

# SEWAGE PIPE LEAKAGE DETECTION USING ROBOTICS AND INTERNET OF THINGS

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## Abstract

*This article presents a method that combines robotics and Internet of Things (IoT) technology to detect water leaks in pipelines. The system involves using small autonomous robots equipped with sensors to monitor sewage pipes for leaks. These robots are designed to move in pipes and detect pressure or flow changes that could indicate a leak. The robots are also equipped with wireless communication capabilities that allow them to send data to a central server or cloudbased platform. The system uses IoT technology to collect and analyze data from multiple sensors in real time, providing a comprehensive view of the sewer system. By detecting leaks early, the system prevents damage to the environment and reduces repair costs.*

**Keywords— Robotics, App Development, Internet of Things.**

## I. INTRODUCTION

Leaky pipes can cause serious damage to the environment and human health. The routine process of checking for sewer leaks is timeconsuming, expensive, and often requires human intervention. IoT and robotics can improve pipeline management by accurately detecting leaks without human supervision. It can increase the safety and efficiency of wastewater management while reducing operational risks.

Advances in robotics and the Internet of Things (IoT) make it possible to identify water leaks efficiently and accurately. Robotic systems equipped with sensors can monitor pipes and identify leaks or damage. The data collected by the robot can be sent to a central monitoring center in the Internet of Things to analyze and detect problems in real time.

The machine has a good way to deal with sewage, resulting in faster and better treatment, reducing the risk of spills and the environment. This article examines the use of robotics and IoT to define wireframes.

## II. PROBLEM STATEMENT

Check and prevent sewer leaks. Leaks in water pipes can cause significant economic losses as well as environmental and health hazards. Current research requires manual review, which can be time consuming, expensive, and sometimes dangerous.

## III. OBJECTIVES

The main purpose of using robotics and IoT for pipeline leak detection is to provide a better and more efficient way to detect water leaks in pipelines.

Here are some key objectives:

Objective 1 - Check for leaks in the sewer lines.

Objective 2 – The Internet Of Things (IoT) enables remote sensing and/or control of objects from existing network devices

Objective3- The system uses robotics to detect and warn.

IV.EXISTING SYSTEM

Sewage is an important part of wastewater management, it carries wastewater from homes and businesses to treatment plants. Over time, these pipes can become clogged with oil, debris, and other materials, causing blockages, corrosion, and leaks. If left untreated, these problems can cause serious environmental and health hazards as well as economic losses. To prevent these problems, regular maintenance and cleaning of the pipes is important. Pipeline cleaning involves removing debris, oil and other substances from pipes to restore pipe efficiency and flow rates.

Various methods are available to clean the pipes, including hydro-spraying, stick and chemical cleaning. Hydro spraying involves the use of high-pressure water jets to clean the pipes, while oil extraction involves the use of mechanical equipment to remove deposits and blockages. Chemical cleaning involves using chemicals to dissolve oil and other materials.

Leak detection is another important part of plumbing maintenance. Leaks in water pipes can cause significant economic losses as well as environmental and health hazards. The routine process for detecting leaks involves manual inspections, which can be time consuming, expensive and dangerous.

There are many examples of existing sewer systems around the world whose design and use may vary depending on factors such as geographic location, population density and resources.

V.LITERATURE REVIEW

Recent years have focused on using robotics and IoT technology to detect and locate leaky pipes. A study by Mohanty et al. (2021) reported a robotic system equipped with IoT sensors to detect water leaks in pipelines. The system is designed to collect temperature, pressure and humidity data used to move along pipes and detect leaks. The results show that the proposed method can detect leaks with high accuracy.

