Project Report on

THE POTHOLE DETECTION AND FILLING

Submission to THE ROBOTICS CLUB - SNIST as a part of INDUCTION'24

TEAM NO - 01

THE ROBOTICS CLUB-SNIST

SREENIDHI INSTITUTE OF SCIENCE AND TECHNOLOGY

(AUTONOMOUS)

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2024

CERTIFICATE

This is the project work titled '**THE POTHOLE DETECTION AND FILLING'** by 'Ch.Manvith, S.Alekhya ,T.Abhishek, D.Nishmitha, G.Sai kiran, Ch.Jayalakshmi, G.Karthik,K.Purushotham,Afif Mansur Baig' under the mentorship of '**P.Phani Anirudh , P.Sangeetha**' and is a record of the project work carried out by them during the year 2024-2025 as part of INDUCTION under the guidance and supervision of

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DECLARATION

The project work reported in the present thesis titled **“THE POTHOLE DETECTION AND FILLING”** is a record work done by Team 01 in **THE ROBOTICS CLUB** as a part of **INDUCTION-2024.**

No part of the thesis is copied from books/ journals/ Internet and wherever the portion is taken, the same has been duly referred in the text. The report is based on the project work done entirely by TEAM 01 and not copied from any other source.

ACKNOWLEDGMENT

This project report is the outcome of the efforts of many people who have driven our passion to explore into implementation of THE POTHOLE DETECTION AND FILLING**.** We have received great guidance, encouragement and support from them and have learned a lot because of their willingness to share their knowledge and experience.

Primarily, we would like to express our gratitude to our mentors, P.Phani **Anirudh and P.Sangeetha**. Their guidance has been of immense help in surmounting various hurdles along the of our goal.

We thank our technical heads "**Mr.G. Kovidh Addhish & Mr. Aarushraj Puducherry"** for being with us till the end of the project completion.

We thank all the members of **Steering Body**, **Executive Body, Technical Advisory Board, Club's Incubation and Competence Committee** of **The Robotics Club** for helping us with crucial parts of the project. We are deeply indebted to **Mr. N V V S Narayana –** The President, **Ms. Mugala Shravani-** The Vice President and **Ms Maliha** – SAB Chairman and **Mr. N Abhinav** – General Secretary **THE ROBOTICS CLUB** respectively and also every other person who spared their valuable time without any hesitation whenever we wanted.

We also thank our faculty advisor **Dr. A. PURUSHOTHAM**, Professor, Mechanical Department, who encouraged us during this project by rendering his help when needed.

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ABSTRACT

THE ROBOTICS CLUB – SNIST

INDUCTION'24

TEAM No – 1

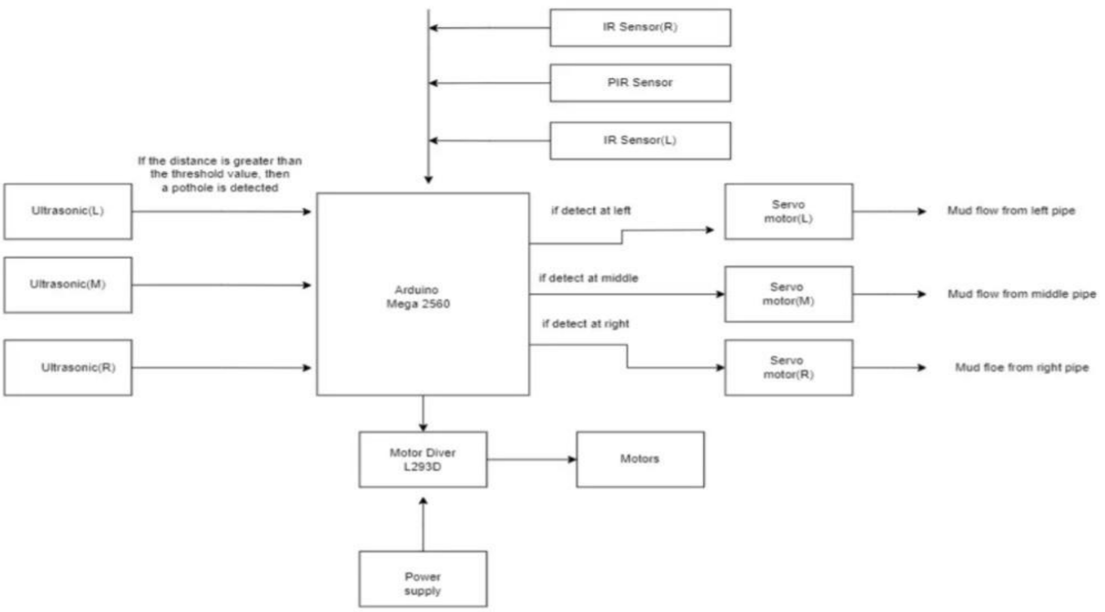
The Problem:

