the appropriate authorities. The system allows the government to prioritize areas that require attention and repair, leading to a more efficient allocation of resources. Additionally, the system helps to eliminate the threat posed by potholes and ensures safer roads for everyone. In conclusion, the smart pothole reporting system is an easy- to-use solution that addresses the growing concern about potholes and provides a safer road network for citizens. The system ensures transparency and accountability between the government and citizens, using advanced technology to identify and report potholes promptly.

Keywords: Potholes, Smart Reporting, Classification Algorithm, TensorFlow, Colour code, Alert

I. INTRODUCTION

The Ministry of Road Transport and Highway (MoRTH) survey reveals that more than 5000 people die yearly due to bad road conditions and potholes. The increasing number of accidents caused by potholes is a massive issue, and no serious actions have been taken to address it. Maharashtra is currently the second most pothole-ridden state in India. Currently, road maintenance companies require several working hours to roughly estimate the damage on a road. It becomes difficult to spot potholes during the night due to reduced visibility. While there are systems available that allow users to report potholes by using their mobile phones, the current system has many limitations. It cannot guarantee the presence of potholes at the reported location, and it also lacks transparency in the repair process. Although users can upload pictures of potholes, there is no algorithm to verify the authenticity of the images, and no standard definition of what is considered a pothole. While Google Maps offers many advanced features, it does not provide real-time updates on road conditions. So, a smart pothole reporting system is designed to report problems to the authorities as soon as they arise and maintain transparency between the government and citizens. The system is user-friendly and efficient in resolving pothole-related threats throughout the nation. While potholes are being repaired, the system uses navigation to guide citizens about road conditions.

To address the problems related to potholes using an application where users can upload images of potholes along with their coordinates, which results in an indication of road conditions by using a color code on the Navigation system.

The road with the highest intensity of potholes should appear as red on the map, while under- construction roads should be denoted by a yellow

color, and roads with no flaws are shown in green. This system should improve road understanding, allowing drivers to analyze the road properly using the provided information.

II. LITERATURE SURVEY

1. Indian pothole detection based on CNN and anchor-based deep learning method.:
Mallikarjun Anandhalli., and Vishwanath Baligar, In Proc. in International Journal of Information Technology. A study from February 2022 demonstrates the application of deep learning techniques for pothole identification. For the purpose of spotting potholes on the road, a convolutional neural network is employed. With the use of this method, image flaws

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 11, Issue 4, April 2024

DOI: 10.17148/IARJSET.2024.11474

are found and extraneous images of other objects are avoided. The pothole in the image is detected using deep learning methods as well as the layers in the CNN algorithm. In Proc. in International Journal of Information Technology · February 2022[1].

2. A Real-Time Pothole Detection Approach for Intelligent Transportation System:

Hsiu-WenWang, Chi-Hua Chen, Ding-Yuan Cheng, ChunHao Lin, and Chi-Chun. An intelligent transport system is a cutting-edge program that intends to offer cuttingedge services connected to various modes of transport and traffic management and to give users the information they need to use transport networks in a safer, more effective, and ”smarter” way. The intelligent transportation system needs to be able to detect potholes. Road accidents caused by potholes are less common since it detects them in real time and prevents accidents on the roadways. 2015 in the Proceedings of HsiuWen Wang et al., Taiwan, China.[2]]

Convolutional neural networks-based pothole detection using thermal imaging

Aparna, Yukti Bhatia, Rachna Rai, Varun Gupta, Naveen Aggarwal, and Aparna Akula. Convolutional neural networks are a kind of artificial neural network that are commonly used to analyze visual data. Deep learning is relevant to this. Thermal imaging is a type of infrared imaging that uses a camera to gather and create images of objects using infrared radiation that is emitted from the objects throughout a process. It helps in determining the potholes' width and depth as well as in evaluating the specifics of their structural design. Computer and Information Sciences 34 (2022) 578-588, King Saud

University Privacy Journal, February 2019. [3]

3. Real-Time Pothole Detection using Android Smartphones with Accelerometers

Artis Mednisy, Girts Strazdinsy, Reinholds Zviedris, Georgijs Kanonirs, and Leo Selavoy.An accelerometer is a piece of electromechanical equipment used to monitor acceleration forces. These forces may be static, like the gravitational pull that is always there, or dynamic, like those used by many mobile devices to sense motion or vibrations. Here, the user can utilize the camera and accelerometer on their smartphone to find potholes. In Proc. of Institute of Electronics and Computer Science 14 Dzerbenes Str., Riga, LV 1006, Latvia Faculty of Computing University of Latvia 19 Raina Blvd., Riga, LV 1586, Latvia. [4]

