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Smart pothole detection system using crowd sourcing

Anik Basak
iambasakanik@gmail.com
Narula Institute of Technology, Kolkata, West Bengal

Sayan Desarkar
sayan.desarkar2001@gmail.com
Narula Institute of Technology, Kolkata, West Bengal

Rathindra Pramanick
rathindrapramanick22@gmail.com
Narula Institute of Technology, Kolkata, West Bengal

Arnav Sarkar
arnavsarkar201@gmail.com
Narula Institute of Technology, Kolkata, West Bengal

Ankita Ghosh
ghoshankita811@gmail.com
Narula Institute of Technology, Kolkata, West Bengal

Dr. Sangita Roy
roysangita@gmail.com
Narula Institute of Technology, Kolkata, West Bengal

ABSTRACT

Roadways are the primary mode of transportation in our daily lives. As such it is very important to be cautious about potential mishaps due to road damages which can have serious consequences. Thus for traffic safety it becomes very important to identify the various road damages, specially the hazardous ones, as quickly as possible. In this project we are proposing our idea on how a road damage identifier system can work to detect the damages.

***Keywords*: -** *Accident, Potholes, Ultrasonic Proximity Sensor, Arduino*

1. OBJECTIVE

Objective of this project is to increase the security of the driver while driving. This project will help driver to avoid accident due to potholes.

2. INTRODUCTION

Road transportation networks are an essential social and economic component for all nations. But are crumbling to a dangerous level all over the world due to aging, lacking periodic maintenance, or natural disasters. Nearly millions of injuries are caused by road accidents every year, around 300 000 of them are seriously injured and lead to around 1.5%–3% of economic losses throughout the world. In INDIA form 2015-2019 there has been nearly 472,606 accidents annually in which on an average 149,472 died and 477,331 left injured. Currently routine of road damage monitoring is mostly performed by certified inspectors, which is labor-intensive, costly, and time-consuming and even subjective. Moreover, most of previous works only focus on road damage (e.g., cracking) detection, while very few researchers address the problem of warning drivers about serious damages like big holes in real time.

Figure 1: Bad Condition of Road Due to Potholes

3. CRITERIA FOR SYSTEM DESIGN

The Design of the Smart Pothole Detection System must address some key points like:-

Safety and Robustness: it must ensure the safety of the users who are using the device, the device must be capable of functioning properly in situations like diverse climatic condition, shadows, and obstacles like vehicles, pedestrians etc.

Accuracy and Latency: The Road Damage Detection system should correctly and fluently detect damages in roads to avoid accidents. As it is a very resource heavy task so we need to use the data in hand effectively to maximize the benefit from this system. We can use data from security and surveillance cameras and cameras mounted on public or private vehicles.

Prompt Service: Once the system is up and running it must be able to detect damages in the roads and thereby send necessary warnings to the users and road administrators who can repair the damage within a short period of time and thereby avoiding unnecessary traffic and accidents.

Crowd Sourcing: Collection of data by primitive methods is not sufficient as we would require a huge amount of data to make the system error free and robust, so we will need to obtain information or input by enlisting the services of a large number of people, typically via the internet, which is also known as crowd sourcing.

4. MATERIALS REQUIRED

Ultrasonic Proximity Sensor: It is an electronic device that converts sound wave to electrical signal. It is utilized to measure the distance between its position and the object to be detected by emitting ultrasonic sound wave. To doing the same, it calculates the time taken by the ultrasonic wave to travel from sensor to the targeted object. The formula that is used for this is:-

$$d = (1/2)*t*c$$

Where,

d = distance covered by ultrasonic wave

t = time taken by the ultrasonic wave to cover the distance d

c = speed of light

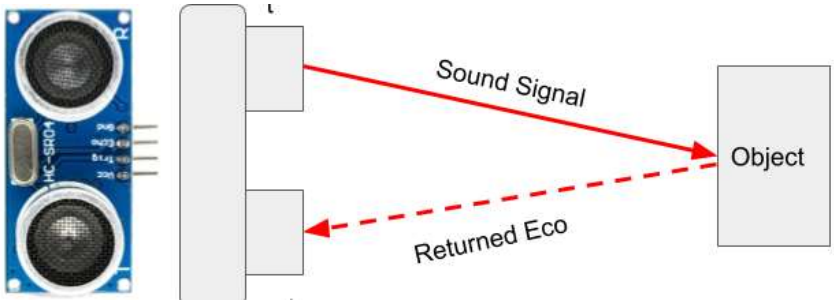

Figure 2: Ultrasonic Sensor

Arduino Uno Board: It is an open source microcontroller board based on the microchip Atmega328P microcontroller. The board consists of 14 digital input/output pins, 6 Analog input/output pins, a USB connection, a power jack, an ICSP header and a reset button. It can be programmed with Arduino IDE using a USB cable. It just needs to get connected to a computer with a USB cable or power it with an AC to DC adapter or battery to get started with it

Figure 3: Arduino Uno Board

Camera: We are going to use OV7670 camera module as it is cheap and we only need to take the photos of the potholes to send it to the administrators.

Figure 4: Camera

Wi-Fi Module: ESP8266 Wi-Fi module is low cost standalone wireless transceiver that can be used for end-point IoT developments.

Figure 5: Wi-Fi Module

GPS Module: NEO-6M GPS Module Pinout GND is the Ground Pin and needs to be connected to GND pin on the Arduino. TxD (Transmitter) pin is used for serial communication. RxD (Receiver) pin is used for serial communication

Figure 6: GPS Module

5. METHODOLOGY

Flowchart

Figure 7: Flowchart of Proposed Model

Working Principal

In this project we used ultrasonic sensor, camera, Arduino Uno, GPS and Wi-Fi module. Ultrasonic sensor will detects the potholes and will send information to the Arduino and GPS module will also send the location to the Arduino. Then Arduino will check this pothole/s is/are new or old by comparing with the data of crowd sourcing. If pothole/s is/are old one then Arduino will send a warning to the user's mobile and will send a message to the authority through Wi-Fi module. If this is the new one then Arduino will send the position, photos (those are captured by camera) to crowd sourcing and also send warning to the user.

6. FUTURE SCOPE

- We can use Camera for potholes detection.
- We can use machine learning to detect potholes.
- We can also upgrade this to detect speed breaker and give warning to the driver to decrease vehicle speed

7. CONCLUSION

In this project we studied various types of road damages and also saw how it can be hazardous for traffic safety. Here we tried to propose our approach on how road damages can be detected beforehand to prevent any future mishaps involving any kind of danger to lives and property.

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Anik Basak
Narula Institute of Technology, Kolkata, West Bengal, India

Sayan Desarkar
Narula Institute of Technology, Kolkata, West Bengal, India

Rathindra Pramanick
Narula Institute of Technology, Kolkata, West Bengal, India

Arnav Sarkar
Narula Institute of Technology, Kolkata, West Bengal, India

Ankita Ghosh
Narula Institute of Technology, Kolkata, West Bengal, India

Dr. Sangita Roy
Narula Institute of Technology, Kolkata, West Bengal, India

