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# Analysis of Potholes on Road Using Image Processing

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***Abstract:*** ***Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image. Nowadays, image processing is one among rapidly growing technologies. It forms core research area within engineering and computer science disciplines too. Image detection on road is primarily carried out with the help of camera with Raspberry pi 3 model b+ and stimulation software. The device is built in such a way that we can identify any potholes in the respective roads and able to rectify as soon as possible with the help of the device. The data signals shared by the device will be converted to text signals from which we can get it right. These devices are fixed at top of the lamppost which is located at the corners of the road from where the device is monitoring the road at 120 degree for weekly once respectively.***

***Keywords: Image processing, Image detection on road, Raspberry pi 3, 120 degree***

## I. INTRODUCTION

The conservation of city infrastructure requires the maintenance of road pavement as an important asset. This requires continuous monitoring of road pavement cracks for making later decisions such as sealing them. This task is ideal for automation to save money and human efforts. Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image. Nowadays, image processing is among rapidly growing technologies. It forms core research area within engineering and computer science disciplines too. Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image. Nowadays, image processing is one among rapidly growing technologies. It forms core research area within engineering and computer science disciplines too. There are two types of methods used for image processing namely, analogue and digital image processing. Image detection on road is primarily carried out with the help of camera with Raspberry pi 3 b+ and stimulation software created by Python language. The device is built in such a way that we can identify any potholes in the respective roads and able to rectify as soon as possible with the location latitude and longitude which is separated for each pole in street feed in software. The Image which captured is compared with the image in software, where there are mistakes in comparing spot 3 that area and mark it with red, then the data signals shared by the device will be converted to text signals from which we can get it right with the help of E-mail. These devices are fixed at top of the lamppost for identify the poles with certain amount of height which will not disturbed by any other things from where the device is monitoring the road at 120 degree for weekly once respectively.

## II. MATERIALS AND METHODOLOGY

### *A. Raspberry pi 3b+*

The Raspberry Pi 3 Model B+ is the latest product in the Raspberry Pi 3, It has 64-bit quad core processor running at 1.4GHz and dual-band 2.4GHz and 5GHz wireless LAN, Bluetooth 4.2/BLE, faster Ethernet, and PoE capability. Model 3+ has metal heat spreader on top and this is for better thermal performance and in the whole board is designed for better thermal performance than the previous raspberry pi3.There are a pair of 5 volt pins it's because for connecting to something like display on maybe a servo motor or something like that which needs a 5 volt. It's no reference voltage so in that case these 5 volts is very handy. Model B+ maintains the same mechanical footprint as both the Raspberry Pi 2 Model B and the Raspberry Pi 3 Model B.

### *B. Webcam with CMOS sensor*

The potholes are captured with the help of Webcam which was built with CMOS sensor. CMOS means Complementary metal oxide semiconductor which consist millions of photosites or pixels. So, these photosites converts incoming light into charge or electron So, in case of the CMOS sensor, the charge to voltage conversion as well as the voltage amplification is carried out in the pixel itself. So, the processing speed of the CMOS sensor will be much higher than the CCD sensor.

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We using 14-megapixel camera with 30 frames per second shooting capability. So, in case of the CMOS sensor, the voltage that is generated by each pixel is being reading a line-by-line fashion. In CMOS sensor, as the fabrication procedure is very similar to the fabrication procedure of the integrated circuit, it is possible to integrate these peripheral components into the single chip. So, that it is possible to have the camera on chip or system on chip In CMOS sensor. And because of that CMOS sensor is quite compact. CMOS traditionally consumes little power. Implementing a sensor in CMOS yields a low-power sensor.

### *C. HDMI Port*

HDMI (High-Definition Multimedia Interface) is proprietary audio/video interface for transmitting uncompressed video data and compressed or uncompressed digital audio data from an HDMIcompliant source device, such as displays like monitor, Mobile, Television, and any other visual output devices that supports HDMI. It is a digital replacement for analog video standards. HDMI is a digital interface, single cable solution for combined HD video and audio, replacing analogue solutions which require sperate video and audio cable. The CEC (Consumer Electronics Control) capability allows HDMI devices to control each other when necessary and allows the user to operate multiple devices with one handheld remote-control device.

