POTHOLE DETECTION USING YOLO V3

A UG PROJECT PHASE-1 REPORT
Submitted to

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IN

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Submitted by

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CERTIFICATE OF COMPLETION

UG PROJECT PHASE -1

This is to certify that UG project phase-1 entitled **“POTHOLE DETECTION USING YOLO V3”** is being submitted by **SYED ASIMUDDIN (19UK1A0517)**, **MATTAPALLY AMRUSHA (19UK1A0508), KULLA ALEKYA (19UK1A0513), DOMMETI SAIKUMAR (19UK1A0540), MYDAM SWAPNA (19UK1A0542)** in partial fulfilment of the requirements for the award of the degree of **Bachelor of Technology** in **Computer Science and Engineering** to **Jawaharlal Nehru Technological University Hyderabad** during the academic year **2022-2023,** is a record of work carried out by them under the guidance and supervision.

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ABSTRACT

In countries like India road maintenance is a challenging task. Year after year, the accident rates are increasing due to the up-surging potholes count. As the road maintenance process is done manually in most places, it consumes enormous time, requires human labour, and subject to human errors. Thus, there is a growing need for a cost-effective automated identification of potholes.

Potholes on roads constitute a serious problem for citizens acting as pedestrians furthermore as vehicular drivers. Government bodies which carries with it engineers and workers are responsible to detect damages on roads. Manually assessing every single a part of the road is very time- consuming, requires lots of manpower and hence it cannot be done efficiently. the tactic to repair this issue by automating the detection. The study focuses on collecting and analyzing the dataset of potholes to coach a convolutional neural network. the thing detection system tiny YOLOv3 is employed for detecting the potholes. the look of a system is identified which may be used for developing a mobile application for detection and presenting a visualized view of the potholes.

Key Words: YOLOv3, Deep Learning, Pothole, Object Detection.

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REPORT OF POTHOLE DETECTION USING YOLO V3

1.INTRODUCTION

1.1 Overview

Potholes on roads constitute a serious problem for citizens acting as pedestrians furthermore as vehicular drivers. Government bodies which carries with it engineers and workers are responsible to detect damages on roads. Manually assessing every single a part of the road is very time- consuming, requires lots of manpower and hence it cannot be done efficiently. the tactic to repair this issue by automating the detection. The study focuses on collecting and analysing the dataset of potholes to coach a convolutional neural network. the thing detection system tiny YOLOv3 is employed for detecting the potholes. the look of a system is identified which may be used for developing a mobile application for detection and presenting a visualized view of the potholes.

1.2 Purpose

To solve this problem, we are going to build a model using YOLOv3 which helps us in identifying the potholes. For instance, we will be giving a video feed to our model such that it will be in a position to identify potholes and store its images

2. LITERATURE SURVEY

2.1 Existing problem

In countries like India road maintenance is a challenging task. Year after year, the accident rates are increasing due to the up-surging potholes count. As the road maintenance process is done manually in most places, it consumes enormous time, requires human labour, and subject to human errors. Thus, there is a growing need for a cost-effective automated identification of potholes.

Transportation by roads has been fairly easy and cost saving, although the condition of road decides the comfort of the ride. Potholes on roads are a major cause of inconvenience for the people travelling by vehicular modes of transport. They are caused by the expansion and contraction of ground water after the water has entered into the ground under the pavement. Potholes are therefore becoming a sizable threat to drivers as they face accidents and damage to the vehicle. In 2017, Union Ministry of Road Transport and Highway in India reported 2,000 pothole-related deaths

