Gutter and Hump Detection

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Abstract: One of the major problems in the developing country is safety while driving through the roads. The roads should be well maintained to improve the economy of the country. Identification of distress such as potholes and humps not helps the drivers to avoid accidents or damages for the vehicle but also help to maintain roads. Our project mainly discuss about the economical solution to identify pothole and hump and give a timely alert for the drivers to avoid accidents and damages for the vehicles.

Keywords: Embedded system, raspberry pi, GPS, sensor ultrasonic sensor

I. INTRODUCTION

Dangerous road surface conditions are major distractions for safe and comfortable transportation .Both drivers and road maintainers are interested in fixing them as soon as possible. However, these conditions have to be identified at the earlier phase. While driver errors such as speeding, distracted driving and drunk driving are among the leading causes of automobile accidents, dangerous road conditions are also a significant contributor .Dangerous road conditions may be the result of natural events, such as tropical rains and flooding, that make driving unsafe. Dangerous conditions can also arise from the poor physical condition of a road and its surrounding. Various government agencies are responsible for maintaining road and ensuring they are safe for drivers, cyclists and pedestrians, including providing proper signage, lighting, pavement marking, signals and traffic control devices. The government has a duty to design, build and maintaining safe roads. If an accident occurs because of a hazardous road conditions, the government agency responsible for maintaining the road may be liable. In order to eliminate the potholes on the road, several researches have been done. One approach to road damage detections is to use human reports to road damage detection is to use human reports to central authorities.

While it has the highest accuracy, assuming that people are fair, it also has the most human interaction and is not comprehensive. Statistical analysis can be used to estimate damage probabilities of road segments based on their usage intensities. Integration of vibration and vehicle counting sensors in the pavement are used for statistical data collection. Surface analysis method using Ground Penetrating Radar (GPR) has been developed and commercial products do exists. Unfortunately, this technology is using expensive equipments and there for limits its accessibility. As an alternative, participatory sensing has the potential to increase the collected data resolution and scope.

Here we discusses previous pothole detection method that have been developer and proposes a cost effective solution to identify pothole and humps on roads and provide timely alerts to avoid accidents or vehicle damages. Ultrasonic sensors are used to identify potholes and humps and also to measure their height respectively. The proposed system captured the geographical location coordinates of potholes and hump using GPS receiver. The sensed data includes pothole depth, height of hump and geographical location, which is stored in the cloud. This serves as a valuable source of information to the government authorities and to vehicle drivers. A web page is used to alert the drivers and authorities so that precautionary measures can be taken to avoid accidents.

II. RELATED WORK

In [1] Dangerous road conditions may be the result of natural events, such as tropical rains and flooding, that make driving unsafe. Dangerous conditions can also arise from the poor physical condition of a road and its surroundings. It may cause road accidents. Also while driving in the night just the headlights might not be a sufficient assistance for driver. Unexpected hurdles on road may cause more accidents. Also because of bad road conditions, fuel consumption of the vehicle increases causing wastage of precious fuel. In [2]We proposed this system 'Pothole and hump Detection and vehicle speed control System' to inform the driver about the pothole or hump and controlling the speed of the vehicle. This system uses ultrasonic sensor to sense the potholes and humps and which measure the height and depth of the potholes. There is a controller module which is used to gather information about potholes and humps and their geographical locations and this information is sent to the server. Ultrasonic sensors are used to measure the distance

between the car body and the road surface and this data is received by the ARM processor. The distance between car body and the ground, on a smooth road surface, is the threshold distance. Threshold value depends on the ground clearance of vehicles and can be configured accordingly. If the distance measured by ultrasonic sensor is greater than the threshold, it is a pothole, if it is smaller, it is a hump otherwise it is a smooth road.