Due to heavy rains, potholes on roads pose significant hazards to motorists and pedestrians, leading to accidents, vehicle damage, and infrastructure degradation. Traditional methods of detecting and filling potholes are labor-intensive, and using conventional materials like asphalt for repairs may not always be feasible due to resource constraints or environmental concerns. These methods are reactive, inefficient, and unsustainable, resulting in prolonged road closures, traffic delays, and increased maintenance expenditure. To address this challenge, advanced technology, sustainable materials, and streamlined processes are critical to revolutionizing pothole management. This approach ensures safer roads, reduced environmental impact, and optimized resource utilization.

THE TEAM'S APPROACH TO SOLVE THE PROBLEM:

To overcome the issue of potholes, we propose an innovative solution: a semi-autonomous bot equipped with ultrasonic sensors. Strategically positioned sensors detect potholes, initiating a repair process using a unique filling mechanism tailored to each specific hazard. Servo motors ensure precise filling for a controlled period. This process is repeated until the pothole is completely filled. A specialized roller attachment applies optimal pressure to stabilize the filled areas thoroughly, preventing future degradation. This approach integrates technology, precision, and sustainability to enhance road safety and prevent accidents.

BLOCK DIAGRAM



TITLE OF THE PROJECT:
POTHOLE DETECTION AND FILLING -道路の救世主

WHAT WE FOUND INNOVATIVE:

Innovations in pothole detection and levelling stem from advancements in technology, particularly in machine learning, computer vision, and robotics. The use of ultrasonic sensors and rollers represents a significant advancement in automating and improving the efficiency of pothole detection and repair processes. Ultrasonic sensors accurately detect pothole dimensions and depth, generating detailed maps for precise filling. Rollers equipped with appropriate materials then fill potholes based on sensor data. This technology enables automated robots to detect, level, or repair potholes with minimal human intervention, enhancing road maintenance by making it faster, safer, and more efficient.

POTHOLE DETECTION AND FILLING

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June 22, 2024

Abstract

Due to the heavy rains, we are currently facing significant problems with potholes on roads. These potholes pose serious hazards to motorists and pedestrians, leading to accidents, vehicle damage, and infrastructure degradation. Traditional methods of detecting and filling potholes are often labor-intensive, and using conventional materials like asphalt for repairs may not always be feasible due to resource constraints or environmental concerns. These methods are reactive, inefficient, and unsustainable, resulting in prolonged road closures, traffic delays, and increased maintenance expenditures. To address this challenge, there is a critical need for advanced technology, sustainable materials, and streamlined processes to revolutionize pothole management, ensuring safer roads, reduced environmental impact, and optimized resource utilization.