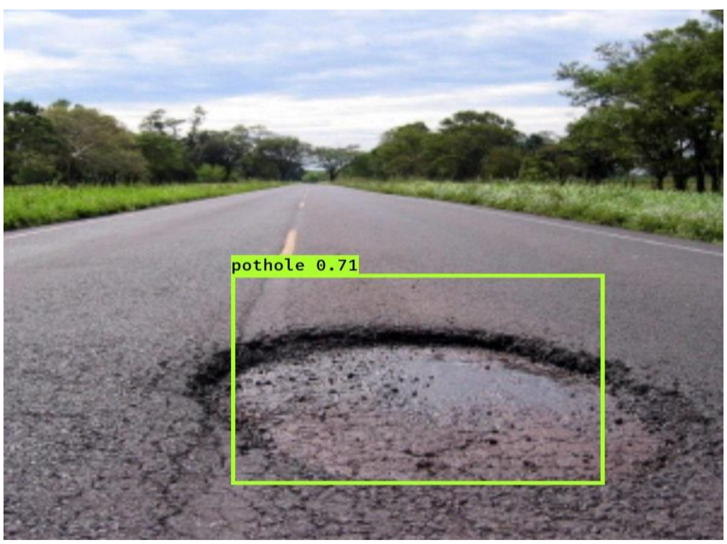
2.2 Proposed solution

The thing detection system tiny YOLOv3 is employed for detecting the potholes. the look of a system is identified which may be used for developing a mobile application for detection and presenting a visualized view of the potholes.

The aim is to provide a solution to automate the manual challenges of finding the potholes by the municipal body. It constitutes a Deep learning model which can be used to detect potholes and visualize them on map using a mobile application. The road to setting up the entire system includes a mobile being mounted on the dashboard inside a vehicle belonging to the municipal authority. When the vehicle is in motion, the mobile application begins recording the video of the road ahead of the vehicle. The video feed is simultaneously processed to capture images based on distance intervals. Images are fed to the pothole detection model to detect potholes. The data pertaining to the pothole is stored, which is then retrieved to be able to visualize it on a Map. This information can be used by the Municipal Authority to repair the potholes.

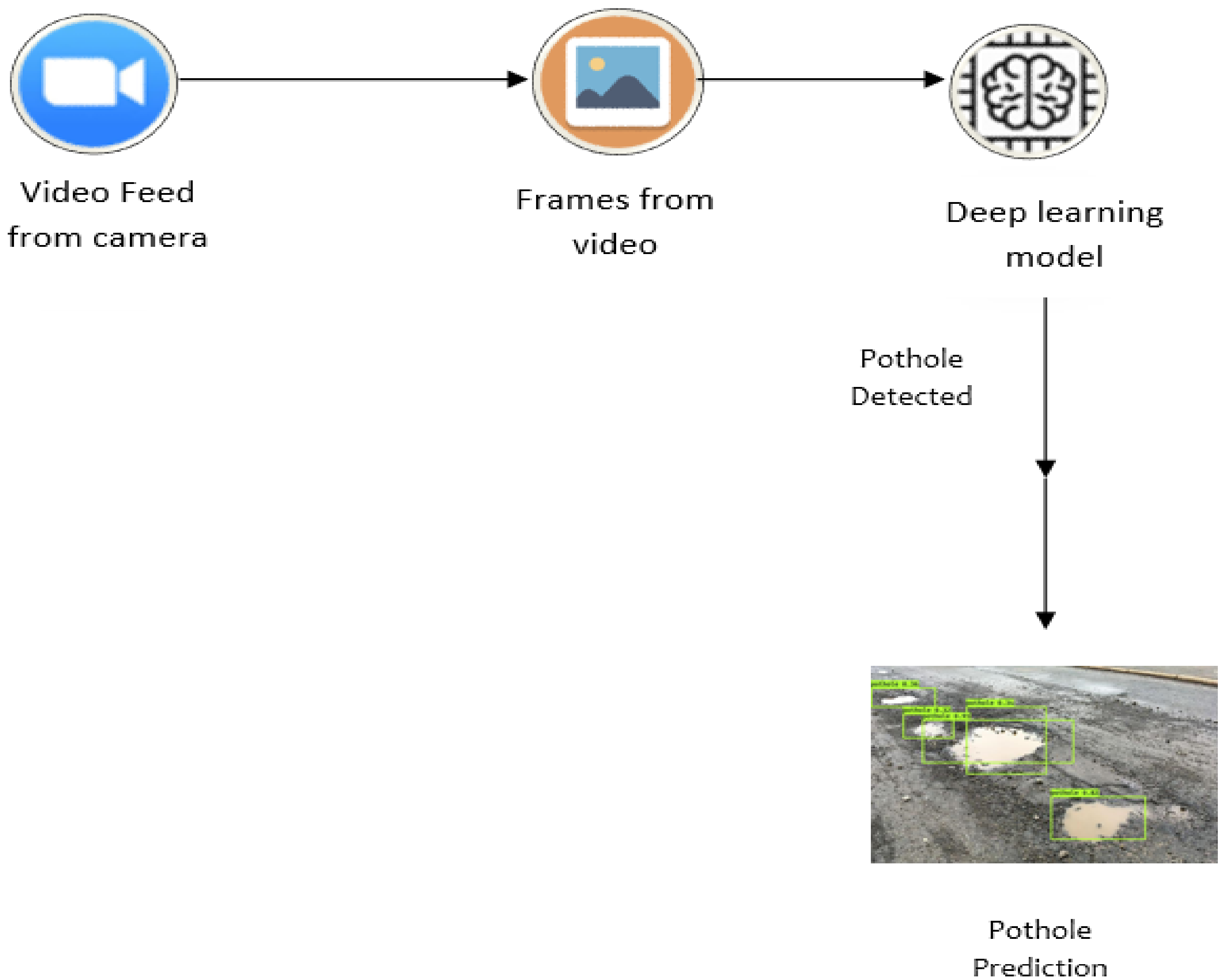
Obstacle detection has been the subject of extensive research in the past, with different methods for avoiding various types of impediments in diverse environments being tested. However, the focus has been mostly on autonomous agents avoiding impediments, which has been confined to extruding obstacles. As a result, the detection mechanism became exceedingly system-specific and unsuitable for widespread use. Road transportation has been very simple and cost-effective, albeit the comfort of the ride is determined by the state of the road. Potholes on roadways are a big source of frustration for people who travel by car. Accidents and loss of human lives are caused by potholes generated by severe rainfall and heavy vehicle activity.