In [2] The GPS receiver captures the location coordinates of the detected pothole or the hump. The information about pothole collected by the proposed system is displayed on the LCD and also sends to the driver's mobile phone. The information includes depth of the pothole or height of the hump and its location coordinates. The distance between the vehicle location and the pothole location stored in database is computed. If the distance between the two is within 100 meters, an alert message pops up on the screen. This message is accompanied with an audio beep. In [4] Drive shaft is the rotating part which drives the vehicles wheel via a gearbox. So drive shaft determines the vehicles speed. To control the speed of this shaft we need to control the engines combustion. Basically fuel is sprayed to the engine by means of fuel injectors. So by controlling the rate of fuel injection we can control the rotation of the drive shaft. Also we need to check for the drive shafts speed by means of an IR Non-contact tachometer. Here we are monitoring the drive shaft from the feedback receiving from the speed sensor and we can simply vary its speed by co-relating the values from ultrasonic sensor and effectively control the fuel injector.

In[3]Major problem in developing countries is maintenance of roads. Identification of pavement distress to avoid accidents mainly. It is a cost effective solution to identify potholes and humps. Ultrasonic sensors are used to detect hump and gutters. The system captures geographical location coordination using GPS receivers. It is stored in cloud. These data serves valuable for government it is stored in cloud. These data serves valuable for government authority and vehicle drivers. Alert given as flash messages. In [6] Road ways is the majority mode of transportation in India today. There are certain maintenance required to remove the hurdles this proposed system has mainly 3 units. Sensing subunit server contain ultrasonic sensor which is used to get the location .the data is stored in server unit. User sub unit is used to help the drivers to get the timely alert.

In [4] once fault is rectified the database updated automatically. Alerts are given in the form of audio. Normally we use GPS, GSM, and ultrasonic sensor. In this system to detect pothole and hump to reduce vehicle speed, accident and vehicle damage. Vehicle has database server it collects pothole and hump information and then pass to govern through TCP protocol. The information is stored in Google spread sheet. Data will be kept with the government authority and driver. Here android application application is used. Automatic detection is done by raspberry pi-3, liquid sensor, temperature sensor, fuel sensor and we use MCP 3204 ADC to convert information into digital value. The sensor quality is shown in raspberry pi.

In [5] in this we use an embedded wireless gadget for the car management. It controls the speed of vehicle at essential zones. The backside station has transmitter for modulation (FM).ARM processor is enforced at receiver side it get vital frequency and activate at the critical mode. All the novel system and pressure alerts are enforced with the assist of embedded processor.IR sensor used to detect obstacles and ultrasonic to detect height and depth of pothole and hump so that precautionary measures can be taken to evade accidents. Message given to the driver with a beep sound.

In [6] Mobile sensing method is used for detection. Accelerometer data normalized by Euler angle computation and passed to an algorithm from where we get the pothole information. Here by using spatial interpolation method we reduce the location error. It is high accurate approach. It improves the safety.

In [7] Maintenance of road is a tiresome reconstructed task that is to be carried regularly. It uses GSM, GPS and ultrasonic and all the information is passed to the authority for using these information for maintaining a record. Improper warning sign leads to accidents at night. Here we use Gray level occurrence matrix (GLCM) features. It has 3 stages pre processing, feature extraction and classification. The work of preprocessing is to remove noise, resizing image and grey scale conversion, features extraction do the spatial relationship between pixels obtained. Neural network based classifier used to identify presence of speed breaker.

In[8]It use smart phones using inbuilt sensor (accelerator and gravity sensor).It collect pothole information using step count algorithm and send to central server. Server process data using Machine Learning algorithm and classify pothole to different categorist. Image processing method was used but it is not done in Indian roads. So to overcome we use a 2D images based detection method to improve the existing system. It automatic calculates the crack on roads and help to detect and find the levels of crack used to reduce errors in manual calculation. This project provide a warning message to driver when it is near to crowded zone the indication is done by two units such as transmitter unit which provide zone based information to the driver and receiver unit that contain LCD to display zone. It is a way to regulate the speed of the vehicle. In [12] the maintenance of the street is one of the significant issues in the creating countries. Well maintained streets contribute a major portion to the country's economy. Identification of pavement distress such as potholes and humps not only helps drivers to keep away from mischance's or vehicle harms, additionally helps specialists to look after streets. Pothole location techniques have been produced to give a cost-effective solution to identify the potholes and humps on streets. It gives convenient alarms to a driver which helps them in maintaining a strategic distance from mishaps or vehicle harm Ultrasonic sensors are utilized to recognize the potholes and humps and also to measure their depth and height, respectively. The proposed framework catches the geological area

