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# A REVIEW PAPER ON DETECTION OF POTHOLE AND SPEED BREAKER USING INTERNET OF THINGS (IOT)

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**ABSTRACT**

Internet of things (IoT) is a current innovative system embedded with sensors nodes, software and other distinct technologies that connect and communicate data through the internet or alternative communication devices. IoT is primarily used in our daily routine. Moreover, IoT plays an important role in health care, smart cities, smart home applications, etc. In recent days the highway based real time applications such as road we travel everyday have many problems. To overcome this, potholes play a major role in roads based activities. IoT with sensors helps us to overcome the difficulties faced with potholes and speed breakers. Sensor is a device which detects the changes in environment and sends information to other processor or end device. Sensor nodes have recently been considered as a highly prospective feature of scientific research. Thereby, IoT with sensors plays a major role in the industrial and health care sector. IoT is used to automate the working processes and minimize expenditure on human. With relevance to IoT, everything can be automated and regulating frequently. Ultimately, potholes and speed breakers being barriers on the road can be surpassed with IoT based sensor technology.

*Keywords: -*Internet of Things (IOT), Sensors Nodes, Potholes, Speed Breakers

## I. INTRODUCTION

India is one of the youngest developing nations, where more than 3500 accidents occur due to improper roads with potholes and speed breakers. Being inattentive leads to damage of vehicle and wheel, leads to punctures and loss of human lives. According to a census taken in 2020, more than 4000 accidents occur mainly due to potholes and 10,000 due to speed breakers. In addition, based on the data collected almost 80% of accidents occur due to potholes and speed breakers. So detection of these potholes and speed breakers has become mandatory to avoid accidents in the nearer future. In order to overcome this difficulty caused due to potholes and speed breakers we use a pothole and speed breaker detecting system. This system identifies the depths and heights of the potholes and speed breakers. The internet of things, or IoT, is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. Smart homes, self-driven cars etc are one of the best and the most practical                                                applications                                                of                                                IoT.

## II. LITERATURE REVIEW

**Pothole detection using Raspberry Pi3:**

M.S. Kamalesh, et al **[1],** used Raspberry Pi3, which controls the peripherals of GSM, sensor module and camera. The sensor module is made of microcontroller and accelerometer as sensor controlling unit and AWS ThingsBoard server is an open-source platform for data storage and for future analysis. Once the sensor module detects the potholes the data is sent to the Raspberry Pi3 that fetches the GPS location and sends it to the AWS ThingsBoard(database) which can be accessed by the local authorities and can also be used for future reference.

**Pothole detection based on accelerometer, gyroscope, GPS and android app:**

Ajit Gholap, et al **[2],** gave an idea on detecting anomalies in road construction and pothole detection. They focused on work done using inertial sensors and smartphone applications developed, to make use of sensors. They used IoTRMS and tested using Arduino

UNO with ESP 8266. Their proposed architecture contains GPS, gyroscope, accelerometer and other sensors like magnetometer, pedometer. Anomaly detection receives data from accelerometer, gyroscope and GPS which is further filtered using fault exclusion component. Atlast the anomalies are classified and the database is maintained for reference purposes.

### Pothole Detection system using Internet of Things:

P.Sudhakar, et al **[3],** used vibrational technique for the detection of potholes on roads. They used sensors to detect the potholes and the location coordinates of the detected potholes are determined by a GPS module which is then sent to a server(cloud) wirelessly through WiFi by making use of the nodeMCU board. This cloud is provided by the Blynk which is made accessible to the government authorities who are responsible for road maintenance.

### IoT based Automatic Detection of Potholes and Speed Breaker Mapping:

K. B. Naveen, et **[4],** used microcontroller module, server module and the mobile application module.. In this they use an ultrasonic sensor which calculates the distance between the pothole and vehicle and sends the information to the microcontroller. And the distance between the automotive body (vehicle) and therefore the ground is the threshold distance. If the distance measured by an ultrasonic sensor is greater than the threshold, it is a pothole and if it is smaller than the threshold it is a speed breaker. The microcontroller module gathers information on the geographical locations of potholes and speed breakers and this gathered information is sent to the server where it processes and stores in the database. And the mobile application module uses the information in the server database and provides timely alerts to the driver.

### Pothole detection based on machine learning, raspberry pi:

Alfandino Rasyid, et al [5], used a machine learning method and captured the frames with a combination of a high computational computer and mini-computer. Their system consists of 2 big parts which is VaaMSN (Vehicle as a Mobile Sensor Network) for the edge side and SEMAR (Smart Environment Monitoring and Analytical in Real-time) for the server side. The Wireless Camera Device is a Raspberry Pi Zero attached with No-IR Pi Camera and armed with various photographic accessories. Hardware setup has a processing unit and additional sensor device. Object detection process is using tensor flow library and OpenCV library for the image processing section. Additional sensor device is used for location tagging. That device consists of a GPS sensor, IMU sensor, external GPS antenna, and Microcontroller to control the sensor and send it to the Processing Unit. After the process is done, all of the data is sent to the SEMAT IoT Platform for visualizing.