### *D. Power Supply*

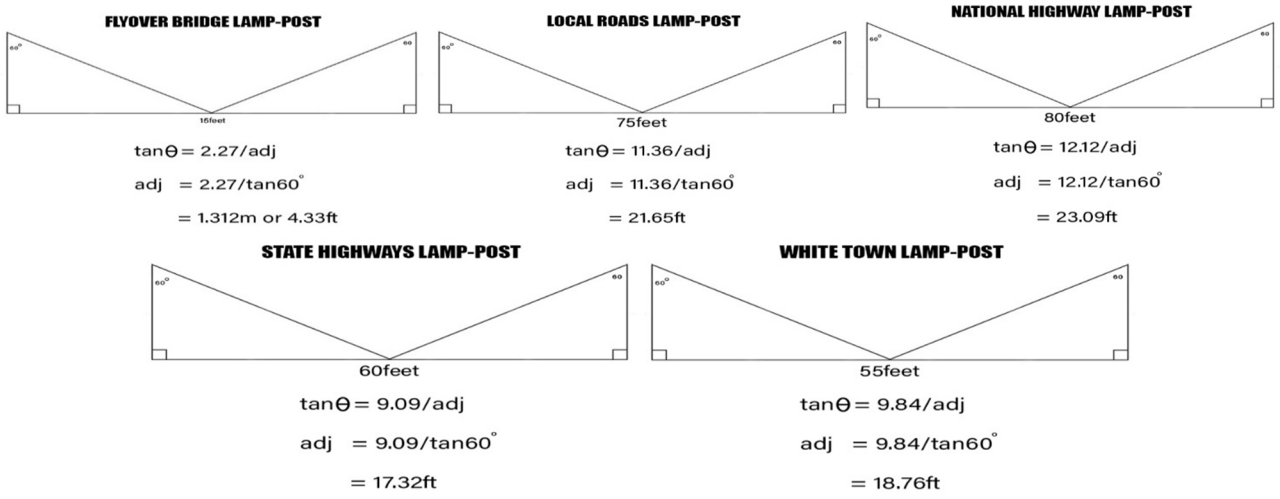
Power source is the most important thing for any devices. Initially every raspberry pi requires at least 5.1V power supply for functioning. The supply is given through micro USB port which is commonly seen in mobile charger cables. In this case the power source is obtained by a portable power bank which can be carried easily and plugged wherever needed. Since the device is going to fixed on lamp post, the power supply can be obtained by the existing lamp post power source itself respectively. In future, it can also get power through Solar power which will be much for efficient way for power source.

### *E. Ethernet Port and WIFI*

The Raspberry pi3 model b+ comes with an Ethernet port for giving internet connection. This model also supports with WIFI connectivity which will be much more compact. The reason for using internet in this device is to get connected to IOT (Internet of Things). Only if the device is connected to IOT, it is possible to share the Pothole information to the receiver. There are five types of Ethernet cables namely Cat5, Cat5e, Cat6, Cat6a, and Cat7. From all these types Cat5 and Cat5e are most commonly used. WIFI connection seems to be much compact than ethernet because of its wireless transmission. Since the device is mainly focused on smart city mission, WIFI connection is much expected during field setup. Because of smart cities, WIFI will be available for 24x7 throughout the city.

