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A SURVEY BASED ON POTHOLE DETECTION SYSTEM USING IOT AND IMAGE PROCESSING TECHNIQUES

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Abstract: Here we propose a 'Pothole detection system' which can aid the driver to avoiding the potholes on road by giving him preceding in timewarnings, thus reducing the number of road accidents causing due to potholes. Warnings can be like buzzer if the driver is approaches a pothole, or driver may be warned in advance about which road has how many potholes and their location. The government authority can also be notified through the database about the existing potholes.

Keywords: Access point, GPS, pothole detection system, road safety, Image Processing, Smartphone, Wi-Fi

1. Introduction

The increase in world's population, there has been in-creasing load on the infrastructure. Roads have been flooded with the vehicular traffic. It has become increasingly difficult to manage this traffic. The volume of traffic and the axle load experiencedbytheroadareexamplefactorsthatleadtofatigabi lityoftheroadsurface, resulting in the formation of cracks. These cracks allow water to seep through and mix with the asphalt. When a vehicle drives over this area, this water will be expelled through the crack with some of the asphalt, and this will slowly create a cavity underneath the crack. Eventually the road surface will collapse into the cavity, resulting in a visible pothole.

Roads are normally placed with speed breakers that are used to control the speed of the vehicle. But these speed breakers have been a cause of accidents because a definite dimension is not followed throughout. Likewise, potholes are formed due to oil spills, heavy rains and also due to movement of heavy vehicles. These bad road conditions cause accidents, affect the quality of driving and also consumes more fuel. Hence, we have proposed a system that would notify the drivers regarding any hurdles such as potholes information can be used by the Government to correct these roads effectively.

India is being a under developing country, construction and development of infrastructure is still in progress. This ever growing number of vehicles combined with the lack of infrastructure makes the road difficult to drive upon eventually leading to accidents.

According to the road accidents in India is report of Ministry of Road Transport and Highways (MORTH), the number of accidents that occurred in the state between 2013 and 2017 alone due to the potholes is a staggering 89,401 accidents which led to the death of 4,415 peoples and injuries to 8792 people only in India which is 4.93% of the total number of road mishap deaths. This number takes care of only the reported case and if the unreported cases are also considered then the same number may go up to tens of thousands which is an alarming factor. Above stated factors enabled the need of designing intelligent vehicles which is able to detect potholes and humps on road. Identification of pavement distress such as potholes and humps not only helps drivers to avoid accidents or vehicle damages, but also helps authorities to maintain roads. Several methods to detect humps and potholes are reported in published literatures

The presence of cameras in cell phones is becoming extremely common place as the price of inclusion plummeted. As more and more people are equipped with these cameras it becomes easy to develop a range of applications that utilize the camera for purposes other than simply taking a snapshot. One such application is to use the camera to sample the data contained in a visual code marker and to use this as a code to reference information. In a typical use case might be to include a visual code marker next to the advertisement and also movies. By taking an image of the marker the phone can decode the data and then query a backend database for the local screening times of the movies.

Designing of the prototype model. Those are explained below-

A. Required Components

The requirement of having accurate and descriptive data related to potholes. This project aims at realizing some general and universal policies related to classifying a potholes via crowd-sourcing. Some of the requirements to achieve this were recognized below.

a. Determining the most appropriate influence factors that would be able to signify the destructuration of a pothole so it can be assigned a priority.

b. Providing vehicle commutual or concerned citizens a quick and efficient way to report pothole data related to factors that influence its priority and at the same time extracting some contextual information if possible from users so as to the effort of scheduling the repair of said pothole.

c. After extracting the information, using a progressive intelligent system to determine a calculated priority for the pothole.

d. Estimating the correctness of the data that is generated using some factors which are derived from the completeness of the data and certain factors of the input device itself that is involved in the data collection process.

e. Sending the information to a database where, it can be analyzed and used for scheduling pothole repair.

B. Application

- Detect the potholes using image processing techniques and alert the driver through the drivers blinking LCD display or through an buzzer
- Store the GPS information about the detected potholes in the local database using sensors.
- Send the database to the cloud and share with the common public so that municipality agencies or related government can track and repair the potholes.
- It can be used by other vehicles also if we can link the database to mapping software such as Google Maps, etc..

II. The Pothole Detection System

A pothole detection system was designed to collect road images through a newly developed optical device mountedona vehicle and detects a pothole from the collected data using a cloud. Shows a pothole detection system that was developed in this study and its application. This system includes an optical device and a pothole detection algorithm.

The optical device on a vehicle collects potholes data, and the collected data is sent to a pothole detection algorithm. Also, the pothole information such as the location and survey of a pothole obtained from a pothole detection algorithm is sent to a road management system. The optical device was designed to easily be mounted in a vehicle, and it has several functions such as collecting and storing data of potholes, communicating throughout a Wi-Fi, and getting location information by GPS.