4. Road Pothole Detection using Deep Learning Classifiers :

Surekha Arjapure, D. R. Kalbande.A classifier is a particular kind of machine learning algorithm used to categorize data input. Machines can recognize and extract features from photographs thanks to deep learning. The photographs will be classified by classifiers, who will also assist in spotting any potholes. In Proc. International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878 (Online), Volume8

Issue6, March 2020.[5]

5. Webbased framework for smart parking system:

Alharbi A, Halikias G, Yamin. This study shows how parking on specific streets and in important metropolitan areas greatly increases traffic congestion. The proposed web application, introduces the idea of an intelligent system to address this issue by enabling users to pre- reserve arriving at the venue and then modifying the process in response to the automatic detection of the composite plate. On pages 1495– 1502 of JJT Information Technology.[6]

III. PROPOSED SYSTEM

- **Problem Statement**

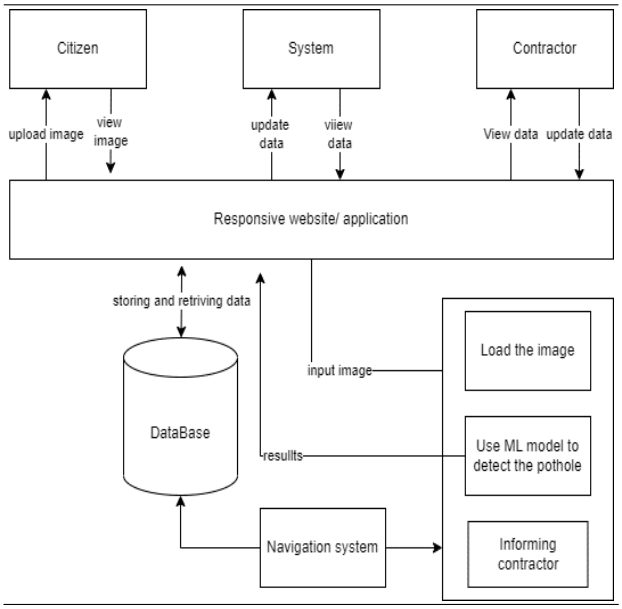
The problem statement revolves around the project is to address the growing concern of potholes causing road accidents. This is being achieved by developing a smart pothole reporting system that utilizes advanced technology for prompt detection and resolution. The system ensures transparency and accountability between citizens and the government by providing a user- friendly platform for reporting potholes and monitoring their resolution. It employs image recognition and machine learning techniques, such as the Classification Algorithm using TensorFlow, to accurately identify potholes. The system collects data and maps areas with a higher density of potholes on a color-coded map,alerting drivers to road conditions. Prompt reporting enables authorities to quickly address reported potholes, and the system assists the government in efficiently allocating resources for repairs. Ultimately, the goal is to eliminate the threat of potholes and create safer roads for everyone.

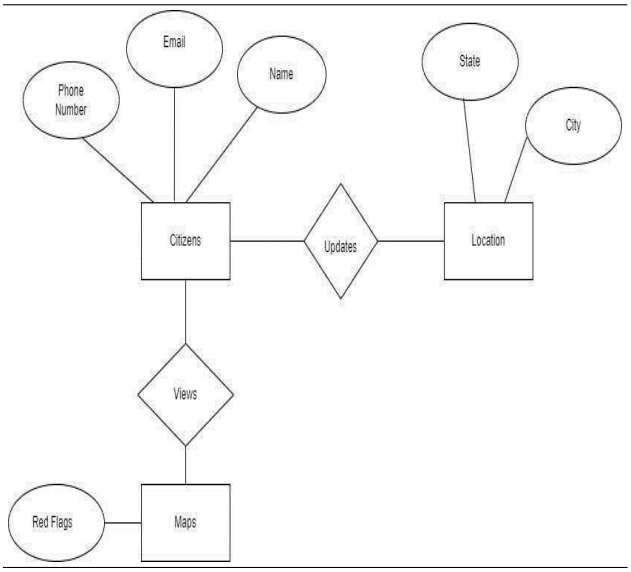
IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 11, Issue 4, April 2024

DOI: 10.17148/IARJSET.2024.11474





- **METHODOLOGIES OF PROBLEM SOLVING**

1. Capturing of the image:

Once users access their account on our application, they are presented with a ”Create case” option on the dashboard. By clicking on this option, users can provide informationabout the location and pothole they have encountered. Furthermore, they have the optionto capture a photograph of the pothole. If the photograph captured by the user contains apothole, it is added to the database for further analysis and processing. On the other hand,if the photo does not contain a pothole, it is discarded as it does not contribute to the dataset. This process allows users to actively participate in documenting and reporting potholes through our application. By selectively adding photos with potholes to the database, we aim to enhance the accuracy and effectiveness of our system in detecting and addressing road damage.