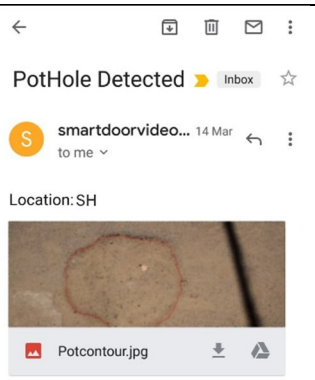
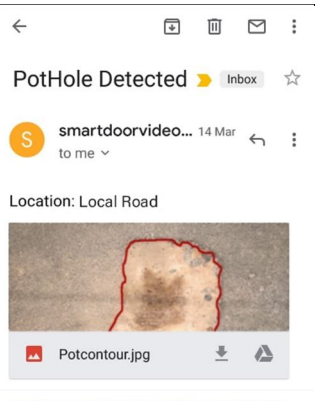
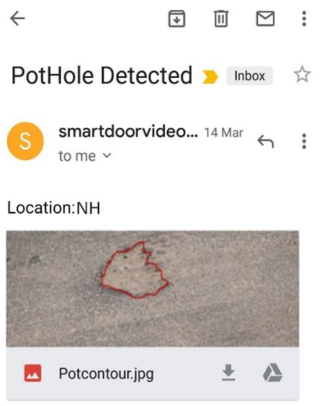
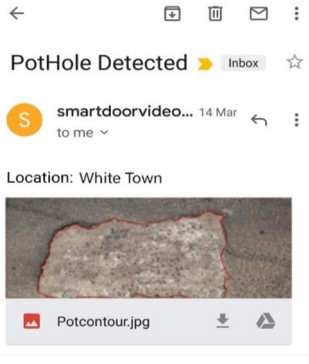
### *F. Calculation for Minimum Height*

Since all types of roads have their own respective lamp-post distance, it is necessary for calculating the minimum height for fixing the device, so that the device can cover the complete road and even in between two lamp-posts. The range of this webcam which is used in device is 120 degrees so the calculation works goes respectively. The device is tested with five different types of road such as National highway road (NH32), State highway road (SH136), Local Road (Muthialpet main road), White town street road and 100 feet Flyover bridge road.

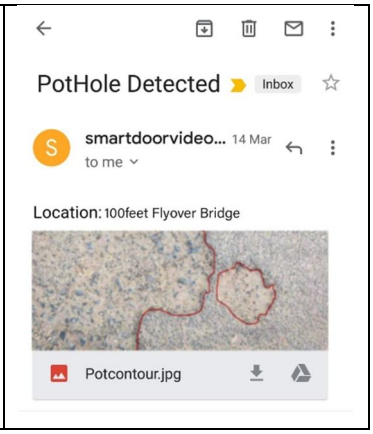



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## III. EXPERIMENTAL RESULTS WITH IMAGE

| LOCATION | LAMP-POST DISTANCE | POTHOLE IMAGE | ALERT MESSAGE |
|---|---|---|---|
| State Highways SH136 | Distance between each pole is 60 feet so the camera must be placed at minimum height of 17.32feet rounding it as 18feet. |  |  |
| Local Roads (Muthialpet) | Distance between each pole is 75 feet so the camera must be placed at minimum height of 21.65feet rounding it as 22feet. |  |  |
| National Highways NH32 | Distance between each pole is 80feet so the camera must be placed at minimum height of 23.09feet rounding it as 23feet. |  |  |
| White Town Street Road | Distance between each pole is 55 feet so the camera must be placed at minimum height of 18.76 feet rounding it as 19feet |  |  |

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| | | | |
|---|---|---|---|
| Flyover Bridge Road | Distance between each pole is 15feet so the camera must be placed at minimum height of 4.33feet rounding it as 5feet. |  |  |

## IV. CONCLUSIONS

Analysis of potholes in road by image processing method was developed. The developed prototype detects the potholes in road by a smarter way. The prototype encompasses of raspberry pi, Webcam and power source in any format. Since there are many types of roads in our country our device is tested in such way that it is capable of Analyzing any type of potholes in road. Since we provided minimum height for fixing the camera in the pole, it is very useful for Considering the height during Camera fixing and thereby saving the time. With the help of IOT we can transfer the details from one place to another which what it is done here. The webcam we using will be sensing at an angle of 120 degree so the distance between two poles should be measured before fixing the camera thereby it can able to sense the road at correct position to cover entire area of road surface. Since we using raspberry pi which is a mini computer, it makes the work simple. The internet connection can be given 49 through neither Wi-Fi or ethernet because raspberry pi has support to both utilities. In the project we gave power source through a power bank but it can also get power source from solar power or existing power source in the lamp post, so there is no problem in giving power source to our device during field setup. Since the webcam covers at range of 120 degree so it is divided into two equal parts as 60 degree each side. So in between distance between two poles will be captured in such a way that fixing the camera at appropriate height so that if a pothole occurs at between two poles also will be captured. Since we using webcam the quality and accuracy may be limited but when we enhance the camera quality by using High-Definition cameras, the device will bring the extraordinary accuracy and sensing power.