### Pothole detection based on Node MCU, ultrasonic sensor, GPS module:

Etukala Jaswanth Reddy, et al **[6],** used Node MCU which consists of firmware which runs mainly on the esp8266 wi-fi module. Also ultrasonic sensors, GPS module, Arduino IDE are used. And the depth is calculated for pothole detection. Finally the server database for this system will be the database of the G- mail provided by Google.

### Pothole detection based on Grubbs' test and sensor network:

Van Khang Nguyen, et al **[7],** built client- server architecture to use sensors on smartphones to detect road anomaly. Anomaly Detector, Fault Exclusion and Anomaly Classification are the three main stages for the detection of anomalies. The detection of potholes is processed on an embedded computer. Results are sent to a control center by means of a WiFi network. The Grubbs' test has been applied for basic algorithms

### Pothole and Speed breaker detection on Roads:

Rajeev Kumar, Et al **[8],** proposed a speed breaker and pothole detection using ultrasonic sensors that estimates their height and depth, respectively. They also use a global positioning system receiver(GPS) for the identification of location coordinates of the detected potholes and speed breakers. The data which are sensed by the ultrasonic sensors includes geographical location, height of speed breakers and depth of potholes, which is saved in the local cloud database. And once information is received, the system gives alert messages to the drivers in order to prevent accidents and damages.

### Pothole detection based on Vibration, Vision and 3D reconstruction:

Riya, et al **[9],** proposed a pothole detection system using Vibration and Vision based pothole detection systems. The vibration based system uses Accelerometers to detect potholes. The Vision based system uses 2D Image and Video based approaches and 3D constructions are used to detect the Potholes present in the roads

**Pothole detection based on computer vision, disparity map:**

Rui Fan ,et al **[10],** used 2D image analysis for pothole detection. The four main steps are image preprocessing, image segmentation, shape extraction, object recognition. In recent years, many authors use disparity maps. However, finding a proper disparity map area for plane fitting is always challenging, because the selected area may contain an obstacle or a pothole. Next, they utilize Otsu's thresholding method to segment the transformed disparity map

**Pothole Detection System using 2D LiDAR and Camera**:

Byeong-ho Kang, et al **[11],** used a LiDAR sensor that obtains information on the distance when the infrared ray travels back from the object. Two 2D LiDAR, called RPLIDAR, and a camera are connected to the Raspberry Pi 3 .LiDAR gives the information such as the object diatnce, angle etc to the single board computer. Once the LiDAR information is received, the pothole detection algorithm is performed using MATLAB. Approximate pothole information such as width and depth are compared with those of the actual pothole information. As the information the pothole was collected using 2D laser and it is then compared with the video data . This combined data gives more accurate pothole detection performance and hence alerting the drivers.

**Detection using Kinetic, ultrasonic sensors with GPS:**

Mr.K.Edison Prabhu, et al **[12],** put forward a work which uses a kinetic sensor for depth images and measurements, these images are analyzed using MATLAB. Ultrasonic sensors are used for detection of distance. GPS is used for determination of a vehicle and tracks it with the data which is already recorded and transmits to a database which is used for Pothole and Speed Breaker detection.

**Ultrasonic sensors and Accelerometers in detection:**

Amitha Terish, et al **[13],** used Ultrasonic sensors and Accelerometers for identifying depths and jerking of the vehicles. When the set threshold value is lower than the measured value, then a pothole is detected. The GPS module identifies the Pothole and sends the location and data transmitted from the server (XAMPP).

**Speed Breaker detection with Arduino Board:**

Kumaravel, et al **[14],** uses an Arduino based board to detect the Speed Breaker. Based upon the distance of the speed of the vehicle from the Speed Breaker, The Arduino Board sends a signal to the driver in a buzzer form to warn them from the Speed Breaker.

**Detection of Speed Breaker and Pothole with Sensors:**

Ramsha Suhail, et al **[15],** proposed a real time application, two piezoelectric sensors are attached to the shock absorbers of the front wheel in a vehicle. If the measured value exceeds the threshold, then a Speed Breaker or a Pothole is detected. If the variations of value are absorbed in both sensors then it is detected as a Speed Breaker. If it is absorbed in any one of the sensors then it is a Pothole.

