AUTOMATIC POTHOLE DETECTION AND CEMENT DISPENSING ROBOT

Prof. Divya B N[1], Aditi K Uttarkar [2], Balaji S[3], Chandu L[4], Pannag T N[5]

Assistant Professor, Electronics and Communication, East West Institute of Technology, Bengaluru, India[1]

Student, Electronics and Communication, East West Institute of Technology, Bengaluru, India[2-5]

Abstract: In developing countries, maintaining roads is one of the most crucial difficulties. Well-maintained roads contribute greatly to the nation's economy. To ensure safe driving, it is therefore essential to recognize potholes and determine their depth.

An Arduino UNO, an ultrasonic sensor, servo motors, DC motors, and other electronic parts are used in the design and creation of the model. In order to do this operation, sensors that identify potholes and transmit the signal to the Arduino UNO are used. The pothole on the road is then fully filled after the signal is sent to the circuit that powers the different motors and dispenses the required amount of cement into the identified hole. The cement is then levelled using a roller.

Keywords: Well-Maintained roadways, Potholes, Dispense, Arduino UNO.

I. INTRODUCTION

Roads make a crucial contribution to economic development and bring important social benefits. They are of vital importance in order to make a nation grow and develop. Roads open up more areas and stimulate economic and social development.

According to the survey report "Road Accidents in India, 2022", a total of 1,64,373 people have lost their lives due to road accidents. Of these, nearly 2% (3600) deaths were due to poor condition of roads. For those reasons, road infrastructure is the most important of all public assets. However, due to repeated loading and weathering on roads, a pothole may be caused, affecting human life very badly.

A pothole is a structural failure in a road surface, caused by failure primarily in asphalt pavement due to the presence of water in the underlying soil structure and the presence of traffic passing over the affected area. So, the project is to develop a robot that helps society in promoting road safety and reduces the difficulties in detecting the pothole and also reduces the usage of human power and hence saves time.

We designed an Automatic Robot that will detect the pothole on the road and will discharge the required amount of concrete to fill the pothole and to do a levelling process on the discharged concrete using the slider. Therefore, the pothole on the road will be filled completely and hence the accidents that occur due to the pothole will be reduced.

II. OBJECTIVES

- The Robot will detect potholes and fills them automatically.

- Levelling of potholes is done after filling the potholes.
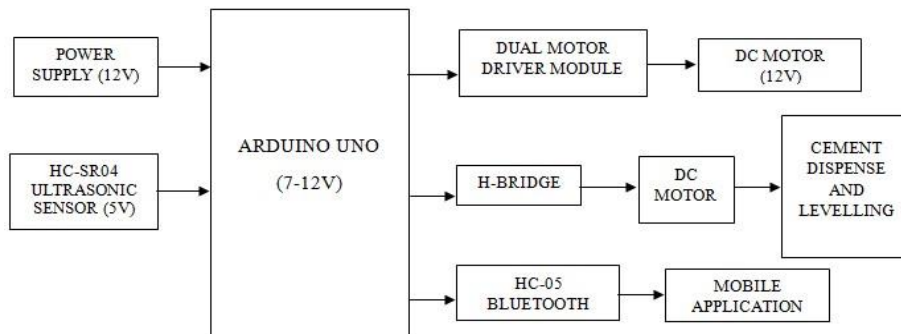
- Obstruct detection.

III. METHODOLOGY

Fig 1: Block Diagram of Automatic Pothole Detection and Cement Dispensing Robot

The Ultrasonic sensor on the front of the Model is allowed to sense the surface of the road, if the pothole is detected, the sensor send the signals to the Arduino UNO, and the Arduino UNO suddenly stops the movement of model near the pothole, and allows to discharge the required cement needed for the detected pothole. Then the pothole is levelled by slider crank mechanism. The architecture of proposed system consists of three parts i.e., sensing unit, server unit and user unit. Ultrasonic sensors are based on measuring the properties of sound waves with frequency above the audio range. The HC-SR04 module includes ultrasonic transmitter, receiver and control circuit. It measures distance between two objects and this distance is calculated depending upon the time taken by the ultrasonic pulse to travel a particular distance. The module sends a 40 kHz square wave and detect the received pulse signal automatically. The depth of pothole is calculated based on the time taken by the transmitted signal to return.

- The Arduino UNO is used as a control device to carry out various activities by making appropriate decisions.
- Two Ultrasonic Sensors are connected in the front of the robot, one is to detect the pothole and the other is to detect an obstacle.
- If a pothole is detected, the message is sent to the application through Bluetooth HC-05 module.
- Then the robot fills the pothole and then levels it with the help of the roller connected to the robot.
- The ongoing processes such as Detection, Filling and Levelling of the pothole are all showed in the Bluetooth Terminal android application.
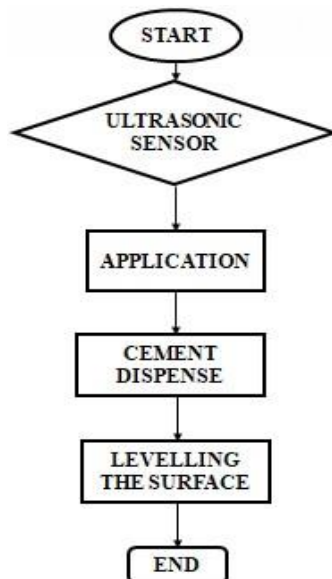
IV. IMPLEMENTATION

Fig 2: Flow Chart of Automatic Pothole Detection and Cement Dispensing Robot

- Assuming a pothole in a straight path and detected by the ultrasonic sensor in the robot.
- The robot sends a message to the user through the application.
- The robot then dispenses cement into the pothole i.e., filling.
- The roller then levels the pothole that is filled with the cement.