1 Introduction

Potholes are a frequent problem on roads, caused by traffic, weather, and poor maintenance. They can lead to accidents, vehicle damage, and worsening road conditions, making effective pothole management crucial for safety. Traditional methods involve manual checks and repairs with asphalt, which are labor-intensive, slow, and often temporary. These methods are also unsustainable due to limited resources and environmental concerns. New technologies and materials offer better solutions. Automated systems and eco-friendly materials can improve the detection and repair of potholes, making the process faster, cheaper, and more sustainable. This not only makes roads safer but also saves resources and reduces environmental impact.

1.1 Existing System

Existing pothole detection systems utilize various technologies to ensure timely identification and maintenance of road hazards. Recent technological advancements have introduced automated solutions such as vehicle-based sensors and mobile applications. Vehicle sensors, like accelerometers and cameras, detect potholes as vehicles travel, automating data collection over large areas. However, these systems require significant data processing and may miss smaller potholes, limiting their comprehensive effectiveness. Mobile apps allow citizens to report potholes directly, leveraging GPS and photo capabilities. Although engaging and cost-effective, these apps depend heavily on user participation and can vary in accuracy. Advanced technologies like satellite imaging and ground-penetrating radar (GPR) provide high-resolution views and subsurface scans, respectively, enhancing detection capabilities. Satellite imaging covers extensive areas but is costly and sensitive to weather conditions. GPR identifies subsurface issues before potholes form, yet its specialized equipment and complexity increase implementation costs. Integrating these diverse approaches improves road maintenance efficiency, ensuring safer, reliable road networks through prompt pothole detection and repair efforts. .[3]

1.2 Proposed System

To overcome the issue of potholes, we introduce an innovative solution expressed in an semiautonomous bot equipped with ultrasonic sensors. Calculatedly positioned sensors detect the pothole. Upon detection, the bot initiates the repair process, using a unique filling mechanism tailored to the specific location of the detected hazard. To ensure controlled filling, we will use servo motors, which will help in filling the pothole only for a specific period of time. We will repeat this process until the pothole is completely filled. Then, using a specialized roller attachment and applying optimal pressure, we'll stabilize the filled areas thoroughly to prevent future degradation. This approach unites technology, precision, and sustainability, making the roads safer and preventing road accidents.

2 Architecture

2.1 Hardware

2.1.1 Arduino Mega 2560

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Mega 2560 board is compatible with most shields designed for the Uno and the former boards Duemilanove or Diecimila.

Figure 1: Ardunio Mega 2560

2.1.2 Bread Board

An electronics breadboard (as opposed to the type on which sandwiches are made) is actually referring to a solder-less breadboard. These are great units for making temporary circuits and prototyping, and they require absolutely no soldering.

Figure 2: Bread Board

2.1.3 Servo Motors SG90

A servo motor is a self-contained electrical device that moves parts of a machine with high efficiency and great precision. In simpler terms, a servo motor is a BLDC motor with a sensor for positional feedback. This allows the output shaft to be moved to a particular angle, position, and velocity that a regular motor cannot do. Fig. 8. Servo Motor SG90 A servo motor is controlled by controlling its position using Pulse Width Modulation Technique. The width of the pulse applied to the motor is varied and sent for a fixed amount of time. Servo Motor generally requires a DC supply of 4.8 V to 6 V.

Figure 3: Servo Motor SG90

2.1.4 UltraSonic Sensors

Ultrasonic sensors, such as the HC-SR04, measure distance by emitting ultrasonic sound waves and timing their echo return. They consist of a transmitter and receiver, where the transmitter emits sound waves that bounce back from objects, and the receiver captures the echoes. The sensor calculates the distance based on the time interval between sending and receiving the pulse. These sensors are widely used for obstacle avoidance in robots, level detection, and various distance measuring applications due to their accuracy and non-contact measurement capability.