**Speed Breaker Detection using microcontroller, accelerometer with GPS module:**

Rahul Ramakrishnan, et al [16], used an accelerometer that is capable of measuring variations in 3-D. This monitors the proximity of the vehicle from road level which is then compared to the predetermined threshold. If the value of the accelerometer is greater than the threshold it indicates that there is a speed breaker. And when the threshold values increases than the accelerometer, the GPS system sends the co- ordinates of the detected speed breaker to the microcontroller which then sends it to the database system

## III. CONCLUSION

Thus proposed survey paper in the field of IoT and its applications has overcome the problem of facing Potholes and Speed Breakers can be solved. By the review taken from above papers, Sensors are used to detect the difficulties each person is facing in day to day life. In Future, The methods can be implemented with Voice Assistant to suggest a direction to move either left or right side of a road when a Pothole is encountered and to give a voice of alert when a Speed Breaker is faced.

## REFERENCES

[1] M.S.Kamalesh, Bharatiraja Chokkalingam, Jeevanantham Arumugam, Gomathy Sengottaiyan, Shanmugavadivel subramani, and Mansoor Ahmad Shah. An Intelligent Real Time Pothole Detection and Warning System for Automobile Applications Based on IoT Technology. Journal of Applied Science and Engineering. 2020.

[2] Ajit Gholap and Prof.M.Rokade. Potholes and speed bumps detection. International Journal of Current Engineering and Technology.. 2021

[3] Asst. Prof. P.Sudhakar , R. Ramya Sri, V.Harika, S Navya Sudha, V.N.S.Sandeepthi, S.Uma maheswari. Pothole Detection System Using IoT. UGC care Group I Journal. Vol-10. 2020

[4] K. B. Naveen, J. Adithya Gowda, O.H Amrutha, Harshitha N. Kumar, R Kushwanth. IoT based Automatic Detection of Pot Holes and Speed Breaker Mapping. International Jounal of Research in Engineering , Science and Management. 2019.

[5] Alfandino Rasyid, Mochammad Rifki Ulil Albaab, Muhammad Fajrul Falah, Yohanes Yohanie Fridelin Panduman, Alviansyah Arman Yusuf, Dwi Kurnia Basuki, Anang Tjahjono, Rizqi Putri Nourma Budiarti, Sritrusta Sukaridhoto, Firman Yudianto, Hendro Wicaksono. Pothole Visual Detection using Machine Learning Method integrated with Internet of Thing Video streaming Platform. International Electronics Symposium(IES). 2019.

[6] Etukala Jaswanth Reddy, Padhuri Navaneeth Reddy, Govindula Maithreyi, M.Bharath Chandra Balaji, Santanu Kumar Dash, K. Aruna Kumari. Development and Analysis of Pothole detection and Alert based on NodeMCU. International Conference on Emerging Trends in Information Technology and Engineering (ic-ETITE). 2020.

[7] Van khang Nguyen and Eric Renault. Cooperative sensing and Analysis for a Smart Pothole Detection. 15th International Wireless Communications & Mobile Computing Conference (IWCMC). 2019.

[8] Gupreet Singh, Rajeev Kumar, Poonam kashtriya. Detection of Potholes and Speed Breaker on Road. First International conference on Secure cyber Computing and Communication (ICSCCC). 2018.

[9] Riya R , Nakulraj K and Anusha A. Pothole Detection Methods. Proceedings of the International Conference on Inventive Computation Technologies (ICICT-2018). 2018.

[10] Rui Fan, Ozgunalp, Brett Hosking, Ming Liu, Ioannis Pitas. Pothole Detection Based on Disparity Transformation and Road Surface Modeling. IEEE Transaction on Image Processing (volume: 29). 2019.

[11] Byeong-ho kang and Su-il Choi. Pothole Detection System using 2D LiDAR AND Camera. 2017 Ninth International Conference on Ubiquitous and Future Networks (ICUFN). 2017.

[12] Stepheena Joseph, Mr.K.Edison Prabhu. Role of Ultrasonic Sensor in Automatic Pothole and hump detection System. International Journal of scientific & Engineering Research volume 8. 2017.

[13] Amitha Terish, Shiji Johnson, Sinu Valsan, Sooraj P, Indrasena N V. Real Time Pothole Detection and Road Monitoring System. International Journal of Innovative Research in Science, Engineering and Technology. 2019.

[14] Kumaravel A, Tharani R, Thillaikarasi G, Varsha A. Automated Speed Breakaer to Control the Speed breaker to Control the speed of the vehicle based on IoT. International Research Journal of Engineering and Technology (IRJET). 2020

[15] Ramsha Sumail, Harleen Boparai, Faraz Ahmed. Automated Sensor based Pothole Detection System for Preventing Unfortunate Casuality. International Journal of Engineering Research & Technology (IJERT).

[16] Rahul Ramakrishnan, Ayusha Pendse, Chetna Sharma, Priya Chimurkar. Speed Breaker Detection and Mapping using IoT.Proceedings of the Third International Conference on Smart Systems and Inventive Technology (ICSSIT 2020).