As a result, potholes are becoming a significant concern to drivers, who risk accidents and car damage. Unexpected humps and ditches on the road could lead to more collisions. As a result, the potholes must be filled to make the ride more comfortable and to eliminate potential hazards. As a result, the suggested system employs the YOLO (You Only Look Once) v3 Algorithm to detect potholes. We utilized the following ways to test this model



3.THEORITICAL ANALYSIS

3.1 Block diagram



The pothole detection system aims to provide a solution for both municipal authority and the citizens to reduce the number of potholes by developing an application for mobiles. The entire design of the system is based on the integration of various libraries and frameworks. A mobile application, APIs to provide insights from data gathered, an object detection model to precisely detect the potholes and a cloud storage solution to store and handle various forms of data. The application has two major functionalities: First, for detection and gathering of data mainly for the local municipal body’s usage and the other is the view of the gathered data on a map which is helpful for both the authorities responsible for maintenance and also for citizens of the locality to be aware of their surrounding roads.

3.2 Hardware / Software designing

To complete this project, we must require the following software’s, concepts, and packages

Software requirements

- Python IDE (IDLE / Spyder / PyCharm) (Python 3.7)
- Microsoft's Visual Object Tagging Tool (VoTT)
- Python Packages need to be installed

  If you are using **anaconda navigator**, follow below steps:

  Open anaconda prompt as administrator.

  Type "pip install tensorflow==1.15.2” and click enter.

  Type "pip install keras=2.2.4” and click enter.

  Type "pip install opencv-python==4.1.0.25” and click enter.

  Type "pip install Pillow==6.2.2 and click enter.

the above steps allow you to install the packages in the anaconda environment

Hardware Requirements

- Processors: Intel Atom® processor or Intel® Core™ i3 processor.
- Disk space: 1 GB.
- Operating systems: Windows* 7 or later, macOS, and Linux.
- Python* versions: 3.9.

4.EXPERIMENTAL INVESTIGATIONS

MILESTONE 1: Create Dataset

Create Dataset from Scratch

To train the YOLO object detector on your own dataset, copy your training images to [`yolostructure/Data/Source_Images/Training_Images`](/Data/Source_Images/Training_Images/).

Collect at least 100 pothole images and place them in this folder.

Tip: If you do not already have an image dataset, consider using a Chrome extension such as Fatkun Batch which lets you search and download images from Google Images

MILESTONE 2: Annotate Images

To make our detector learn, we first need to feed it some good training examples.

