IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Pothole Hole Detection And Filling Robot

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Abstract— Potholes can drastically impair driving and road performance. In 2018, 2019, and 2020, there were 2,015, 2,140, and 1,471 fatalities from road accidents caused by potholes, according to data from the Ministry of Road Transport and Highways (MoRTH). Potholes caused 4,775 incidents in 2019 and 3,564 accidents in 2020, respectively. Many researchers and transportation experts have directed their attention toward developing pothole maintenance techniques that work. Our requirement is for a pothole filling equipment that is long-lasting, economical, and requires minimal human labour. The objective of this project is to develop and construct a prototype for the Automatic Pothole Filling Robot, an automated road maintenance vehicle.
Without assistance from an operator, it is capable of automatically locating and fixing potholes on road surfaces. A straightforward mechanical technique was created to find potholes. It assists in reducing the expenses and complexity, which up to now have been the primary disadvantages of autonomous vehicles used for road maintenance. The breadth and depth of the pothole are measured and detected using ultrasonic sensors. The pothole will be automatically filled by the robot.

Introduction

Roads have a significant positive social impact and contribute significantly to economic growth. They are essential to the growth and development of a country. Roads promote social and economic development by opening up new spaces. Road infrastructure is the most significant of all public assets because of these factors. However, a pothole may form on a road as a result of continual loading and weathering, which would be extremely detrimental to human life. A pothole is a structural breakdown in the surface of a road that is mostly brought about by water seeping into the underlying soil structure and traffic passing over the impacted area.

Therefore, the goal of our project is to create a robot that will benefit society by increasing road safety, reducing the difficulty of spotting potholes, and using less human labor, which will save time. We created a semi-automated robot that can identify potholes in the road, release the necessary quantity of concrete to fill them, and then use a slider to level the released concrete. As a result, the pothole on the road (Fig. 1 Pothole) may be filled entirely, which would reduce the number of accidents caused by the pothole. Pancake pavement, a flexible base, or a hard composite base would all contain the pothole. The patches of pavement next to the pothole may be made of asphalt. The system had to be efficient in order to place the maximum amount of material each day for the least amount of money and manpower. Calculated operating and maintenance costs influence various technical decisions as well as the system's overall design. The cost of different patching processes can be found from a variety of sources.

1. LITRETURE REVIEW

[1] Identifying and Reporting of Potholes and Humps using IoT Smita Saitwadekar1, Dr. Payel saha2)

One of the most vital problems in developing countries is conservation of roads. Well maintained roads contribute a significant portion to the country's economy. Spotting of pavement distress like potholes and humps helps drivers to avoid accidents or vehicle damages, conjointly helps authorities to take care of roads.

[2]POT-HOLE DETECTION AND CLEARANCE ROBOT Ripal Patel*1, Devayya*2, H. Lallawmawma*3, Harsha KG*4, Suraj P*5

The preservation of roads is one of the most important issues in emerging nations. The economy of the nation is significantly boosted by well-maintained roadways. Finding pavement problems like potholes helps drivers prevent collisions or vehicle damage and also aids in road maintenance. Numerous ongoing efforts in the field of transportation networks aim to give drivers pertinent information about the roads and traffic patterns. Indian secondary roads frequently have potholes, some of which may be wet or dry. Therefore, it is crucial to spot potholes and gauge their depths in both situations to ensure safe driving. In this project, we create a sensor model based on the Raspberry

Pi, which allows for such detection and depth estimates utilizing.

[3] AUTOMATIC DETECTION AND FILLING OF POTHOLES Boopathi D*1, Gagana BP*2, Girish S Tevari*3, Kiran M*4, Mr. Channappa Gowda D V*5

Indian secondary roads frequently have potholes, some of which may be wet or dry. Therefore, it is crucial to spot potholes and gauge their depths in both situations to ensure safe driving. In this paper, we create a geometric framework based on physics, where such detection and depth estimation can be achieved by employing suitable. Here, we take into account how resolution drops down as you get farther from the camera. Additionally, we design and construct a semi-automated robot that will pour the necessary quantity of concrete into the identified pothole and then level the concrete so that the pothole on the road is completely filled.