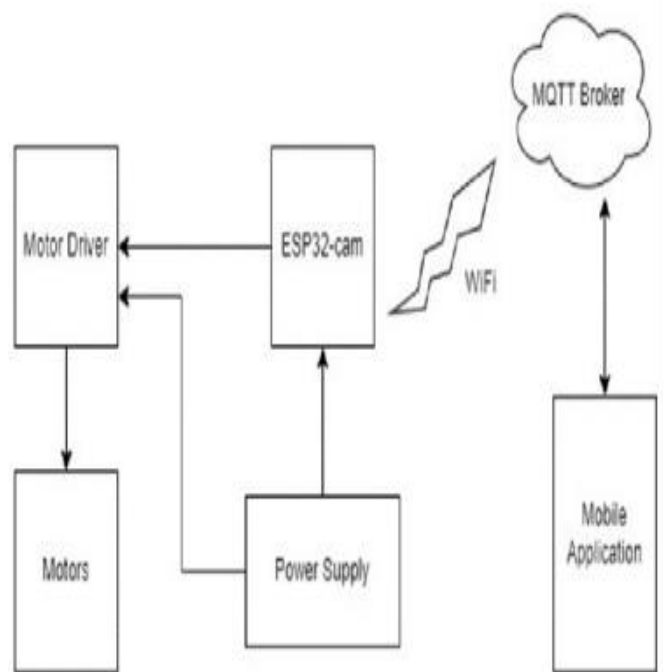
In another study, Li et al. (2021) reported a machine learning based method to detect and locate leaks in sewers using IoT sensors. The system is designed to collect data on flow, pressure and temperature and then use machine learning algorithms to analyze the data and identify leaks. The results show that the proposed method can detect and identify leaks in sewer pipes.

Similarly, Zhang et al. (2020) reported a robotic system equipped with IoT sensors to detect and locate leaks in sewer pipes. The system is designed to collect temperature, pressure and flow rate data used to move pipes and detect leaks. The results show that the proposed method can detect and identify leaks in sewer pipes.

Additionally, research conducted by Xu et al. (2021) proposed a new method for combining IoT sensors and acoustic signals to identify and locate leaks in sewer pipes. The system is designed to collect data on flow, pressure, temperature and acoustic signatures that can be used to detect leaks. The results show that the proposed method can detect and identify leaks in sewer pipes.

VI.PROPOSED SYSTEM

- Using robots with IoT technology, you can detect.
- The use of sensors and real-time data analysis helps pinpoint the leak location, allowing for fast and effective repairs.
- This avoids environmental and health risks and minimizes financial losses associated with pipelines .
- In addition, the use of robots and the Internet of Things can enable inspections in places inaccessible to humans, such as pharmaceutical factories or other hazardous areas.
- Using an IoT-enabled camera, you can capture live video onsite and stream it to a mobile device, enabling remote viewing .
- Overall, this offering can provide a more efficient and cost-effective solution to detect and prevent pipeline leaks while improving safety in hazardous areas.



Block Diagram Of Proposed System

VII.TOOLS & METHODOLOGY

**HARDWARE REQUIREMENTS**

Microcontroller - ESP32-cam

Microcontroller-ESP32

L298Motor

ESP32 Cam

Gas sensor-MQ 6

**SOFTWARE REQUIREMENTS**

Flutter is a Google SDK for building native interfaces for iOS and Android using the Dart programming language. Flutter has been a production-ready, stable product on iOS and Android since its official launch in December 2018. Flutter is powered by Dart programming language optimized for fast apps on any platform

C for microcontroller programming

Vscode

Android studio

**B.ESP32 CAM**

We use ESP32 CAM for real input. The ESP32 CAM board is built around the ESP32 microcontroller, a powerful 32-bit dual-core processor with Wi-Fi and Bluetooth connectivity.

The ESP32 CAM can be run using the Arduino IDE, which is usually a place to write code in the Arduino IDE. ESP32 CAM is a powerful microcontroller board designed for camera and IoT applications.



VIII.PROPOSED METHODOLOGY

**A. L298N**

Here we are using the L298N IC has four input pins, two for each motor, and four output pins, two for each motor. The input is used to control the direction and speed of the motor, while the output provides power to the motor. The input pin is set high or low to control the direction of the motor. If you set the input pins to the high and low state, the motor will rotate in one direction, and if you set them to the low and high state, the motor will rotate in the opposite direction.