We use Microsoft's Visual Object Tagging Tool (VoTT) to manually label images in our training folder [`TrainYourOwnYOLO/Data/Source_Images/Training_Images`](/Data/Source_Images/Training_Images/).To achieve decent results annotate at least 100 images. For good results label at least 300 images and for great results label 1000+ images.

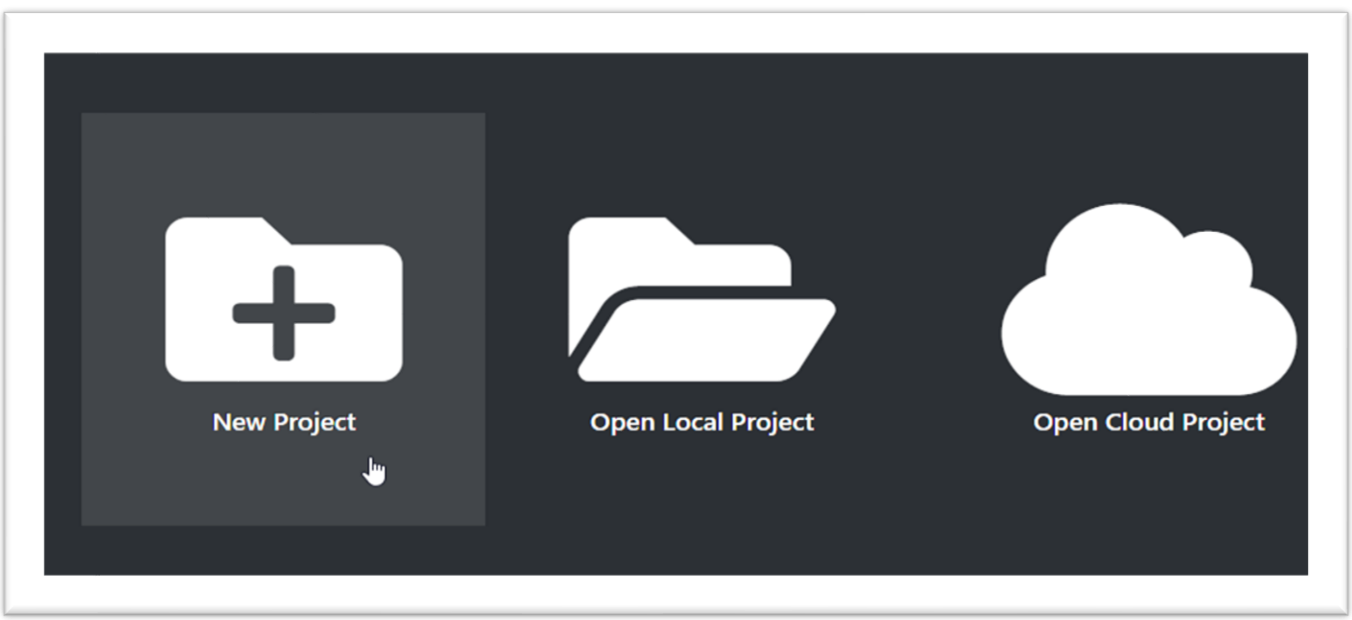


Image annotation is **a vital part of training computer vision models that process image data for object detection, classification, segmentation, and more**. A dataset of images that have been labelled and annotated to identify and classify specific objects, for example, is required to train an object detection model