2. COMPONENT REQUIRED

1. ESP32

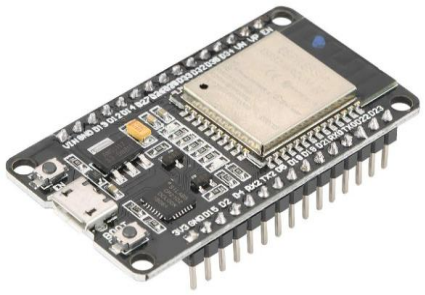


Fig. 3. ESP32 Wi-Fi, Bluetooth Module

One popular low-cost and low-power microcontroller chip for Internet of Things (IoT) applications is the ESP32. It is made by Express if Systems and serves as a substitute for the ESP8266 chip. Because of its many features and capabilities, the ESP32 is a good choice for many Internet of Things applications.
The key characteristics of the ESP32 are as follows: Processor with two cores: The ESP32's dual-core Extensa LX6 CPU provides more performance and parallel processing when compared to single-core microcontrollers.

Wi-Fi and Bluetooth compatibility: The ESP32 supports Wi-Fi 802.11 b/g/n and Bluetooth v4.2 and Bluetooth Low Energy (BLE). It can now connect to the internet and communicate wirelessly with other devices thanks to this.
GPIO pins: The ESP32 has a large number of general-purpose input/output (GPIO) pins.

2. Ultrasonic sensor:

An apparatus that uses ultrasonic sound waves to gauge an object's distance is called an ultrasonic sensor. An ultrasonic sensor transmits and receives ultrasonic pulses using a transducer to determine the proximity of an item.

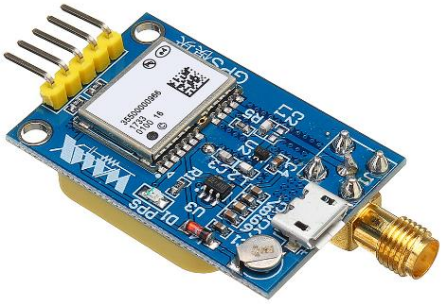
DC motor

Motors that run on direct current (DC) are electromechanical devices that transform electrical energy into motion. They function according to the electromagnetic induction principle, which states that rotational motion is produced when current-carrying conductors and a magnetic field interact. The stator and the rotor are the two major parts of a DC motor. The motor's stator, which is immovable, is usually made up of several electromagnets or permanent magnets organized in a magnetic field. The motor's rotating component, known as the rotor, is made up of an armature, or coil of wire, that is fixed on a shaft. A torque is produced when an electrical current is given to the armature, interacting with the stator's magnetic field to create its own magnetic field.

Motor Drive:

The motor driver plays a vital role in controlling the speed and direction of DC motors in the pothole detection and repair robot. It employs an H-bridge configuration to manage the flow of current through the motor windings, allowing bidirectional control. Pulse Width Modulation (PWM) signals regulate motor speed by adjusting the duty cycle of the PWM waveform. Motor drivers come in various types, including integrated and modular versions tailored for brushed and brushless DC motors. These drivers enable precise and efficient motor control, essential for the robot's movement and functionality. Operating principles involve toggling the state of H-bridge transistors to change the motor's direction and adjusting PWM signals for speed control.

GPS Module:



The GPS module serves as a critical component within the pothole detection and repair robot, providing precise location data essential for navigation and geospatial mapping. Utilizing a network of satellites orbiting the Earth, the GPS module receives signals to triangulate the robot's position accurately. This information enables the robot to determine its coordinates, altitude, and speed, facilitating efficient navigation along predefined routes and aiding in the identification and recording of pothole locations.

Esp32 Cam.

The ESP32-CAM module is a multipurpose microcontroller board that combines a camera module and an ESP32 microprocessor, giving it a strong foundation for DIY and Internet of Things applications. It allows for easy control and communication across local networks or the internet thanks to its integrated WiFi and Bluetooth capabilities. It is perfect for embedded vision applications including robotics, smart home devices, and surveillance systems because of its small size and low power consumption. The camera module enables developers to take high-quality pictures and films for a range of applications by providing different frame rates and resolutions. Furthermore, it may be quickly prototyped and customized by both novice and expert coders due to its support for MicroPython and Arduino IDE compatibility.