2. Classification:

When a user uploads a photograph using our application, it undergoes verification through a binary classification model designed to determine the presence or absence of a pothole. This classification model is trained using TensorFlow, a popular machine- learning framework. To train the binary classification model, we employ a combination of K-Means clustering and Convolutional Neural Networks (CNN). K-Means clusteringis used as a preprocessing technique to extract relevant features from the input images. It helps identify patterns and group similar image regions together, aiding in the

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 11, Issue 4, April 2024

DOI: 10.17148/IARJSET.2024.11474

subsequent classification process.

3. Upload in the database:

Once the binary classification process determines that a photo contains a pothole, it is added to the database specifically used for training the model. This database serves as a valuable resource for refining and improving the performance of the model over time.

4. Contractors:

After new pothole cases are reported on the website, the administrator is empowered to assign these cases to the appropriate contractors for further action. This ensures efficient distribution of workload and facilitates timely resolution of the reported potholes.

5. Maps:

The integrated map navigation system in our application leverages the powerful features of Google Maps to provide comprehensive navigation and mapping functionality. Userscan easily find routes from their selected source to a desired destination using this system.

- **Requirements**

Hardware Requirements

1. Processor- Intel i5/i7
2. Speed- 3.1 GHz
3. RAM- 8 GB(min)
4. Hard Disk- 50 GB
5. Camera Interface

Software Requirements

1. Operating System- Windows
2. SQL Database
3. .NET Platform
4. Google Maps API

- **Algorithm**

1. START
2. Enter your credentials to login.
3. Verify the pothole image
4. Complaint details
5. Admin panel
6. User panel
7. Pothole image verification.
8. END

IV. RESULT DISCUSSION

A smart pothole navigation system has been developed, consisting of both a mobile application and a website. The mobile application is designed for use by the general public, allowing citizens to access and utilize the system. On the other hand, the website is specifically intended for administrative officers and contractors involved in the management and maintenance of the road infrastructure. The primary component of the smart pothole navigation system is the user application. Upon registration, users gain access to a dashboard that offers several key features. The dashboard includes options such as ”Create Case,” ”All Cases,” and ”View Map.”

In the ”Create Case” section, users can raise a complaint regarding a pothole by either capturing a photo using the device’s camera or uploading an image from their gallery. This feature enables users to report potholes they encounter on the roads. All registered cases can be viewed in the ”All Cases” section, providing users with an overview of the reported potholes. This section allows users to track the progress of their complaints and stay informed about the status of reported potholes.

The ”View Map” option provides users with the ability to input their source and destination locations. Upon doing so, the map displays the entire route, highlighting potholes as red flags. This feature assists users in identifying and planning

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 11, Issue 4, April 2024

DOI: 10.17148/IARJSET.2024.11474

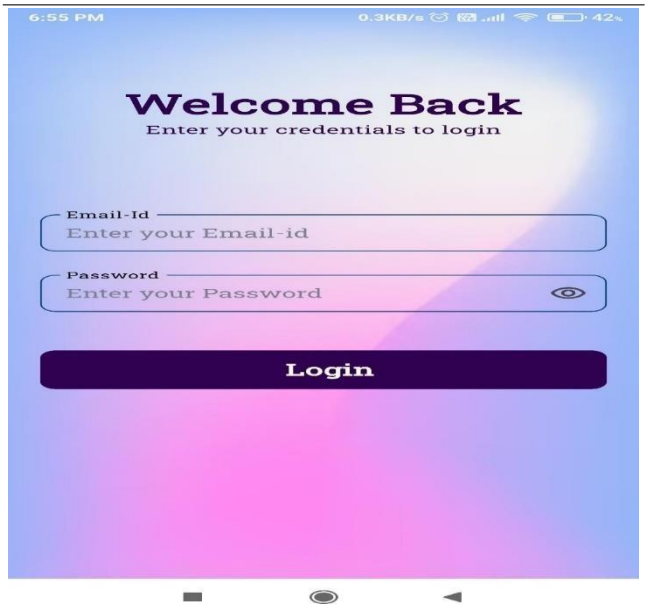
routes that avoid roads with reported potholes, enhancing their navigation experience and potentially minimizing vehicle damage.