III. IMPLEMENTATION

Implementation is the main stage of the project when the theoretical design is turned out into a working system. Thus it can be considered to be the most critical stage. In achieving a successful new system and in giving the user, the confidence that the new system will work and be effective.

The implementation stage involves careful planning, investigation of the existing system and its constraints on implementation, designing of methods to achieve changeover and evolution of changeover methods.

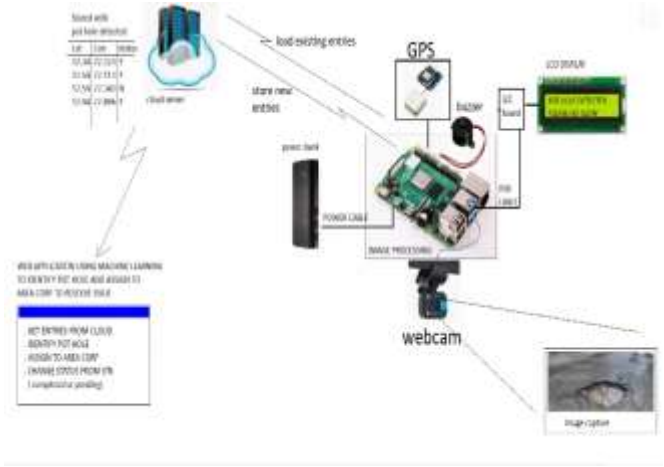

Figure1: Hardware and software requirements

A. Android IDE

The Arduino integrated development environment (IDE) is across-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It is used to write and upload programs to Arduino compatibleboards. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU tool chain, also included with the IDE distribution. The Arduino IDE employs the program argued to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

B. Android Studio

Android has several accessibility-focused features baked into the platform, which make it easy to optimize your application for those with visual or physical disabilities. However, it's not always obvious what the correct optimizations are, or the easiest way to leverage the framework toward this purpose. This lesson shows you how to implement the strategies and platform features that make for a great accessibility-enabled Android application.

Android Studio is based on the Java IDE called IntelliJ. If you've worked with other products by JetBrains (developer of IntelliJ), such as RedMine, PyCharm, PhpStorm, WebStorm, or AppCode, we will find ourself at home. All In- telliJ products share the same shell IDE, which we'll see as soon as we open up Android Studio.

C. Machine Learning

Machine learning (ML) is the study of computer algorithms that improve automatically through experience. It is seen as a subset of artificial intelligence. Machine learning algorithms build a mathematical model based on sample data, known as "training data", in order to make predictions or decisions without being explicitly programmed to do so. Machine learning algorithms are used in a wide variety of applications, such as email filtering and computer vision, where it is difficult or infeasible to develop conventional algorithms to perform the needed tasks.

D. Cloud Server

Cloud storage is a model of computer data storage in which the digital data is stored in logical pools. The physical storage spans multiple servers (sometimes in multiple locations), and the physical environment is typically owned and managed by a hosting company.

Cloud storage services may be accessed through a collocated cloud computing service, a web service application programming interface (API) or by applications that utilize the API, such as cloud desktop storage, a cloud storage gateway

IV. Implementation Of the project and components

Implementation is the realization of an application, or execution of a plan, idea, model, design, specification, standard, algorithm

In computer science, an implementation is a realization of a technical specification or algorithm as a program, software component, or other computer system through computer programming and deployment. Many implementations may exist for a given specification or standard.

A. COMPONENTS

1. Webcam

- Webcams are capable of taking pictures as well as high-definition videos, although the video quality can be lower compared to other camera models.
- Webcams are mostly used in video conferencing and for security surveillance. Other uses include video broadcasting, social video recording and computer vision.

2. GPS

- The GPS (Global Positioning System) is a "constellation" of approximately 30 well-spaced satellites that orbit the Earth and make it possible for people with ground receivers to pinpoint their geographic location. The location accuracy is anywhere from 100 to 10 meters
- The robots get these data from the GPS and then decode and analyze them to output easy movements.

3. Buzzer

A buzzer or beeper is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke

V. CONCLUSION

The Identification of different image processing techniques for pothole detection was done by comparing performance measures for different image segmentation techniques. The segmentation was preferred for its fastest computing time and edge detection based segmentation is preferred for its specificity.

This work can be implemented future for different automated application. Future work could be implementing these image segmentation techniques using hybrid classifiers like neural network and fuzzy rule base and to develop a standalone product for pothole detection.

An IoT based road abnormality monitoring and the status sharing through the cloud is proposed in this paper. The location of is measured with the help of a GPS receiver which is linked with IoT-RMS. the system detects pothole, immediately it stores the coordinates in the server and alert information to the driver that information will be shared to the other vehicles which are passing in that location and hence the good percentage of accidents can be reduced.

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