3. SOFTWARE REQUIRED

Arduino IDE

Install the Arduino IDE or another appropriate development environment before beginning to programmed the ESP32. Use the IDE's supported programming language (such as C++ or MicroPython) to create the ESP32 firmware. Use ESP32-specific libraries and home automation communication protocols like MQTT (Message Queuing Telemetry Transport)

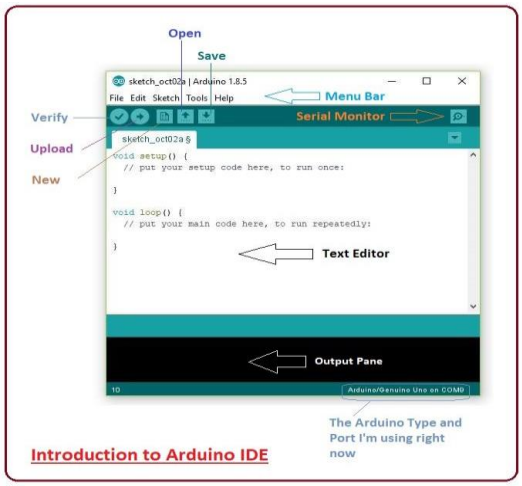
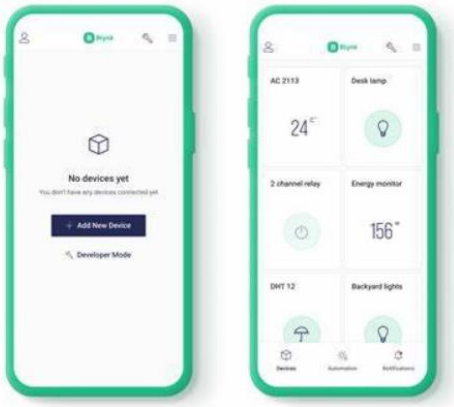


Fig. 3. Arduino IDE Interface

Blynk App:



Using Blynk, an Internet of Things platform for iOS and Android smartphones, users may control Arduino, Raspberry Pi, and NodeMCU remotely. With the help of this application, a graphical user interface (HMI) may be created by gathering and supplying the correct address on the accessible widgets.

4. WORKING

The development of a pothole detection and filling robot with an ESP32 requires the integration of multiple technologies and parts, such as actuators, microcontrollers, and sensors. The DC motor will allow the robot to travel down the road. We'll use the ultrasonic sensor to find potholes. The robot will halt and use the filling system to repair any potholes it detects. The robot's location will be tracked via the GPS module.

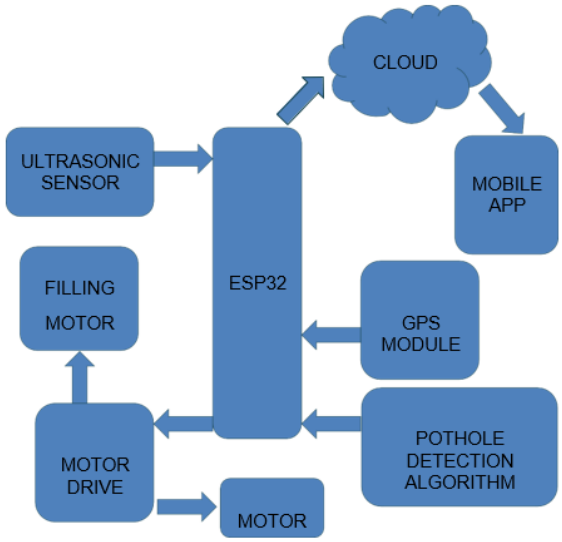
The Blynk app will get the robot's location data for remote tracking. Integration of Sensors: Attach the accelerometer (pothole detection sensor) to the ESP32. To find anomalies in the road surface, read the sensor's data. Data processing: Use

algorithms to analyze the information from the sensors and decide if any potholes have been found.

To detect potholes, you might need to establish a threshold for the sensor values. Wi-Fi Communication: Send data to a cloud platform or a distant server for additional reporting and analysis by utilizing the ESP32's Wi-Fi capabilities. Although optional, this step can be helpful for data analysis and logging. Filling Process: Connect the ESP32 to the actuator (servo motor or hydraulic system). When a pothole is found, program the microcontroller to turn on the filling mechanism. 13 Mobility: Verify the robot's ability to move efficiently. To control how the wheels move, use motor controllers.