directions of the potholes and humps utilizing a Global Positioning System (GPS). The detected information incorporates pothole, hump, and geographic location, which is stored in the Google spread sheet. This serves as an accurate source of data to the Government Authorities and vehicle drivers. An Android application is utilized to ready drivers so that prudent steps can be taken to evade accidents. Automatic detection of potholes and hums is done utilizing Raspberry Pi -3. Liquor sensor, temperature sensor, fuel sensor information is in simple frame. It is changed over into digital value by utilizing MCP 3204 ADC. These sensor qualities are show in site page of Raspberry Pi.

In [9] nowadays potholes and humps on the roads are the major problems in developing countries. The loss of human life due to accident is to be avoided Well maintained road contribute a major portion of the country's economy. Identification of pavement distress such as potholes and humps not only helps to drivers to avoid accidents or vehicle damages but also helps authorities to maintain roads. In exiting method we can get knowledge about pothole location using GPS, GSM and Ultrasonic sensor. It detect the pothole and hump to alert the driver but in our proposed system to detect the pothole and humps and also reduce the vehicle speed, the accident and vehicle damage. In our vehicle contain one database server & the database server collect the information about the pothole and humps and the information are passing to government authorities through the TCP protocol. Well maintained roads contribute a major portion of the country's economy.

In [10] 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 maintain roads. This paper discusses previous pothole detection methods that have been developed and proposes a cost-effective solution to identify the potholes and humps on roads and provide timely alerts to drivers to avoid accidents or vehicle damages. Ultrasonic sensors are used to identify the potholes and humps and also to measure their depth and height, respectively. The proposed system captures the geographical location coordinates of the potholes and humps using a global positioning system receiver. The sensed-data includes pothole depth, height of hump, and geographic location, which is stored in the database (cloud). This serves as a valuable source of information to the government authorities and vehicle drivers. An android application is used to alert drivers so that precautionary measures can be taken to evade accidents. Alerts are given in the form of flash messages with an audio beep.

In [11] here we propose a 'Pothole detection system' which can assist the driver in avoiding the potholes on road by giving him prior warnings, thus reducing the number of road accidents causing due to potholes. Warnings can be like buzzer if the driver is approaching 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 and humps.

In [12] the most common problem that is faced in India is the maintenance of roads. The maintenance of roads mostly focuses on improper roads which are due to potholes, humps etc. Our project mainly aims at detection of potholes and humps to avoid accidents & at the same time damage to the vehicle. We have used ultrasonic sensors for measuring the depth & height of the road surface. The data which are sensed by the sensors include the depth of the potholes & height of the hump & geographic location which is to be already stored in the database. This information serves as a valuable source to the government authorities i.e. PWD office and vehicle drivers via GSM.

In [13] it is known that the technological advancements are increasing at a faster pace. But the utilization of technologies in various sectors is very low. And we also know that the road accidents are also increasing at a faster rate. Most of these accidents are due to the improper construction and maintenance of roads. So we propose a system of pothole detection using Ultrasonic sensor. Then an indication is provided using a voice signal emitted by a speaker. The Voice IC attached to the controller exerts the stored voice signal. An indication is also provided using LCD display. In this system we also have an add-on that is we inform the government officials regarding the detected road conditions by tracking the location of the pothole using an IoT board which has in-built GPRS. Thus this system can be used in order to avoid majority of road accidents and to take further effective measures to reconstruct the improper roads as early as possible.

III. PROPOSED SYSTEM

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 maintain roads. This project discusses previous pothole detection methods that have been developed and proposes a cost effective solution to identify potholes and humps on roads and provide timely alerts to drivers to avoid accidents or vehicle damages. Ultrasonic sensors are used to identify potholes and humps and also to measure their depth and height respectively. The proposed system captures the geographical location coordinates of potholes and humps using GPS receiver. The sensed-data includes pothole depth, height of hump and geographic location, which is stored in the database. This serves as a valuable source of information to the Government authorities and to vehicle drivers. A Webpage is used to alert drivers and authorities so that precautionary measures can be taken to evade accidents.