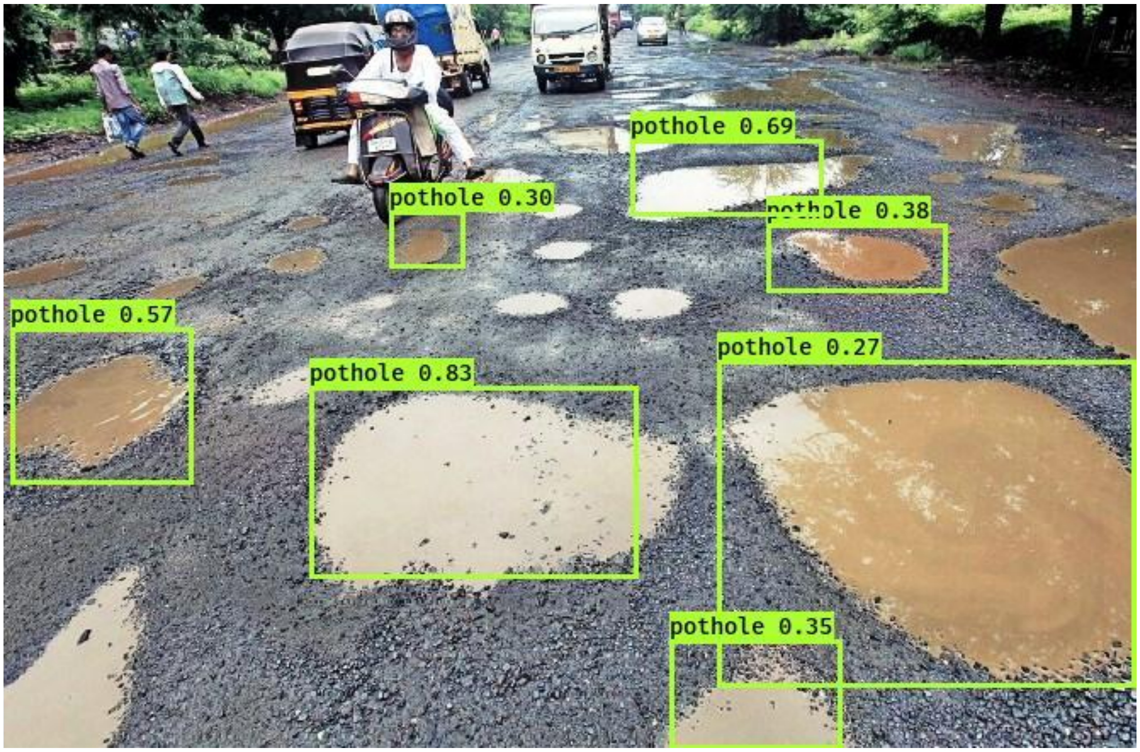
MILESTONE 3: Training YOLO

In this milestone we will we train our model using yolo weights
Using the training images located in
[`yolostructure/Data/Source_Images/Training_Images`](/Data/Source_Images/Training_Images) and the annotation file [`data_train.txt`](/Data/Source_Images/Training_Images/vott-csv-export) which we have created in the [previous step](/1_Image_Annotation/)
we are now ready to train our YOLOv3 detector

MILESTONE 4: Testing the model

in this step we test our detector on potholes and videos located in the following path Place all the test images which can be downloaded from google and place them in
[`yolostructure/Data/Source_Images/Test_Images`]

The outputs are saved to [`yolostructure/Data/Source_Images/Test_Image_Detection_Results`](/Data/Source_Images/Test_Image_Detection_Results). The outputs include the original images with bounding boxes and confidence scores as well as a file called [`Detection_Results.csv`](/Data/Source_Images/Test_Image_Detection_Results/Detection_Results.csv) containing the image file paths and the bounding box coordinates. For videos, the output files are videos with bounding boxes and confidence scores. To list available command line options run **`python Detector.py -h`.**