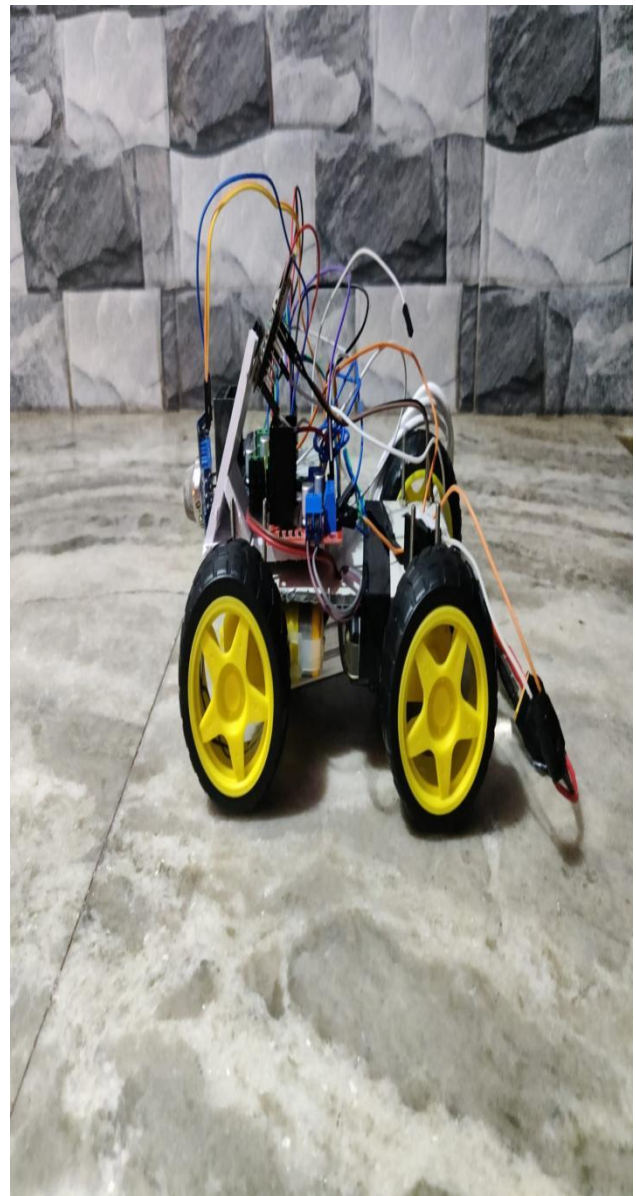
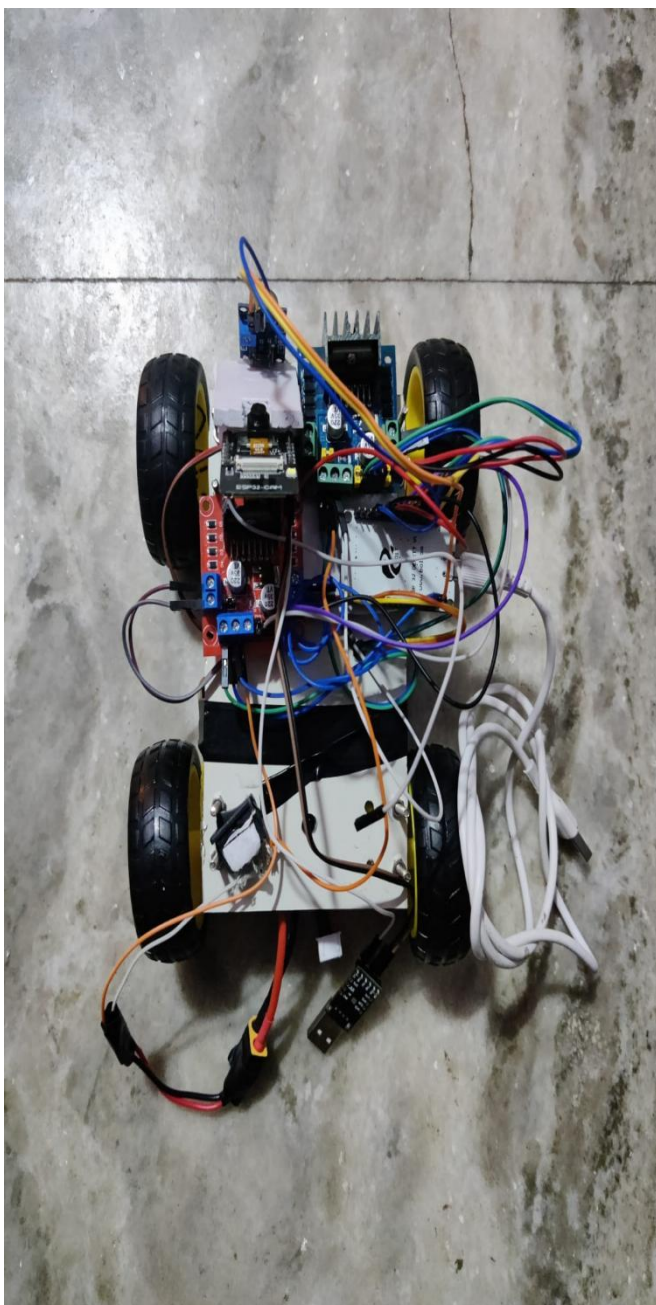
**C. APP DEVELOPMENT**