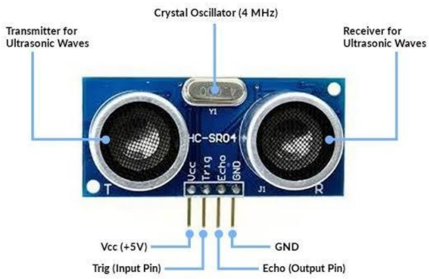

Figure 4: UltraSonic Sensor

2.1.5 IR Sensor

An IR (Infrared) sensor detects objects and measures distances using infrared light. It emits IR light, which reflects off objects, and a photodiode detects the reflected light. The intensity of the reflection is used to determine the presence and distance of objects. IR sensors are commonly used for proximity detection, obstacle avoidance, and remote control applications. They are effective in various lighting conditions and can be integrated easily into robotic systems.

Figure 5: IR sensor

2.1.6 Side Shaft Motor

A side shaft, also known as a half shaft or drive shaft, is a critical component in a vehicle's drivetrain. It transfers torque from the differential to the wheels, enabling the vehicle to move. The side shaft connects the differential, which distributes power from the engine, to the wheels. It ensures that the rotational power generated by the engine is effectively transmitted to the wheels, allowing the vehicle to move forward or backward.

Figure 6: Side Shaft

2.1.7 PIR Sensor

A PIR (Passive Infrared) sensor detects motion by sensing changes in infrared radiation emitted by objects, typically living beings. It contains pyroelectric sensors that detect the heat emitted by humans and animals. When an object moves within the sensor's field of view, it causes a change in the infrared levels, triggering the sensor. PIR sensors are widely used in security systems, automatic lighting, and motion-activated devices due to their sensitivity and reliability in detecting human presence.

Figure 7: PIR sensor

2.1.8 Wheels

Wheels with good grip are used so that the bot moves freely through the pipes.They reduce friction, making it easier to transport heavy loads and navigate obstacles. We can traverse through rough terrain as they have good grip. The ones we are using are made of plastic and rubber.

Figure 8: Wheels

.

2.1.9 Chassis

A chassis serves as the base structure for a robot or vehicle, supporting all other components and ensuring structural integrity. It can be made from various materials, including metal, plastic, or PVC, depending on the required strength and weight constraints. The chassis design must consider the placement and mounting of motors, wheels, sensors, and other parts to ensure balanced weight distribution and stability. A well-designed chassis is crucial for the overall performance and reliability of the robotic system.

Figure 9: Chassis

2.1.10 Motor Driver - L298N

The L298N is a dual H-bridge motor driver integrated circuit (IC) commonly used to control and drive DC motors, particularly in robotics and mechanics applications. It provides a straightforward way to manage motor direction and speed using control signals from micro-controllers like Arduino. The L298N motor driver has a supply range of 5v to 35v and is capable of 2A continuous current per channel, so it works well with most of the DC motors. The L298N is valued for its efficiency, ease of use, and versatility, making it a popular choice for hobbyists and engineers working on projects involving motor control.

2.1.11 PVC Pipes

PVC (Polyvinyl Chloride) pipes are used extensively in various applications due to their durability, lightweight, and cost-effectiveness. In robotics, these pipes are commonly

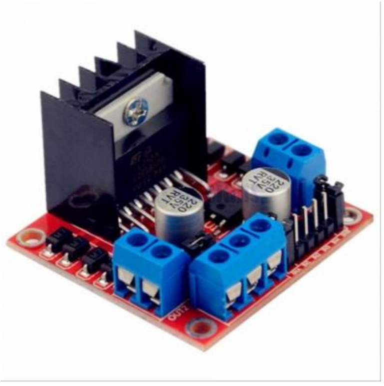

Figure 10: Motor driver - L298N

utilized to construct frameworks or chassis. They can be easily cut, drilled, and assembled, making them a versatile material for building project structures. PVC pipes are also resistant to corrosion and chemical damage, adding to their longevity and reliability in different environments.

Figure 11: pvc pipes

2.1.12 Jumper Wires

A jumper wire is an electrical wire or group of wires used to connect circuits without soldering. They have connectors or pins at their ends. Depending upon the configuration of end connectors, they are classified into three types: male-to-male, male-to-female and female-to-female.