Configure the microcontroller to guide the robot in the direction of identified potholes. Power Management: To make sure the robot can work for a longer amount of time, put in place a power management system. Low-power modes and effective energy resource use may be part of this. Use safety features to keep the robot from colliding and to make sure it moves in a regulated manner. Employ extra cameras or sensors to detect obstacles. Testing and calibration: To guarantee precise pothole recognition and dependable filling, test the robot in controlled settings. Adjust the algorithms and sensor thresholds as necessary. Deployment: After the robot is constructed and tested successfully, use it in real-world situations to get more feedback and make necessary improvements.

5. BLOCK DIAGRAM



Block Diagram

6. KEY FEATURES

Pothole Detection

Navigation System

Filling Mechanism

Wireless Communication

Scalability

Autonomous Operation

7. ACKNOWLEDGMENTS

We extend our heartfelt gratitude to the research community, developers of electronic components, creators of communication platforms, project team members, supervisors, mentors, advisors, and our families and friends for their invaluable contributions, support, and guidance throughout the pothole detection and filling robot project. Your dedication and expertise have been instrumental in the success of this endeavor, and we deeply appreciate your commitment to our shared goals. Thank you for your unwavering support and encouragement, which have fueled our passion and determination. We are honored to have had the opportunity to collaborate with such talented individuals and organizations, and we look forward to continuing our journey together in future endeavors.

8. REFERENCES

[1] Automatic Detection And Filling Of Potholes Boopathi D*1, Gagana BP*2, Girish S Tevari*3, Kiran M*4, Mr. Channappa Gowda D V*5 *1,2,3,4Student, Department of Information Science and Engineering The Oxford College of Engineering, India. 05/May-2023

[2] Pothole Detection and Cement Dispensing Robot Shivam L. Chame, Ashutosh V. Ghale, Subodh A. Garje, Yash A. Satvekar, R. S. Sewane . May 2023.

[3] Automated Pothole Filling Machine. *Authors: Mr. Chavan Pauras P., Mr. Dhapare Pradnyesh P., Mr. Joshi Paresh S., Mr. Karande Pratik S., Prof. Kolwankar Mansi S.March 2023*

[4] A Robot For Spotting & Leveling Of Chunk Hole Using Iot Prof. Dhanraj S1 , Divyashree R2 , Divya N3 , Atmuri Vasavi Lahari4. Fab. 2023

[5] Pot-Hole Detection And Clearance Robot Ripal Patel*1,Devayya*2, H. Lallawmawma*3, Harsha KG*4, Suraj P*5 *1Assistant Professor, Department Of Electronics And Communication Engineering Dr. Ambedkar Institute Of Technology, Bengaluru-560056, India. July 2022.

[6] Automatic Detection, Estimation and Filling of Pothole Vadiraj.R.S #1 , Navaneeth.K *2 , Shashank.K.S #3 , Abhishek.H.N*4 , Srinath.J#5 , Shashi Raj.K*6 #1,2,3,4,5 Students,#6 Asst. Profesor, Electronics & Communication , DSCE Bangalore, India 15 | April 2019

[7] “Identifying and Reporting of Potholes and Humps using IoT” Smita Saitwadekar1, Dr. Payel saha2International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 06Issue: 02 | Feb 2019

[8] Gaurav Singal, Anurag Goswami, Suneet Gupta, Tejalal Choudhary “Pit free: Pot-holes detection on Indian Roads using Mobile Sensors”,978-1- 5386-6678-4/18/$31.00 c 2018 IEEE.

[9] Ashish Gaikwad, Yashwant Belhekar, Mandar Dangre, Ankit Chaudhary” Path hole Detection System: Using Wireless Sensor Network” International Engineering Research Journal (IERJ), Volume 2 Issue 12 Page 4643-4646, 2018 ISSN 2395-1621.

[10] Pothole Detection using Machine Learning Hyunwoo Song, Kihoon Baek and Yungcheol Byun Dept. of Computer Engineering, Jeju National University, Korea chzhqk1994@gmail.com, masinogns@gmail.com, ycb@jejunu.ac.kr. February 2018

[11] Pothole Damage Costs U.S. Drivers $3 Billion Annually, https://www. oregon.aaa.com/ 2016/02/pothole-damage-costs-u-s-drivers-3-billion-annually/. (2017)