The website serves as a platform for administrators and contractors involved in the smart pothole navigation system. Both administrators and contractors have the ability to register and log in to the web portal. Once logged in, they are presented with a comprehensive dashboard containing various sections, including ”Home,” ”Assign,” ”Assign Information,” ”About the Program,” and”Pothole Support.”

The ”Home” section provides an overview and summary of the system, offering a centralized hub of information for administrators and contractors. In the ”Assign” section, administrators can view and manage different parameters such as user assignments and assignment informa- tion. This allows them to allocate specific potholes to contractors for repair and monitor the progress of each assigned task. The ”Assign Information” section provides detailed information about the assignments, specifying which potholes are assigned to which contractors and displaying the progress status for each individual pothole. This feature assists administrators and contractors in efficiently managing the repair process. The ”About the Program” section offers a brief overview and description of the smart pothole navigation system, providing relevant information to users and stakeholders.

V. RESULT SCREENSHOTS

- **Enter your credentials to login**



Verify the pothole image

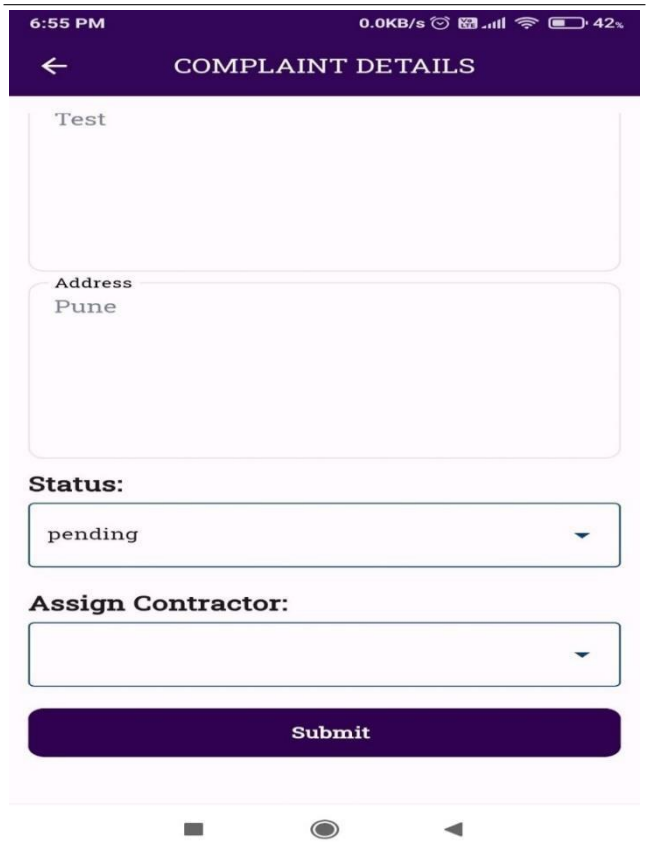
IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

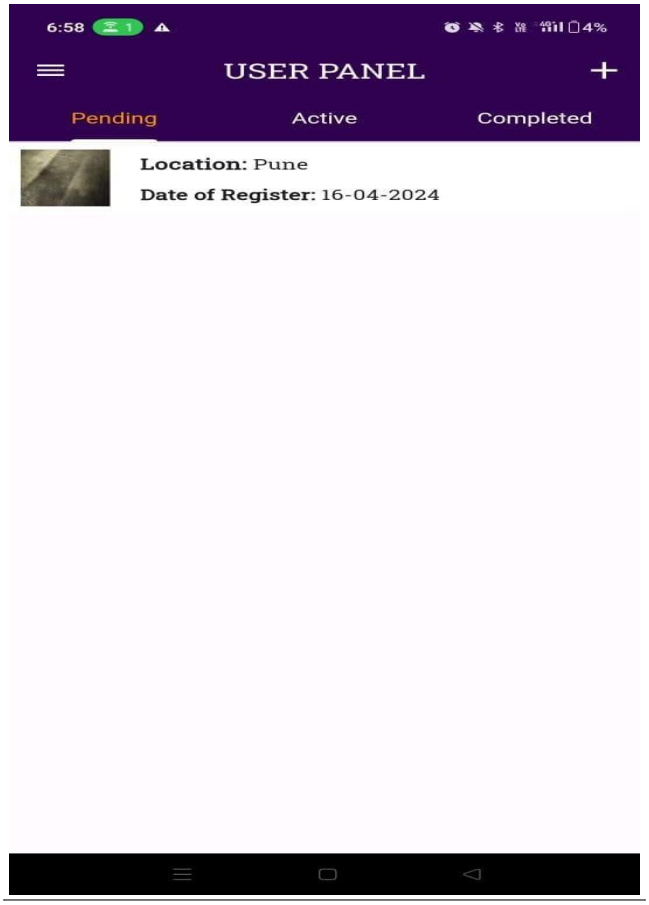
International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 11, Issue 4, April 2024

