DECLARATION

I **Naman Rathore R (38110350)** hereby declare that the Project Report entitled **"DETECTING POTHOLES USING IMAGE PROCESSING TECHNIQUES AND REAL-WORLD FOOTAGE"** done by me under the guidance **of Dr. V . Nagarajan** is submitted in partial fulfillment of the requirements for the award of **Bachelor of Engineering degree** in **Computer Science and Engineering.**

DATE:

PLACE: CHENNAI **SIGNATURE OF THE CANDIDATE**

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ABSTRACT

Roads are the main mode for transportation, now a days. As we use roads heavily and frequently it sometimes leads to potholes. Environmental factors also leads to potholes in several ways. These potholes are main reason for many accidents. A Scheduled and proper maintenance is required where we need to monitor each and every road. AS this maintenance of all the roads at a time is not possible because it is not easy to monitor every single place or just because people ignore to check which causes formation of potholes that causes unnecessary traffic and many of accidents. To monitor all the roads this project for pothole detection using image processing techniques implemented. To test the performance of the proposed system is going to be implemented in a linux environment using Open CV Library. Techniques of Image processing which detects the potholes on roads and save the data of pothole for road maintenance department. This helps in keeping manual labour to the minimum number. Canny Edge Detecting technique and alone with the Contour Detecting Technique are techniques of Image Processing we use in the proposed system. Hough transformation technique in the end gives effective output of potholes, very accurately.

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CHAPTER 1

INTRODUCTION

1.1 POTHOLE DETECTION

Potholes are bowl-shaped openings on the road that can be up to 10 inches in depth and are caused by the wear-and-tear and weathering of the roads. They emerge when the top layer of the road, the asphalt, has worn away by lorry traffic and exposing the concrete base. Once a pothole is formed, its depth can grow to several inches, with rain water accelerating the process, making one of the top causes of car accidents. Potholes are not only main cause of car accidents, but also can be fatal to motorcycles. Potholes on roads are especially dangerous for drivers when cruising in high speed. At high speed, the driver can hardly see potholes on road surface. Moreover, if the car passes potholes at high speed, the impact may rupture car tires. Even though drivers may see the pothole before they pass it, it is usually too late for drivers to react to the pothole. Any sharp turn or suddenly brake , may cause car rollover or rear-end. Motivated from above reasons, we decided to investigate a system to detect potholes on roads while driving and the proposed system will produce the 3-dimensional information of potholes and determine the distance from pothole to car for informing the driver in advance. Also Currently, the main methods for detecting potholes still rely on public reporting through hotlines or websites, for example, the potholes reporting website in Ohio2 . However, this reporting usually lacks accurate information of the dimensional and location of potholes. Moreover, this information is usually out of date as well. A method to detect potholes on road has been reported in a real-time 3D scanning system for pavement distortion inspection3 which uses high-speed 3D transverse scanning techniques. However, the high-speed 3D transverse scanning equipment is too expensive. Rajeshwari Madli et al. have proposed a cost-effective solution to identify the potholes on roads, and also to measure the depth and height of each pothole using ultrasonic sensors.

All the pothole information is stored in database (cloud). Then alerts are provided in the form of a flash messages with an audio beep through android application. To detect the depth of pothole correctly, the ultrasonic sensor should be fixed under the car, which means the car should pass the pothole first. 2D

vision-based solutions can detect potholes as well. Regions corresponding to potholes are represented in a matrix of square tiles and the estimated shape of the pothole is determined. However, the 2D vision-based solution can work only under uniform lighting conditions and cannot obtain the exact depth of potholes. To remove the limitations of the above approaches, we propose a detection method based on computer stereo vision, which provides 3-dimensional measurements. Therefore, the geometric features of potholes can be determined easily based on computer vision techniques.

1.2 OBJECTIVE

To Identify the Pothole detection in real time. Lot of accidents are occurred by potholes, so this project objective is to detect the potholes and reduce accidents.

1.3 MOTIVATION

With the increase in world's population, there has been increasing load on the infrastructure. Roads have been flooded with the vehicular traffic. It has become increasingly difficult to manage this traffic. This is the prime motivation behind making a vehicle intelligent enough to aid driver in various aspects. One of the increasing problems the roads are facing is worsened road conditions. Because of many reasons like rains, oil spills, road accidents or inevitable wear and tear make the road difficult to drive upon. Unexpected hurdles on road may cause more accidents. Also because of the bad road conditions, fuel consumption of the vehicle increases; causing wastage of precious fuel.