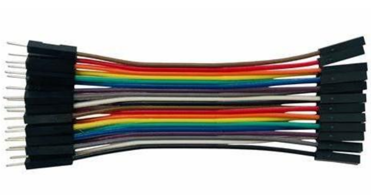

Figure 12: Jumper Wires

2.1.13 Lead-acid Battery

A lead-acid battery is a type of rechargeable battery that uses lead and lead oxide plates submerged in a sulfuric acid electrolyte. It was invented in 1859 by French physicist Gaston Planté and is one of the oldest types of rechargeable batteries. Despite the advent of newer battery technologies, lead-acid batteries remain popular due to their cost-effectiveness, reliability, and capacity to deliver high surge currents.

Figure 13: Lead acid Battery

2.1.14 Metal Clamps

Metal clamps are used to secure components firmly in place within a robotic system or assembly. They are essential for attaching motors, sensors, or structural parts to the chassis or framework. Metal clamps provide strong and adjustable connections, ensuring that components remain fixed during operation. They come in various sizes and designs, tailored to different mounting needs, and are typically made from durable materials like steel or aluminum to withstand mechanical stress.

Figure 14: clamp

2.2 Software

2.2.1 Arduino IDE

Arduino Integrated Development Environment is an open-source application software created by Arduino. It is used to write and upload code on to the Arduino boards. It supports C and C++ programming languages, and has a built-in compiler.

You can compile your code within the IDE to check for errors and then upload the compiled program (known as a sketch) to the connected Arduino board. The IDE handles the compilation and uploading process seamlessly.

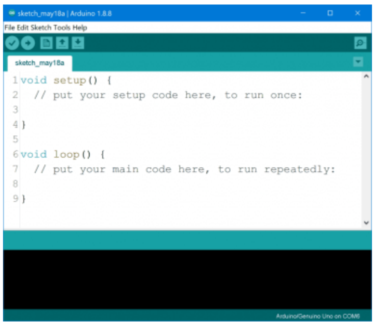

Figure 15: Arduino IDE

2.2.2 Fusion 360

Fusion 360 is a computer-aided designing (CAD) software application for 3-D modelling and simulation. It's other functions include computer-aided manufacturing (CAM) and computer-aided engineering (CAE), as well as designing printed circuit boards.Fusion 360 provides powerful 3D modeling tools that allow users to create complex 3D models of products and components. It supports parametric modeling, direct modeling, and sculpting.

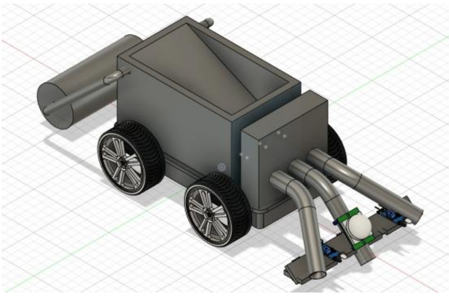

Figure 16: Fusion 360

2.2.3 Easy EDA

EasyEDA is a web-based electronic design automation (EDA) tool that provides capabilities for schematic capture, circuit simulation, and PCB (Printed Circuit Board) layout. It is used by electronics engineers, hobbyists, and makers to design and simulate electronic circuits and create PCB layouts for manufacturing.

3 Implementation and working:

3.1 Circuit Diagram

3.2 Block Diagram

3.3 Working Mechanism

Our semi-autonomous pothole detection and filling bot utilizes an Arduino Mega as its central microcontroller, which