The distance between car body and the ground on a smooth road surface, is the threshold distance. Threshold value depends on the ground clearance of vehicles and can be configured accordingly. If the distance measured by the ultrasonic sensor is greater than the threshold, if it is a pothole, it is smaller, it is hump otherwise it is smooth road. The GPS receiver captures the location coordinates of the detected pothole or the hump. The information about pothole collected by the proposed system is displayed on the LCD and also sends to the pothole or height of the hump and its location coordinates. If the distance between the two is within 100m an alert message pops up on screen.
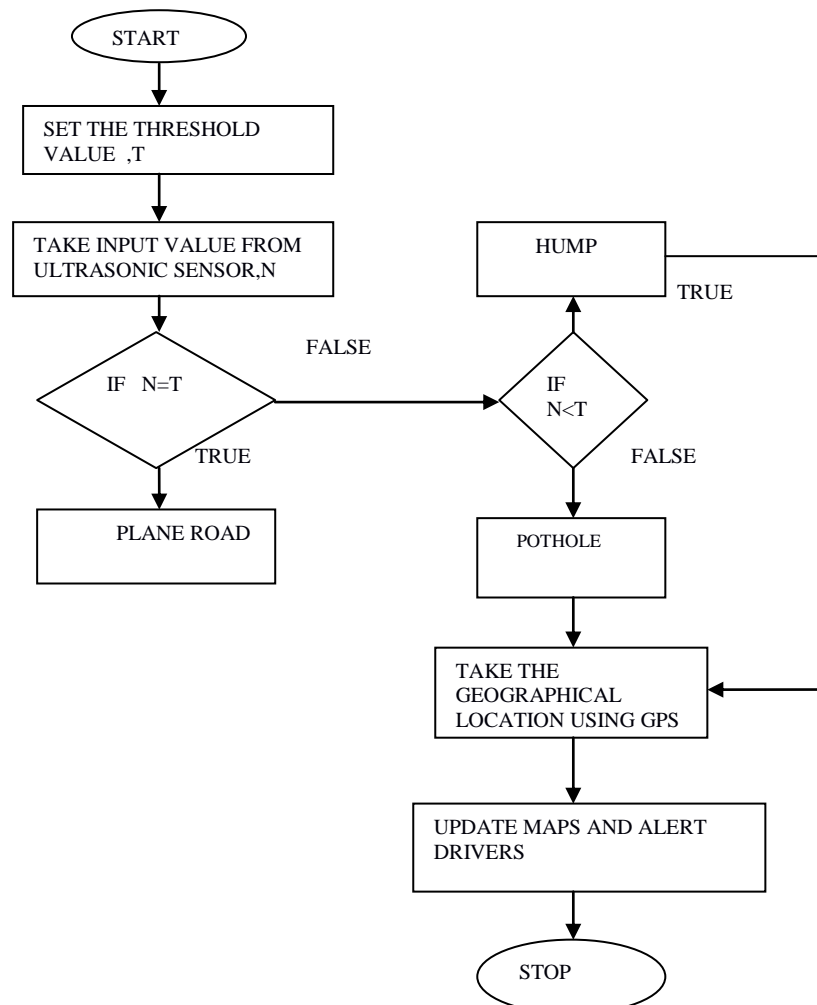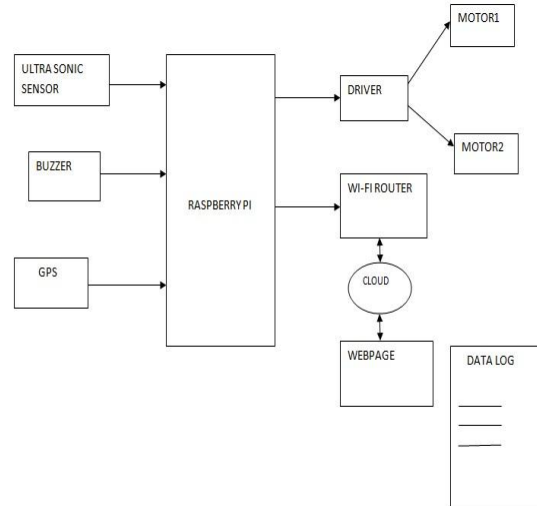
IV. METHODOLOGIES