We created an application to control the power of the robot in the sewer system, you always use a mobile application development platform like Android Studio. The application must be connected to the robot using a communication protocol such as Wi-Fi. The API usually includes controls to move the robot forward, backward, left and right.

## IX.RESULT

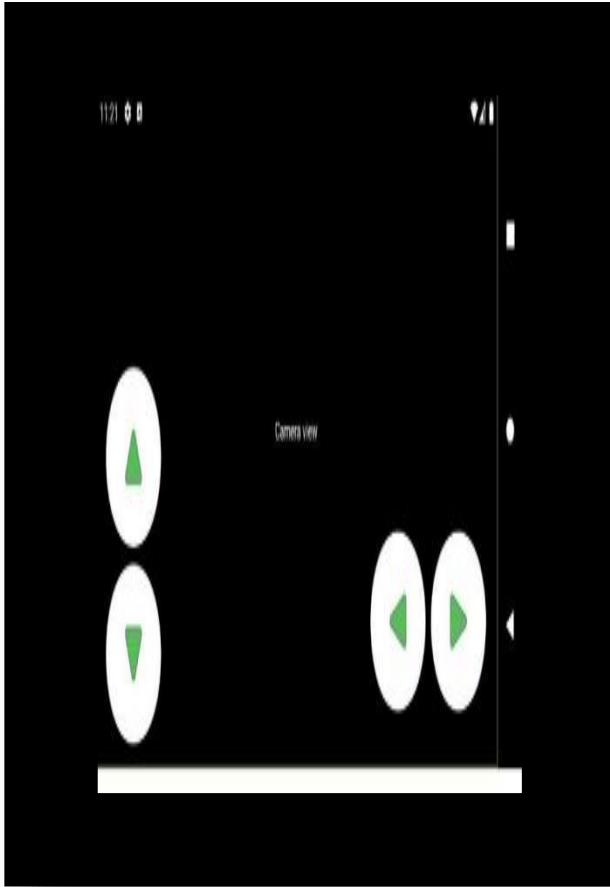
### A. ROBOT

The robot is equipped with all the components that are required for performing different functions such as Detect leaks, Monitor pipe condition, Perform maintenance, Inspect hard-to-reach areas. When the robot is turned on, we need to connect it to the Android app via wifi module, then we have to decide whether to control the robot manually or automatically.



### ANDROID APP

Android App is developed for selecting the mode of operation of the robot and controlling the robot manually. This app operates when the application is connected to the wifi module. When the app is opened there consists of four types of button modes forward, backward, left, and right. The control page is the most important page in the app. For controlling the robot we need to connect the Android app to the robot which can be done by clicking the wifi button. After connecting with the robot, the user can select the mode of operation manual or automatic. When leak is detected, it indicates alert



X. FUTURE

The future of sewers using robots and IoT is significant. With the rapid development of robotics and IoT technology, there are many opportunities to increase the efficiency and effectiveness of these systems. Some of the future areas here are robot control, artificial intelligence and machine learning, predictive maintenance, smart sensors, integration with other systems. The future of leak detection using robotics and IoT is bright, with many opportunities for further research and development..

XI.CONCLUSION

We are trying to develop a water leak detection using robots and the Internet of Things (IoT) is a good way to improve environmental protection and public health. The technology provides an effective and efficient way to identify problems in the installation using sensor technology and sending data over the Internet of Things. This paper examines the development of sewer systems using robots and the Internet Internet of Things, discussing various aspects of the system and the advantages they offer.This technology provides an effective way to monitor the sewer system, reducing the risk of sewer overflow and environmental pollution. Going forward, further research and development is required to realize the full potential of this technology. However, the integration of robotics and IoT into the sewer system has great potential to transform the industry and benefit people and the environment.

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