Because of these reasons it is very important to get the information of such bad road conditions, Collect this information and distribute it to other vehicles, which in turn can warns the driver. But there are various challenges involved in this. First of all there are various methods to get the information about the road conditions. Then this information must be collected and distributed to all the vehicles that might need this information. Lastly the information must be conveyed in the manner which can be understood and used by driver. We in this project try to design and build such a system. In this system the access point collects the information about the potholes in the vicinity and store the information about the

potholes for the future use. Ideally the vicinity is every rout till the next access point.

CHAPTER 2

LITERATURE SURVEY

2.1 AUTOMATIC POTHOLE DETECTION

Most of the Indian rural and sub urban roads are not ideal for driving due to faded lanes, irregular potholes, improper and invisible road signs. This has led to many accidents causing loss of lives and severe damage to vehicles. Many techniques have been proposed in the past to detect these problems using image processing methods. But there has been little work specifically carried out for detecting such issues of Indian roads. Potholes can generate damage such as flat tire and wheel damage, impact and damage of lower vehicle, vehicle collision, and major accidents. Thus, accurately and quickly detecting potholes is one of the important tasks for determining proper strategies in ITS (Intelligent Transportation System) service and road management system. Several efforts have been made for developing a technology which can automatically detect and recognize potholes. In this project, a pothole two dimensional (2D) images based pothole detection method is used for improving the existing method. This system proposes a system Automatic detect the number of recently published papers dealing with crack detection and characterization of pavement surface distresses shows an increasing interest in this area. A recent publication a hierarchical method present in [1], which deals with detection of roads and slopes. In this paper, a novel framework is proposed for segmenting road images in a hierarchical manner that can separate the following objects: road and slopes with or without collapse, sky, road signs, cars, buildings and vegetation from the images. The experiments show that the approach in this paper can achieve a satisfied result on various road images. The roads are unstructured, which are more complex than the structured roads. In [2] multi scale approach based on Markov random field is proposed to segment fine structures (cracks) in road pavement surface images. Cracks are enhanced using a 1-D Gaussian smoothing filter and then processed by a 2-D matched filter to detect them. A total of 64 road pavement surface images representing several crack types are considered for experimentation, producing a qualitative evaluation. Details on image characteristics or the type of sensor used to capture them are not provided. Another paper [3] evidences the difficulty of

detecting cracks of less than 3 mm width when using edge detectors. A non-sub sampled contourlet transform is adopted in [4] to detect cracks, wherein a limited set of experimental results is presented. A complete methodology to automatically detect and characterize pavement defects is proposed in [5], using gray scale images captured by line scan cameras illuminated by lasers during road surveys performed using a high-speed image acquisition system. Crack detection uses a conditional texture anisotropy measurement to each image, and defect characterization uses a multilayer perceptron neural network with two hidden layers. The results presented are promising, but the experimental evaluation does not support the distinction of multiple cracks in the same image. In paper [6],.Neural network method is used. The automated pavement defect detection can only identify crack type defects. To classify defect, a multi layer perceptron neural network (MLPNN) is used. Neural network is used to classify the images into four classes: defect-free, crack, joint and bridged. Experimental results are performed on real road images which are labelled by human operators. There are more additional filters required for this system. In paper [7], Vision-based approaches are used to address functionalities such as lane marking detection, traffic sign recognition, pedestrian detection, etc. This system is possible to detect the free road surface ahead of the ego-vehicle using an on board camera. Novelty Method is used for both Shadowed and unshadowed regions which provide highest performance. Road detection algorithm is devised by combining the illuminant invariant feature space and likelihood based classifier. The defect of this system is under saturation by improving image acquisition system. In paper [8], A neural network based technique for the classification of segments of road images into cracks and normal images. The features are passed to a neural network for the classification of images into images with and without cracks. Another approach [9] extracts linear features (cracks) using two methodologies: one based on holistic thresholding and the second employing the Otsu algorithm.

2.2 AUTOMATIC DETECTION AND NOTIFICATION HUMPS ON ROADS

One of the major problems in developing countries is maintenance of roads. Well maintained roads contribute a Major portion to the country's economy. Identification of pavement Distress such as potholes and humps not only helps drivers to avoid accidents or vehicle damages, but also helps authorities to