RASPBERRY PI:

The raspberry pi is a low cost, credit card sized computer that plugs into a computer monitor or T, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing and to learn how to program in languages like scratch and python. It's capable of doing everything you'd expect a desktop computer to do from browsing the internet and playing high definition video, to making spreadsheets, word processing, and playing games.

The ARM-based Broadcom processor is the secret of how the raspberry pi which is able to operate on just the 5v power supply provided by the on board micro-USB port. It's also reason why you won't find any heat sinks on the device: the chips low power draw directly translates into very little waste heat, even during complicated processing task.

ULTRASONIC SENSOR (HC-SR04):

The HC-SR04 ultrasonic sensor is used in this system. Its operating voltage is 5v.This economical sensor provides 2cm to 400cm of non contact measurement functionality with a ranging accuracy that can reach up to 3mm. The practical measuring distance is 2 cm to 80 cm. Measuring angle covered is less than 15degree. Operating current is less than 15mA. Its operating frequency is 40Hz. Each HC-SR04 module includes an ultrasonic transmitter, a receiver and a control circuit. There are only four pins on the HC-SR04: VCC (power), Trig (trigger), Echo (receive) and GND (Ground). It generates high frequency sound and calculates the time interval.

The basic principle of work using IO trigger for at least 10us high level signal. The module automatically sends eight 40 kHz and detect whether there is a pulse is signal back. If the signal back, through high level, time of high output IO duration is the time for sending ultrasonic to returning between the sending of signal and the receiving of echo. Therefore, ultrasonic sensor can be used to measure distance.

GPS:

Global Positioning System (GPS) is a space based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the earth where there is an unobstructed line of sight to four or more GPS satellites. It uses between 24 and 32 medium Earth Orbit satellites that transmit precise microwave signals. This enables GPS receivers to determine their current locations, time and velocity. A GPS receiver must be locket on to the signal of at least three satellites to calculate a 2D position (latitude and longitude) and track movement. With four or more satellites in view, the receiver can determine the user's 3D positions (latitude, longitude and altitude). Once the user's position has been determined, the GPS unit can calculate other information, such as speed, bearing, track, trip distance, distance to destination, sunrise and sunset time and more.

MOTOR:

Electrical motors are everywhere around us. Almost all the electromechanical movements we see around us are caused either by an A.C or a DC electrical energy to a mechanical energy

   This DC or direct current motor works on the principal, when a current carrying conductor is placed in a magnetic field; it experiences a torque and has a tendency to move. This is known as motoring action. If the direction of current in the wire is reversed, the direction of rotation also reverses. When magnetic field and electric field interact they produce mechanical force, and based on that the working principal of DC motor established. A keypad is a set of buttons arranged in a block which usually bear digits, symbols and usually a complete set of alphabetic letters.

BUZZER:

   Buzzer is an audio signaling device, which may be mechanical, electromechanical or piezoelectric. Here when the ultrasonic sensor senses the gutter or hump the buzzer will beep to alert the driver.

