Mini Project Report

# Project Title: Borewell Rescue Robotic Device

Team ID: IPR-057

Guide: Dr. Galiveeti Poornima, Assistant Professor, Department of CSE

# Abstract

The Borewell Rescue Robotic Device is a compact, modular robotic system designed to assist in the rapid and safe rescue of individuals—especially children—who accidentally fall into borewells. The project integrates live video streaming, environmental sensors, and a robotic arm using an ESP32-CAM platform. It is designed to navigate narrow spaces, communicate with trapped individuals, and potentially assist in lifting them to safety, all while being remotely operated through IoT platforms like Blynk.

# Introduction

Borewell accidents are tragic and common in rural India. Traditional rescue methods involve digging parallel shafts, which are time-consuming and dangerous. This project proposes a tech-based alternative: a robotic rescue system using ESP32-CAM, ultrasonic sensors, and a servo-based robotic arm, capable of live monitoring and real-time control via a mobile or web dashboard.

# Problem Definition

Design a robotic system that can:

- Enter narrow borewells safely.

- Provide real-time video and sensor data.

- Be remotely controlled and monitored.

- Assist in communication and rescue operations.

# Objectives

- Enable live video streaming from within the borewell.

- Provide real-time distance measurements using ultrasonic sensors.

- Facilitate remote robotic arm control to aid the trapped person.

- Ensure easy deployment, low cost, and reusability.

# Methodology

Hardware Used:

- ESP32-CAM

- OV2640 Camera

- Ultrasonic Sensors (HC-SR04)

- L298N Motor Driver

- Servo Motors (Robotic Arm)

- DC Motors (Locomotion)

- Rechargeable Li-ion Battery

Software & Tools:

- Arduino IDE

- Blynk 2.0 for IoT dashboard

- Firebase for logging (optional)

- MQTT protocol (optional)

# System Design

Architecture Highlights:

- Input: Ultrasonic sensors and camera feed.

- Processing Unit: ESP32-CAM controls and processes sensor data.

- Output: Video streaming and motor/servo control.

- Communication: Wireless using Blynk IoT and Wi-Fi.

- Power Supply: Rechargeable battery pack for mobility.

# Code Overview

Sample code enables:

- Sensor data acquisition via NewPing.

- Data push to Blynk dashboard.

- Wi-Fi-based control and monitoring.

(See full code in project document)

# Results

The prototype was able to:

- Send live video feed to mobile through Blynk.

- Detect distances with ultrasonic sensor.

- Control motors and robotic arm remotely.

- Operate within narrow PVC pipes (borewell simulation).

# Advantages

- Real-time remote control

- Autonomous obstacle avoidance

- Lightweight and scalable

- Low cost and high reliability

# Conclusion

This project presents a smart, cost-effective solution to a life-threatening issue. It minimizes risk to human rescuers and significantly reduces the time taken for rescue operations. With further refinement, this robotic device can become a deployable system for local governments and disaster response units.

# Future Scope

- Integrate voice communication with trapped individual.

- Add AI for autonomous decision-making.

- Include GPS for location tracking.

- Enhance robotic arm capabilities for gripping and lifting.

# References

1. Tejaswini S. Mane et al., "Robotic Device for Borewell Rescue Operation", IJCRT, 2024.

2. R. Murphy et al., "Mobile Robots in Mine Rescue and Recovery", IEEE Robotics Automation Magazine, 2009.

3. G. Kavianand et al., "Smart Child Rescue System from Borewell", ICETETS, 2016.