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Detection and Instigation of Potholes

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Abstract: One of the main reasons for auto accidents across the world is potholes. It is believed that poor road conditions, of which potholes account for a sizable portion, are to blame for around one-third of all traffic accidents. Traffic jams and accidents are often caused by bad road conditions. You risk losing control of your vehicle if the pothole is really bad or if your vehicle isn't designed to withstand the impact. This frequently results in vehicle accidents, which cause needless deaths. When riding over potholes, motorcycle riders are particularly vulnerable to harm. A bike only has two wheels on the ground, and although being lighter than a car, a motorbike cannot cope up with potholes in the road. The prototype described in this article locates potholes on the road and updates them in the cloud. This method aids in keeping the road in good condition. Additionally, ultrasonic sensors are used to independently measure the depth of the road to find and identify potholes. The suggested architecture additionally makes advantage of IoT to store in the cloud the geographical location of found potholes. For management experts, this data is a valuable resource.

Keywords: Hump Detection, PotHole Detection, Animal Detection, Conventional Neural Networks Algorithm, Haar Cascade Algorithm.

I. INTRODUCTION

Roads and automobiles are now an essential element of everyone's life in the modern world. Everyone uses the roads in some capacity. Existing transportation methods save travel time but also raise the potential for fatalities. In automobile accidents, many individuals pass away or suffer severe injuries every year. According to the Indian Road Congress (IRC), road speed bumps must be kept to a specific size and have white stripes to be installed on roads to restrict vehicle speed. But in actuality, Speed breakers are badly maintained and constructed according to specifications. Being abruptly aware of the speed or roughness of their breaker amid the road is quite risky for someone inexperienced with the road. Overspeed breakers are unevenly distributed. Potholes can also be caused by heavy rain and the movement of big trucks. It may potentially result in fatalities or severe injuries. 1,42,485 individuals have perished in fatal road accidents overall, according to the census data "Traffic Accidents in India 2011." To avoid this, supplying drivers with pertinent information at the right moment helps lower traffic accidents. As a result, detection and identification systems are now a crucial part of driver aid and warning systems. The implementation of government laws and the legal framework are two problems that have not yet been overcome, despite the numerous potential advantages of expanding vehicle automation. the threat of suburbanization growing as travel expenses and times reduce. These problems are mostly brought about by the fact that autonomous objects would allow computers to travel freely for the first time, raising several safety and security difficulties in the process.

II. PROBLEM STATEMENT

We are proposing this technology that uses machine learning and image processing to detect potholes in order to effectively address the problem since potholes have been a severe problem and a threat to safe road traffic. Potholes are a prevalent kind of road degradation that can harm cars and endanger the safety of both drivers and pedestrians. Through the early detection and repair of potholes, the road surface may be preserved, saving time and money. However, physically locating potholes takes time and might not be practical for extensive road networks. A real-time automatic pothole detection system is required so that repairs may be undertaken as soon as they become necessary. The system must be capable of correctly locating potholes under a range of circumstances, including various illumination and climatic conditions. Additionally, it should be able to differentiate between potholes and other types of road damage, including cracks or depressions, and should be able to run continually without becoming stuck.

III. GOALS AND OBJECTIVES

Potholes are a heavy issue and became a threat to safe road travel, to beat the problem we are proposing this technique using machine learning and image processing, which can detect the potholes and by doing so we will efficiently tackle the difficulty.

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• Better road safety: Machines aren't at risk of Human error and distractions, resulting in swift and appropriate responses in real-time road conditions.
• Reduced commute time: With vehicles communicating with one another.
In India ordinarily, streets have speed breakers so the vehicle's speed can be controlled to keep away from mishaps. Be that as it may, speed breakers are unevenly appropriated with lopsided and informal structures.
• To reduce vehicle damage: Potholes can cause damage to vehicles, which can be costly to repair. By detecting potholes, a triggering system can help reduce the amount of damage sustained by vehicles.
•To reduce the cost of road maintenance: By detecting potholes early on, a triggering system can help prevent further damage to the road and reduce the overall cost of maintenance.

IV. SYSTEM REQUIREMENT SPECIFICATION

Software and Hardware Requirements

● SD-card It is mostly utilized to produce compact, high-capacity memory.
● Camera The optical device used to capture images.
● Sensor using ultrasound It does this by using high-frequency sound waves to resonate a specified frequency and change one kind of energy into the other, from electric to acoustic.
● LCD Screen It is employed to create an observable picture. Compared to cathode ray tube technology, it enables the display to be considerably thinner.
● The Raspberry Pi is a tool that allows users of all ages to learn about computers and to write in languages like Python and Scratch.

Software Requirements

● Arduino IDE: The Arduino Integrated Development Environment (IDE) is a free, open-source software program that you can use to write and upload code to an Arduino board. It includes a code editor, a debugger, and other tools that are useful for developing software for the Arduino platform. The Arduino IDE is available for Windows, macOS, and Linux. It can be downloaded from the Arduino website or installed through the package manager on your operating system. The Arduino IDE uses a simplified version of C++ and provides a set of libraries that allow you to easily interact with the hardware on an Arduino board.

● OpenCV and Anaconda Environment: OpenCV (Open Source Computer Vision) is a free and open-source library of computer vision and machine learning algorithms. It is widely used for image and video processing in a variety of applications, including object recognition, face detection, and robotics. Anaconda is a free and open-source distribution of Python and R that includes more than 1,500 packages for scientific computing and data science. It is particularly popular for machine learning and data analysis and includes many popular libraries such as NumPy and Pandas.

● Raspberry Pi Cam Interface: The Raspberry Pi Camera Module is a small camera that can be used to take still photographs and record video with the Raspberry Pi single-board computer. The Camera Module is connected to the Raspberry Pi using the Camera Serial Interface (CSI), which is a 15-pin ribbon cable that connects to the dedicated CSI interface on the Raspberry Pi's motherboard.