L293D IC:

It is a typical motor driver IC which allows DC motor to drive on either direction. It is a 16 pin IC which can control a set of two DC motors simultaneously in any direction. Which means you can control two DC motor with a single L293D IC. Motor driver is an interface between arduino and the motor. Due to heavy current flow it gets heated. So we need a heat sink to reduce the heating. Therefore we have four ground pin in our IC. Wide Supply Voltage. Range: 4.5 V to 36 V. separate Input-Logic Supply. Internal ESD Protection. Peak Output current 2A per channel (1.2 A for L293D).Output Clamp Diodes for Inductive. Transient Suppression (L293D).
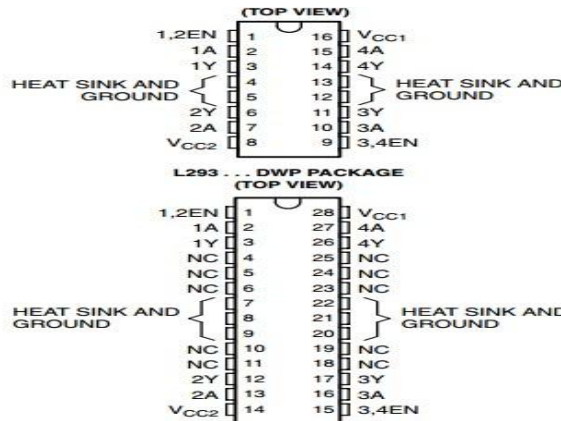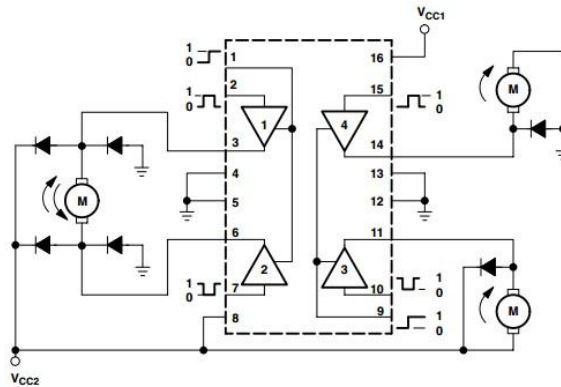
FIGURES

FIG 1:L293D PIN DIAGRAM

FIG 2: BLOCK DIAGRAM OF L293D

V. SIMULATION RESULTS

Our product is made by looking through certain related works. We had made improvement from all the above constraint in those papers. In our project we will be able to detect the pothole and hump that is on the road and alert the drivers with a buzzer message so that they need not look onto the screen to check the notifications. By moving the vehicle once through the road the pothole and hump will be updated to the web server. With the exact location that is with latitude and longitude we can keep track whether that is hump or pothole. We will set up a threshold value and the variation in that values will be noticed. And by looking at this we will be able to find the pothole if there is an increase in the threshold value. And the threshold value is decreased then it will be considered as hump. By the invention of our product we will be able to keep track of the path which has fewer potholes and hump for the easy travel. It will also lower the fuel consumption because when there is a hump or pothole we will need to lower the gear which will lead to more fuel consumption.

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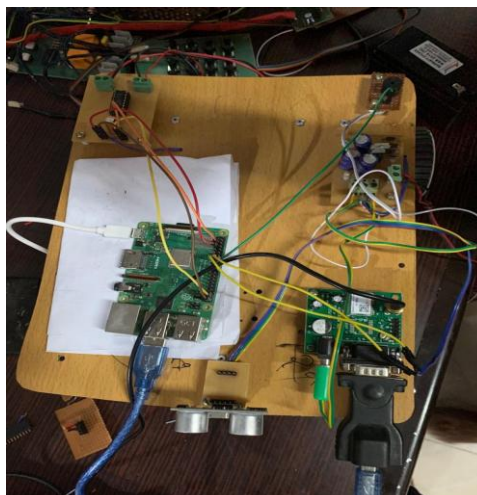
VI. CONCLUSION AND FUTURE WORK

Currently our system can identify pothole and hump. We had made the system not only detect the pothole and hump but also it gives live location on Google maps and alerts the drivers with a beep sound with the help of the buzzer. Our project focuses on Identification of pavement distress such as pothole and humps not only help drivers to avoid accidents or vehicle damages but also help authorities to maintain roads. And we have now seen related works using ultrasonic sensors, smart phones, accelerometer, IOT, black box etc. Thus on the light of these related works it makes more efficient and easy to detect the pothole and humps on roads which will helps drivers to avoid accidents, vehicle damage and also helps authorities to maintain the road well and improve the current road conditions

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