5.DESIGN

5.1 FLOWCHART

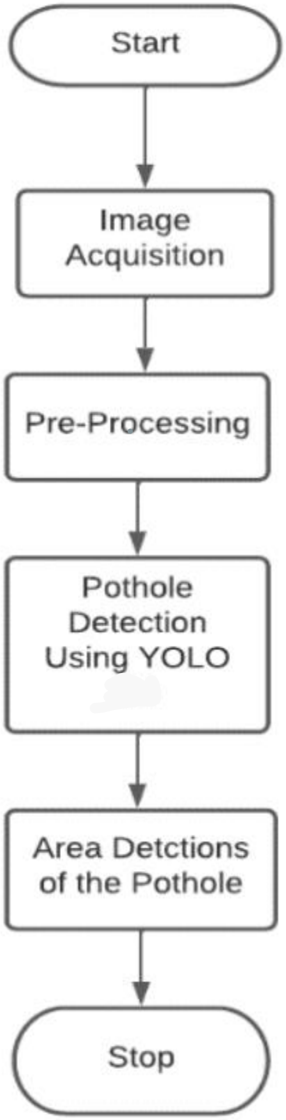
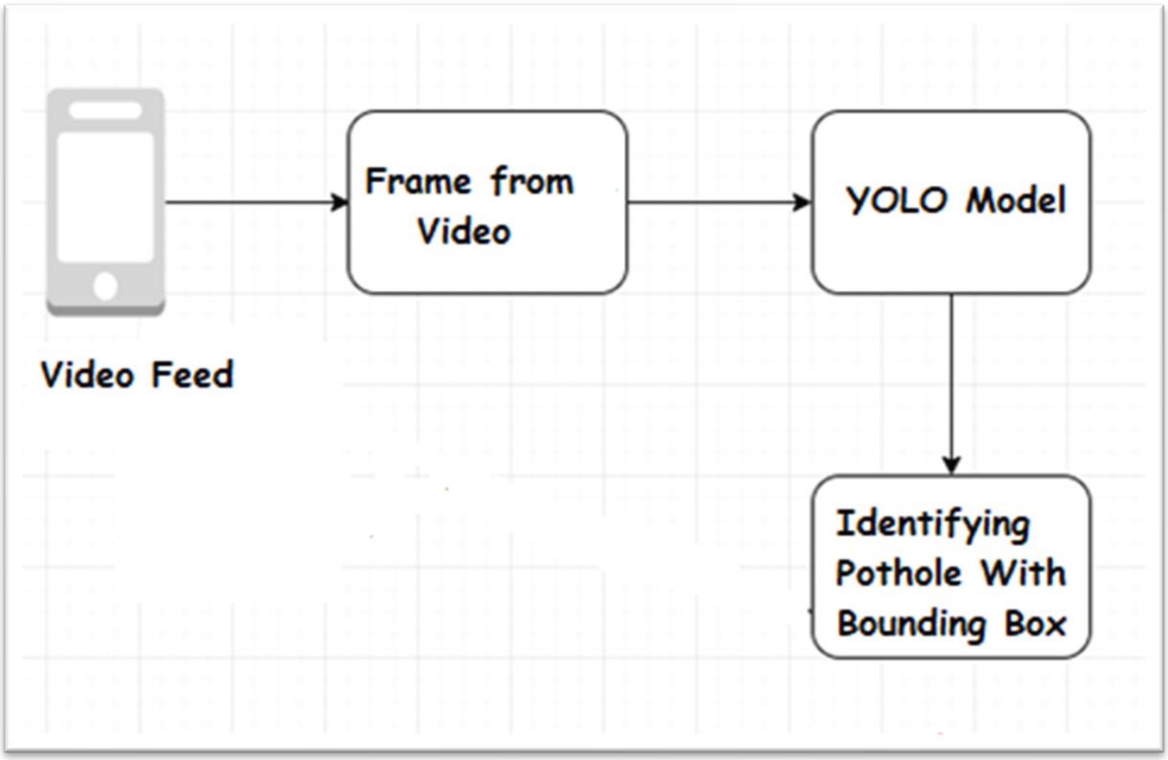


Diagram showing the control flow of the solution



In this model first we had to upload the image/ video in the code to get the desired output. So, for the improvement and to make it usable we connected our model to a live camera to get a real time detection of the potholes. The system flow is as follows: When the system starts, the camera is switched on and real time detection of potholes using Yolo V3 algorithm takes place. The images are extracted from live video and processed in order to detect potholes. The detected potholes are displayed in bounding boxes and as a result real-time potholes detection is achieved.

6.CONCLUSION

In this study, the application of YOLO model for detecting the pothole spots on images from road surfaces is investigated. Given the set of 665 images dataset used to train the models in this study, the research findings provide admissible evidence that the YOLOv3 model achieves the purpose of the pothole detection application because it has the highest mean average precision of 78.7%.The images test images which were provided for the testing successfully detected the potholes on the road surfaces

7.FUTURE SCOPE

Future Scope In future, we can implement image processing system to avoid pothole in embedded system car. We can implement image processing using thermal imaging, night vision camera to detect potholes in poor lighting conditions. The system's continued work includes the development of the mobile application and the integration of the object detection model with the application. Also, integrating the system to the cameras present in the new generation vehicles to give a real-time analysis of roads. With the data gathered through this analysis, providing the vehicle drivers on roads with an alert or prompt regarding the current state of the roads they are travelling on.