V. RESULT

The prototype model was made according to the circuit diagram and the results were as expected. The potholes are detected, filled and levelled satisfactorily using the help of Ultrasonic Sensors and Roller.

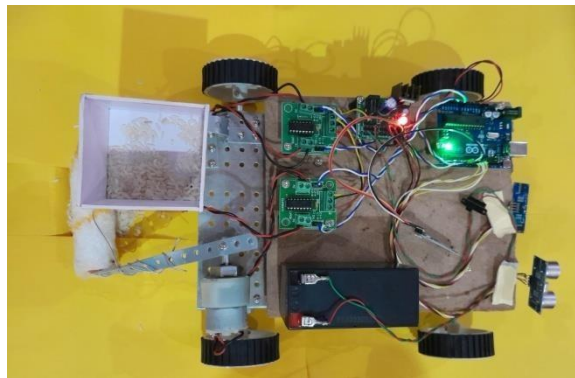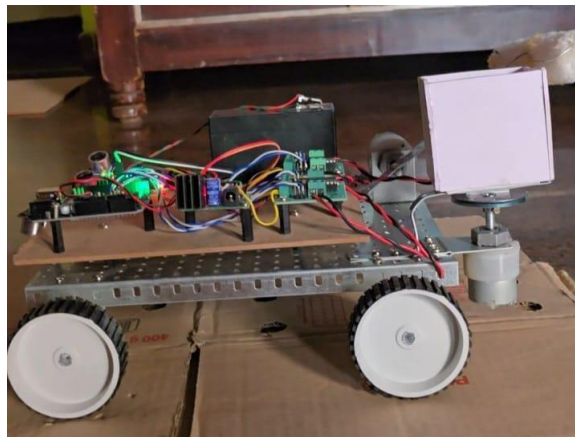The exact figure of resulted Automatic Pothole Detection and Cement Dispensing Robot is shown below,
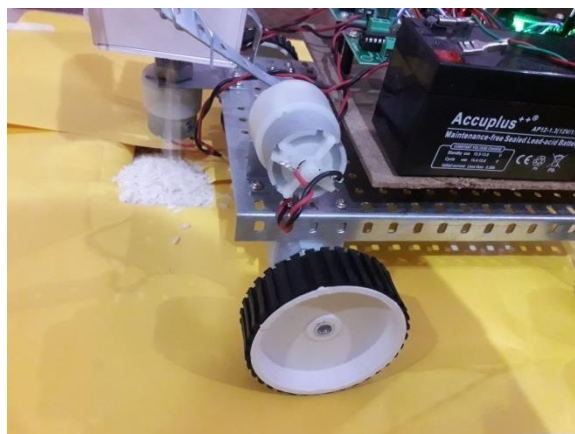

Fig 3: Prototype of the model

Fig 4: Dispense of Cement

Fig 5: Leveling of Pothole

VI. CONCLUSION

The proposed system basically serves two functions, it automatically identifies potholes and obstructions and transmits signals to the device to do further activities, such filling and levelling the potholes by which we can avoid accidents. This is a cost-efficient solution for detection of potholes. The information can also be used by the Government authorities for the maintenance of the roads.

REFERENCES

[1]. A.Boukerche, H. A. B. F. Oliveira, E. F. Nakamura, A. A. F. Loureiro, "Vehicular Ad Hoc Networks: A New Challenge for Localization-Based Systems, "Computer Communications, 2008.

[2]. J.Eriksson, L. Girod, B. Hull, R. Newton, S. Madden, H. Balakrishnan, "The Pothole Patrol: Using a Mobile Sensor Network for Road Surface Monitoring, "Proceedings of the 6th International Conference on Mobile Systems, Applications, and Services, pp. 29-39, 2008.

[3]. G.Strazdins, A. Mednis, G. Kanonirs, R. Zviedris, L. Selavo, "Towards Vehicular Sensor Networks with Android Smartphones for Road Surface Monitoring," Institute of Electronics and Computer Science,University of Latvia.

[4]. S.Rode, S. Vijay, P. Goyal, P. Kulkarni, K. Arya, "Pothole Detection and Warning System: Infrastructure Support and System Design," International Conference on Electronic Computer Technology, pp.286290 Feb. 2009.

[5]. S.Vijay, "Low Cost - FPGA based system for pothole detection on Indian Roads", M-Tech Thesis, Indian Institute of Technology Bombay, Jul. 2006.

[6]. X.Yu, E. Salari, "Pavement Pothole Detection and Severity Measurement Using Laser Imaging," IEEE International Conference on Electro/Information Technology (EIT), pp. 1-5, May 2011.

[7]. https://arduino.cc/en/Main/ArduinoBoard https://arduino.cc/en/Guide/HomePage