Figure 17: Easy EDA

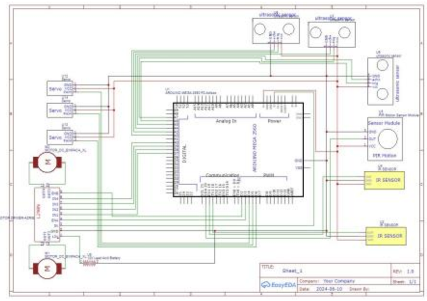

Figure 18: circuit diagram

coordinates the bot's operations. The bot is equipped with four wheels powered by motors, allowing it to move smoothly across various surfaces. The core functionality of the bot relies on three ultrasonic sensors positioned on the left, middle, and right sections of the bot. These sensors are crucial for identifying potholes on the road. When the left ultrasonic sensor detects a pothole, the Arduino Mega triggers the left pipe to dispense sand into the pothole. Similarly, the middle and right sensors activate their corresponding pipes when they detect potholes directly ahead or to the right.In addition to pothole detection, the bot features two infrared (IR) sensors mounted on the left and right sides for obstacle detection. If the left IR sensor identifies an obstacle, the Arduino Mega sends a signal to the motors to turn the bot right, thereby avoiding the obstacle. Conversely, if the right IR sensor detects an obstacle, the bot turns left. For obstacles directly in front, a Passive Infrared (PIR) sensor is positioned centrally. When the PIR sensor detects an obstacle in the bot's path, the Arduino Mega initiates a U-turn to steer the bot away from the obstacle, ensuring it can continue its task uninterrupted.The Arduino Mega plays a pivotal role in managing the bot's operations. It continuously receives input from the ultrasonic and IR/PIR sensors and makes real-time decisions based on this data. As the bot moves forward, the ultrasonic sensors constantly scan for potholes. Upon detection of a pothole, the Arduino Mega promptly activates the appropriate sand-dispensing pipe to fill it. Simultaneously, the IR and PIR sensors monitor for any obstacles. If an obstacle is detected by any of these sensors, the Arduino Mega adjusts the bot's direction

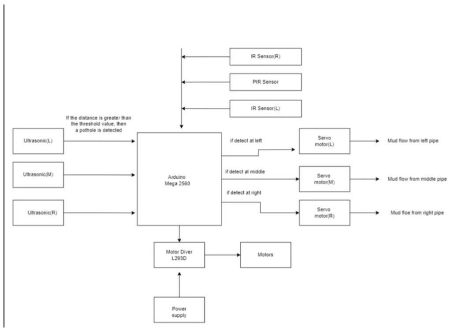

Figure 19: Block Diagram

by sending commands to the motors to turn left, right, or perform a U-turn.Your bot integrates the robust processing capabilities of the Arduino Mega with ultrasonic sensors for detecting and filling potholes, and IR/PIR sensors for obstacle avoidance. The Arduino Mega ensures smooth and efficient operation by processing sensor inputs and controlling the bot's movements and actions. This integration allows the bot to effectively maintain roads by filling potholes while adeptly navigating around obstacles, showcasing a practical application of semi-autonomous technology in road maintenance.

4 Experimental Results and Conclusions:

4.1 Results

Despite advancements in technology, pothole repair remains labor-intensive. Automating this process could significantly enhance efficiency, accuracy, and durability of repairs. Automated systems promise reduced labor costs and minimized human error, potentially offering long-term savings for municipalities. Challenges like technological integration and maintenance must be addressed, but innovations in robotics and materials science are paving the way. Embracing autonomous pothole repair technologies holds promise for revolutionizing road maintenance, improving infrastructure quality, optimizing resources, and enhancing road safety.

4.2 Future Enhancements

In the future, advancements in pothole detection and repair technologies will transform road maintenance. Automated systems using advanced sensors and AI will detect potholes in real-time, enabling prompt repairs to prevent road hazards. These systems will improve repair accuracy and durability by applying materials precisely and compacting them effectively. This approach optimizes resources, reduces maintenance costs, and minimizes environmental impact compared to traditional methods, enhancing overall road safety and efficiency.