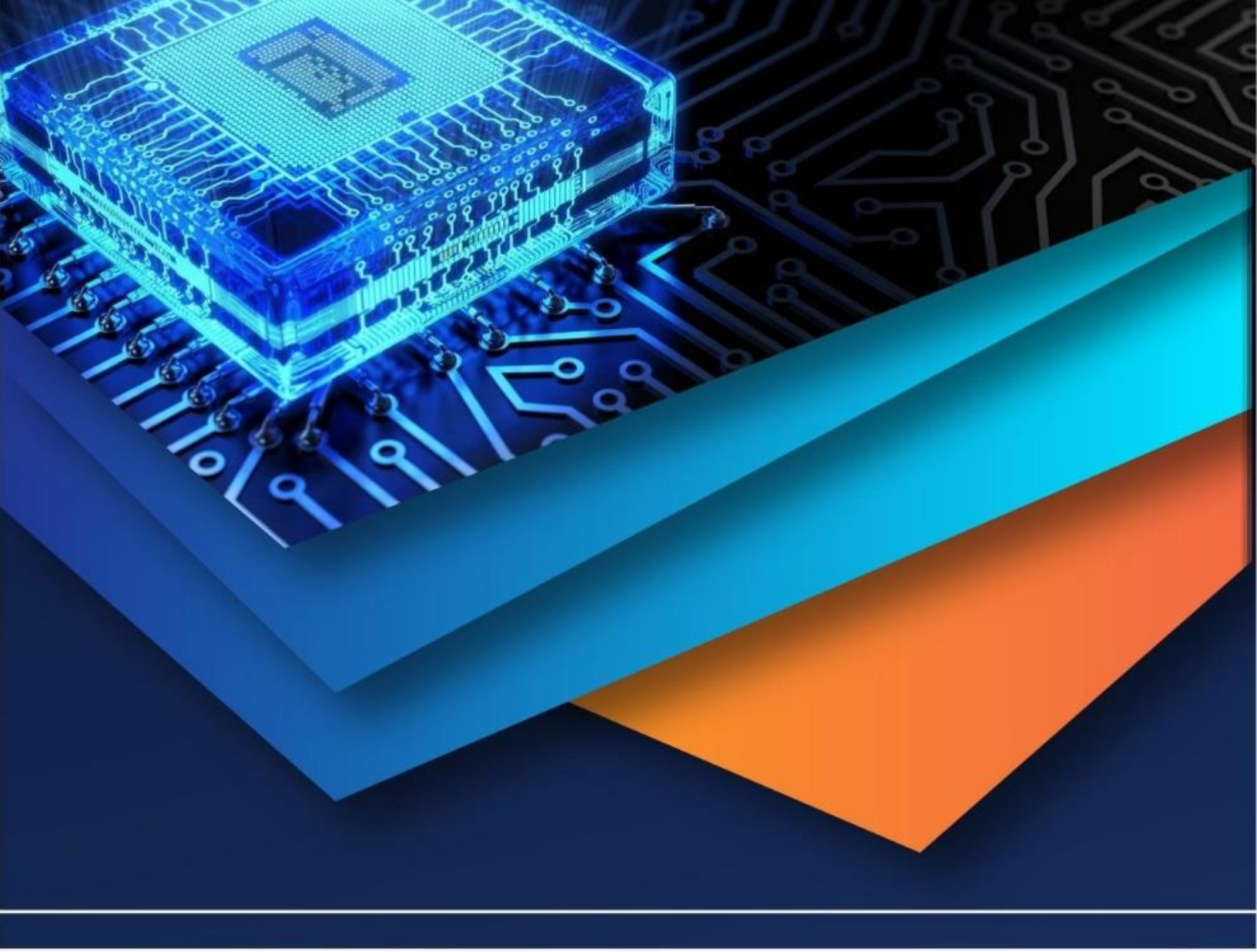
## V. ACKNOWLEDGMENT

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