DOI: 10.17148/IARJSET.2024.11474

- **Complaint details** **User panel**





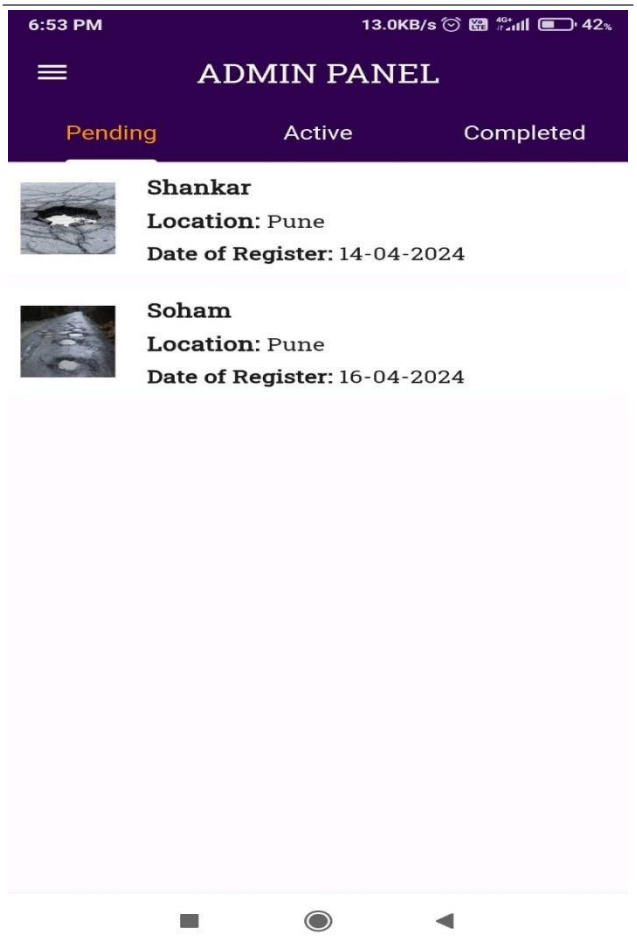
IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

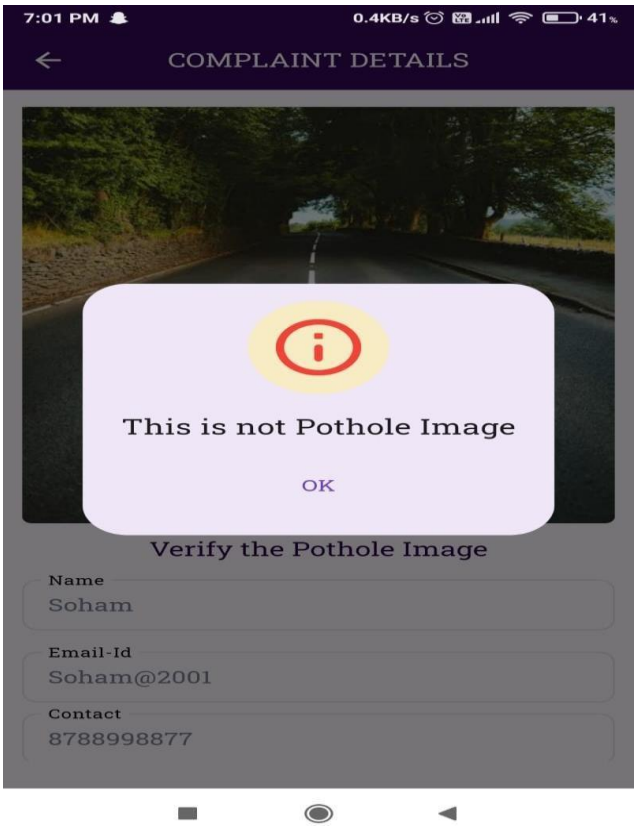
International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 11, Issue 4, April 2024