4.3 Conclusion

In recent times, the task of filling potholes has largely been carried out manually by laborers utilizing road rollers. This traditional method requires significant human effort and time, often leading to inefficiencies and increased labor costs. However, advancements in technology have led to the development of a semi-autonomous bot designed to perform this job with minimal human intervention. This innovative bot not only streamlines the process by efficiently identifying and filling potholes but also enhances safety by reducing the need for workers to be directly involved in the hazardous road repair environment. Additionally, the precision and consistency of the bot ensure a higher quality of road repair, potentially leading to longer-lasting results and reduced maintenance costs in the long run.

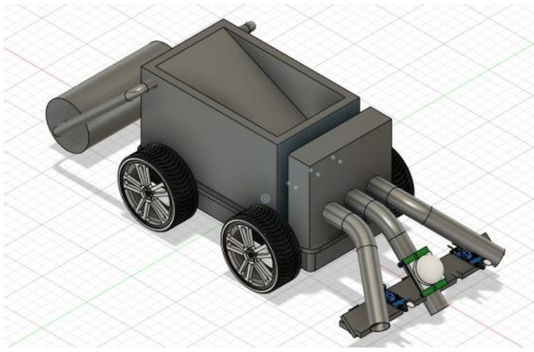

Figure 20: CAD Model

4.4 References

1. Smith, J. (2022). ”Technological Innovations in Road Maintenance: From Manual Labor to Robotics.” Journal of Infrastructure and Technology, 18(4), 235-248. 2. Brown, L., Davis, R. (2023). ”Evaluating the Efficiency and Safety of Semi-Autonomous Road Repair Bots.” International Journal of Robotics in Construction, 12(2), 112-129. 3. Green, P. (2021). ”Cost-Benefit Analysis of Automated Solutions in Road Repair.” Public Works Management Review, 25(3), 78-95.

4. U.S. Department of Transportation. (2022). ”Innovations in Road Repair: Embracing Automation for Improved Infrastructure.” USDOT Publications, Report No. FHWA-HRT-22-001.