V. METHODOLOGY

i. System Architecture

This project aims to create a working prototype of a monocular vision autonomous vehicle. The essential information from the outside environment is sent to the automobile via an HD camera and an ultrasonic sensor. The automobile can drive itself safely and intelligently to the specified location, reducing the possibility of human mistakes. To provide the automobile with the necessary control, many current algorithms like an obstacle and lane identification are merged.

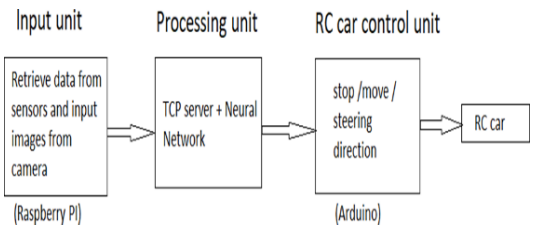

Fig 1: System Architecture

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ii. Data-Flow diagram

The suggested model uses a Pi cam that is mounted to a Raspberry Pi and takes pictures of the road. The laptop and Raspberry Pi are both connected to the same network, and the Raspberry Pi sends the image that was collected and used as the input for the neural network. Before sending the image to the neural network, it is grayscaled. The model predicts an event and outputs one of four options: left, right, forward, or stop. When the expected outcome occurs, an Arduino signal matching that event is activated, which in turn enables the automobile to travel in a specific direction with the aid of its controller.

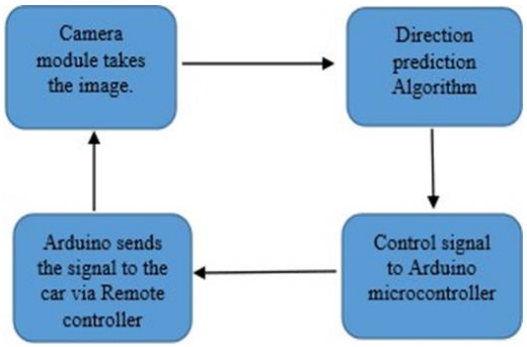

Fig 2: Data-Flow diagram

iii. Sequence Diagram

Object interactions are arranged in temporal sequence in a sequence diagram. It shows the classes and objects involved in the scenario as well as the flow of messages that must be exchanged for the objects to work as intended. In the Logical View of the system being developed, sequence diagrams are often connected to use case realizations. Event diagrams and event scenarios are other names for sequence diagrams. A sequence diagram displays various concurrent

processes or objects as parallel vertical lines (lifelines), and the messages that are passed between them as horizontal arrows, in the order that they take place. This enables the graphical specification of straightforward runtime scenarios.

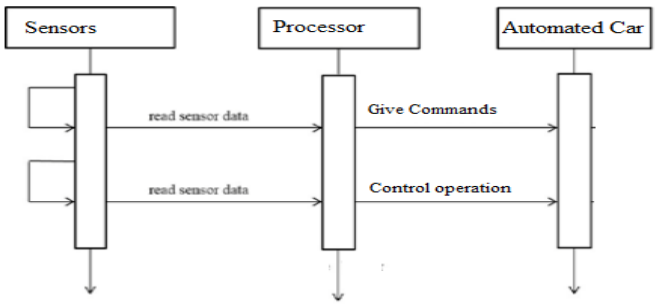

Fig 3: Sequence Diagram

iv. Image Segmentation

The image segmentation used in this is threshold segmentation. To put it simply, the threshold of the grey scale image segmentation is to identify a range in the image compared with the threshold, and accordingly to the results the corresponding pixels are divided into two categories, the foreground, and background.

- The threshold will be determined.
- The threshold value will be compared with the pixel value.

v. Algorithm (METHODOLOGY)

In this WORK, a visual approach is proposed that does not require any machine learning algorithms in the same fashion as the related work presented in the previous section.

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We'll fix the camera inside the car at a 120-degree angle as part of our service. We have utilized a 5-megapixel camera for our work, and we will receive clarity of the photographs based on the resolution of the camera. As the resolution grows, we will get blurry images, and as the resolution decreases, we will get extremely clear images without any form of a blur.

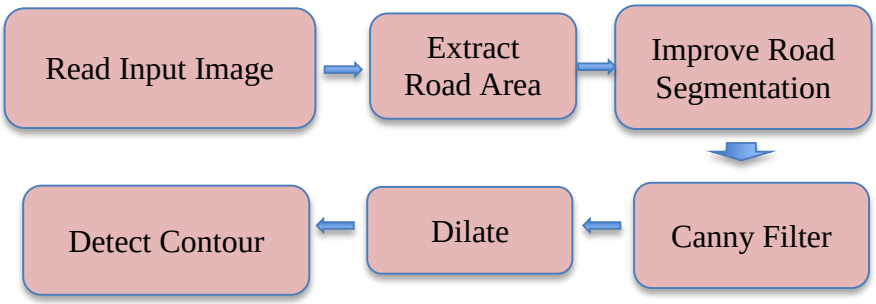

Fig 4: Methodology

VI. CONCLUSION

In conclusion, a pothole detection and notification system can be an effective way to improve road safety and maintenance by alerting local authorities to the presence of potholes promptly. Such a system can be developed using a combination of image processing techniques, machine learning algorithms, and other technologies to accurately detect and classify holes in images. The software and neural network settings will be used to appropriately characterize the physical components. Our model was built using a fully developed machine learning and image processing approach. However, there By addressing these challenges and integrating the pothole detection system with other intelligent transportation systems, it is possible to create a reliable and effective system for detecting and triggering alerts for potholes.

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