DOI: 10.17148/IARJSET.2024.11474

- **Admin panel** **Pothole image verification**





VI . CONCLUSION

In conclusion, This system aims to tackle the challenges faced by citizens as a result of potholes by providing a platform for direct communication with the government. It offers several benefits to citizens in achieving three main objectives. Firstly, citizens can actively contribute by reporting the locations of newly formed potholes, enabling the government to swiftly identify and address them. Secondly, citizens can monitor the progress of pothole repairs, ensuring transparency andaccountability in the government's actions. Lastly, utilizing a navigation system, citizens can proactively check for potholes along their route, facilitating smoother and safer journeys. By effectively addressing potholerelated issues, this system has the potential to reduce accidents and improve road safety. Implementing smart city initiatives not only benefits the residents byenhancing their quality of life but also has positive implications for the overall development andprogress of city.

REFERENCES

[1] Mallikarjun Anandhalli., and Vishwanath Baligar, "Indian pothole detection based on CNN and anchor-based deep learning method," In Proc. in International Journal of Information Technology · February 2022.

[2] Hsiu-WenWang, Chi-Hua Chen, Ding-Yuan Cheng, Chun-Hao Lin, and Chi-Chun Lo1.,"A Real-Time Pothole Detection Approach for Intelligent Transportation System," In Proc. of Hsiu-WenWang et al, Taiwan, China, 2015.

[3] Aparna, Yukti Bhatia, Rachna Rai, Varun Gupta, Naveen Aggarwal, Aparna Akula, "Convolutional neural networks-based potholes detection using thermal imaging," In Privacy iJournal of King Saud University– Computer and Information Sciences 34 (2022) 578–588,
February 2019.

[4] Artis Mednisy, Girts Strazdinsy, Reinholds Zviedrisy, Georgijs Kanonirs, Leo Selavoy, "Real Time Pothole Detection using Android Smartphones with Accelerometers," In Proc. of Institute of Electronics and Computer

DOI: 10.17148/IARJSET.2024.11474

Science 14 Dzerbenes Str., Riga, LV 1006, Latvia Faculty of Computing University of Latvia 19 Raina Blvd., Riga, LV 1586, Latvia.CIRCA-2020) IEEE Xplore Part Number: CFP20N67-ART;
ISBN: 978-1-7281-5374-2

[5] Surekha Arjapure, D. R. Kalbande., "Road Pothole Detection using Deep Learning Classifiers," In Proc. International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878 (Online), Volume-8 Issue-6, March 2020.

[6] Alharbi A, Halikias G, Yamin M, et al (2021) Web-based framework for smart parking system. Int J Inf Tecnol 13:1495–1502.

[7] Akagic, A., Buza, E., Omanovic, S., 2017, May. Pothole detection: an efficient visionbased method using RGB color space imagesegmentation. In: Information and Communication Technology, Electronics and Microelectronics (MIPRO), 2017 40th International Convention on (pp. 1104-1109). IEEE.

[8] Moazzam, I., Kamal, K., Mathavan, S., Usman, S., Rahman, M., 2013. Metrology and visualization of potholes using the Microsoft Kinect sensor. In: Proceedings of the 16th International IEEE Annual Conference on Intelligent Transportation Systems (2013), 1284-1291.

[9] An, K.E., Lee, S.W., Ryu, S.K., Seo, D.,
2018, January. Detecting a pothole using deep convolutional neural network models for an adaptive shock observing in a vehicle driving.In: Consumer Electronics (ICCE), 2018 IEEE International Conference on (pp. 1-2).

[10] Erikson, J., Girod, L., Hull, B., 2008. The pothole patrol: using a mobile sensor network for road surface monitoring. In: Proceedings of the 6th International Conference on Mobile Systems, Applications, and Services (2008), pp. 29-39.

[11] J. Lin and Y. Liu, "Potholes detection based on SVM in the pavement distress image, " in Distributed Computing and Applications to Business Engineering and Science(DCABES), 2010 Ninth International Symposium on, 2010, pp. 544-547.

[12] Kwang Eun An , Sung Won Lee ,Seung-Ki Ryu , Dongmahn Seo, Detecting a pothole using deep convolutional neural network models for an adaptive shock observing in a vehicle driving, IEEE International Conference on Consumer Electronics (ICCE), 2018. Hyunwoo Song, Kihoon Baek and Yungcheol Byun.