4.5 Source Code

```
#include <Servo.h>

#define IN1 4
#define IN2 5
#define IN3 6
#define IN4 7
#define ENA 13
#define ENB 12
#define TRIG_LEFT 26
#define ECHO_LEFT 27
#define TRIG_MIDDLE 10
#define ECHO_MIDDLE 11
#define TRIG_RIGHT 8
#define ECHO_RIGHT 9
#define IR1 24
#define IR2 22
#define PIR 23

Servo  servol;
Servo servom;
Servo servor;

long potholedistance;
int uv_range = 3;

enum  Sensor  {NONE,LEFT,MIDDLE,RIGHT};
Sensor detectedSensor;
void setup() {
  servol.attach(3);
  servom.attach(1);
  servor.attach(2);
  servol.write(0);
  servom.write(0);
  servor.write(0);
  pinMode(TRIG_LEFT,OUTPUT);
  pinMode(ECHO_LEFT,INPUT);
  pinMode(TRIG_MIDDLE,OUTPUT);
  pinMode(ECHO_MIDDLE,INPUT);
  pinMode(TRIG_RIGHT,OUTPUT);
  pinMode(ECHO_RIGHT,INPUT);
  pinMode(IR1,INPUT);
  pinMode(IR2,INPUT);
  pinMode(PIR,INPUT);
  pinMode(IN1,OUTPUT);
  pinMode(IN2,OUTPUT);
  pinMode(IN3,OUTPUT);
  pinMode(IN4,OUTPUT);
  pinMode(ENA,OUTPUT);
  pinMode(ENB,OUTPUT);


  Serial.begin(9600);
  attachInterrupt(digitalPinToInterrupt(IR1),
  ir,RISING);
  attachInterrupt(digitalPinToInterrupt(IR2),
  ir,RISING);
  attachInterrupt(digitalPinToInterrupt(PIR),
  ir,RISING);

  potholedistance=ultra_calibrator();
}

void loop() {
  detectedSensor=pothole_detected();
  if(detectedSensor==NONE){
    forward();
  }
  else
 {
  stop();
  delay(100);
 }
  if(detectedSensor==LEFT)
  {
    operate_servo(servol);
  }else if(detectedSensor==MIDDLE)
  {
    operate_servo(servom);
  }else if(detectedSensor==RIGHT)
  {
    operate_servo(servor);
  }
}

Sensor pothole_detected() {
  if(distance(TRIG_LEFT,ECHO_LEFT)>
  potholedistance+uv_range){
    return LEFT;
  }
  if(distance(TRIG_MIDDLE,ECHO_MIDDLE)>
  potholedistance+uv_range){
    return MIDDLE;
  }
  if(distance(TRIG_RIGHT,ECHO_RIGHT)>
  potholedistance+uv_range){
    return RIGHT;
  }
  else{
    return NONE;
  }
}

long ultra_calibrator()
{
  int readings=6;
  long sum=0;
  for (int i=0;i<readings;i++)
  {
    forward();
    sum+=distance(TRIG_MIDDLE,ECHO_MIDDLE);
    delay(1500);
  }
  return sum/readings;
}
```

```
void ir()
{
  if(digitalRead(IR1)==1&&
  digitalRead(IR2)==0&&digitalRead(PIR)==0)
  {
    //assume ir1 as left
    right();
  }
  else if(digitalRead(IR1)==0&&
  digitalRead(IR2)==1&&digitalRead(PIR)==0)
  {
    //assume ir2 as right
    left();
  }else if(digitalRead(IR1)==1&&
  digitalRead(IR2)==1&&digitalRead(PIR)==1)
  {
    //if there is a dead end.
    right();
    delay(2000);
    right();
  }
delay(200);
}

long distance(int trigPin, int echoPin) {
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  long dur = pulseIn(echoPin, HIGH);
  long dis = (dur * 0.0343) / 2;
  delay(50);
  return dis;
}
void operate_servo(Servo servo) {
  servo.write(90);
  delay(10000);
  servo.write(0);
  delay(100);
}
void forward()
{
  analogWrite(ENA, 255);
  digitalWrite(IN1, HIGH);
  digitalWrite(IN2, LOW);
  analogWrite(ENB, 255);
  digitalWrite(IN3, HIGH);
  digitalWrite(IN4, LOW);
}
void backward()
{
  analogWrite(ENA, 255);
  analogWrite(ENB, 255);
  digitalWrite(IN1, LOW);
  digitalWrite(IN2, HIGH);
  digitalWrite(IN3, LOW);
  digitalWrite(IN4, HIGH);
}
void right()
{
  analogWrite(ENA, 255);
  analogWrite(ENB, 255);
  digitalWrite(IN1, LOW);
  digitalWrite(IN2, HIGH);
  digitalWrite(IN3, HIGH);
  digitalWrite(IN4, LOW);
}

void left()
{
  analogWrite(ENA, 255);
  analogWrite(ENB, 255);
  digitalWrite(IN1, HIGH);
  digitalWrite(IN2, LOW);
  digitalWrite(IN3, LOW);
  digitalWrite(IN4, HIGH);
}
void stop()
{
  analogWrite(ENA, 0);
  analogWrite(ENB, 0);
  digitalWrite(IN1, LOW);
  digitalWrite(IN2, LOW);
  digitalWrite(IN3, LOW);
  digitalWrite(IN4, LOW);
}
```

4.6 List of Expenses

	COMPONENTS	PRICE
1	PVC Pipes	100
2	Arduino mega	800
3	Ultra Sonic Sensor	50 * 3 = 150
4	Servo motor SG90	80 * 3 = 240
5	Chassis (wood)	100
6	Side shaft 300 rmp motors	50 * 4 = 200
7	Metal clamps	103
8	Motor Driver L298N	150
9	Bread Board	108
10	Jumper Wires	106
11	Wheels or Tyres	208
	TOTAL PRICE	**2265**