# Pothole Patrol: An Innovative Robotic Solution for Road Maintenance Using Sustainable Materials

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My project involved creating an autonomous robot that can identify and repair potholes on roads. The robot is designed to measure the dimensions of each pothole and use an eco-friendly material to repair it. It can also generate a precise geographical map of each pothole's location. Pothole damage on roads is a longstanding issue, with the North American market for pothole repair valued at US$3.56 billion in 2021 and the total cold patch revenue is expected to grow by 5.4% from 2022 to 2029. Robots have been developed specifically for detecting and filling potholes on streets, such as the "Pothole Killer", however, these robots can be quite expensive. My robot consists of five main systems: locomotion, pothole detection, volume calculation, filling, and mapping. The locomotion system is 4 12C DC motors. The pothole detection system uses an ultrasonic sensor to detect potholes, while the volume calculation system uses a grid pattern and algorithm, I came up with to calculate the volume of each irregular shaped pothole. My algorithm uses the 900 points the system gathers and makes 841 different rectangular prisms that are used to find the volume. The mapping system sends the location data and volume to an online database, and the filling system uses a 3D printed feeding system to push through eco-friendly material into the pothole. The entire robot is being ran off of 3 Arduinos and 1 Raspberry Pi. After 10 prototypes and multiple iterations, my robot can detect a pothole with 95% accuracy, determine the volume of the pothole within 15% accuracy, fill a pothole within 10% accuracy and publish all the information it gathers on my website. Overall, my project provides an efficient and cost-effective solution to the problem of pothole damage on roads.

**Awards Won:**
International Council on Systems Engineering - INCOSE: Certificate of Honorable Mention, a 1-year free student membership to the INCOSE, and free virtual admission to the 2022 International Symposium of the INCOSE