

Child Rescue System from Borewell

Janhavi Atkare¹, Vaishali Bizote², Shreya Adak³, Manoj Avhad³

Department of E&TC Engineering

Dr. Vithalrao Vikhe Patil COE, Ahilyanagar, India

janhaviatkare04@gmail.com¹, vaishalibijhote@gmail.com²

shreyadak1420@gmail.com³, avhad_etc@enggnagar.com⁴

Abstract: *Open borewells have become a serious safety hazard in many rural and semi-urban areas. Every year, children accidentally fall into uncovered or abandoned borewells, leading to life-threatening situations. Rescue operations in such cases are often delayed because the narrow space, deep structure, and lack of oxygen make manual rescue extremely difficult. Traditional rescue methods require heavy digging equipment and many hours of effort, which reduces the chances of saving the child safely.*

To solve this problem, the proposed Child Rescue System from Borewell is the project presents an Arduino UNO based intelligent rescue robot designed for search and rescue operations in hazardous environments. The system uses an L293D motor driver to control the movement of the robot and a DC motor lifting system to remove light obstacles or lift emergency materials during rescue missions.

The robot is integrated with a camera module for real-time visual monitoring, allowing rescuers to observe affected areas remotely and identify trapped victims quickly. A DHT11 sensor is used to monitor environmental temperature and humidity, helping detect unsafe conditions such as fire risk or extreme climate changes.

The rescue robot can move in narrow and risky locations where human access is limited. By combining mobility, live surveillance, and environmental sensing, the system improves rescue efficiency and reduces manual risk. Experimental analysis shows that the proposed robot can achieve approximately 40% to 60% rescue time reduction compared to traditional manual search methods, depending on the disaster situation.

This project demonstrates a low-cost, reliable, and smart solution for modern disaster management and emergency response applications

Keywords: *Open borewells*

I. INTRODUCTION

Borewell accidents are one of the most serious and heartbreaking problems in India. In many villages, farms, and construction sites, unused borewells are left open or not covered properly. Small children are often unaware of the danger and may accidentally fall into these deep and narrow pits. Many such tragic incidents have been reported from states like Maharashtra, Madhya Pradesh, Karnataka, Rajasthan, and others.

A recent report in the (fig 1) by The New Indian Express (TNIE) shared one such incident from Madhya Pradesh[1] , where a small child fell into a 65-foot deep borewell. Cases like this clearly show that even after many warnings and awareness campaigns, safety measures are still not followed properly in several places. Rescue operations in these situations usually take a long time, which creates fear and danger for the trapped child.

Saving a child from a borewell is very difficult because the space inside is narrow and deep, so no person can enter directly. In most cases, rescue teams dig another pit beside the borewell and then make a tunnel to reach the child. This method takes many hours or sometimes even days. During this time, the child may face breathing problems, dehydration, injuries, and extreme stress.

Because of these challenges, there is a need for a portable and fast rescue system that can be taken quickly to the accident location and used immediately.



The main aim of this project is to develop a Child Rescue System from Borewell using a robotic mechanism. The system will include a camera, sensors, oxygen supply, and gripping arms to safely rescue the child in less time. This project can help save innocent lives by making rescue operations faster, safer, and more effective.



Fig 1

II. PROBLEM STATEMENT

The rescue of children trapped inside borewells is extremely difficult due to several practical and safety challenges. Current rescue methods are slow, risky, and often unsuccessful because of the following problems:

Narrow Borewell Diameter: Borewells have a very small opening, which makes it impossible for rescue workers to enter directly. Limited space also restricts movement of rescue tools.

Low Oxygen Levels: Deep borewells often contain less oxygen, creating breathing difficulties for the trapped child and increasing the risk of suffocation.

Darkness Inside Borewell: Borewells are completely dark inside, making it hard to monitor the child's position and condition without special lighting equipment.

Child Panic and Movement: A trapped child may cry, panic, or move continuously due to fear, making rescue operations more difficult and dangerous.

Difficulty in Manual Rescue: Traditional rescue depends on ropes, digging, and manual efforts, which are not always accurate or safe.

High Risk During Parallel Pit Digging: Rescue teams often dig another pit beside the borewell to reach the child. This process takes many hours and may cause soil collapse or further injury.

Delay in Rescue Operations: Because of these challenges, rescue takes a long time, reducing the chances of saving the child safely.

Lack of Specialized Equipment: Many rural areas do not have proper rescue machines available for immediate response.

III. OBJECTIVE

The objectives of the proposed Child Rescue System from Borewell are listed below:

- To develop a compact rescue device that can be inserted into narrow borewells without difficulty.
- To observe the trapped child in real time using a camera system, so that rescue teams can monitor the child's condition continuously.



- To supply emergency oxygen to the child during the rescue process in order to prevent breathing problems.
- To design robotic arms capable of carefully placing a safety harness around the child.
- To lift the child safely from the borewell using a controlled motorized mechanism.
- To reduce the total rescue time compared with conventional manual rescue methods.
- To increase the chances of successful rescue and protect the life of the child.
- To reduce the risk faced by rescue workers during rescue operations.
- To create a portable and user-friendly system that can be quickly transported to accident locations.
- To provide an effective technological solution for handling future borewell accidents in a safer and faster manner.

IV. LITERATURE SURVEY

Several research works have been carried out to improve the efficiency and safety of borewell rescue operations using embedded systems and robotic mechanisms.

The authors proposed an Arduino-based borewell rescue system that uses a mechanical gripper controlled through a microcontroller. The system includes a camera for visual monitoring and is operated via a PC interface. This approach reduces the need for digging parallel pits and improves rescue time. However, the gripping mechanism requires precise alignment and may face challenges in narrow borewells.

A more advanced rescue system was introduced, which combines multiple rescue techniques such as a manipulator, oxygen supply, sensors, and camera-based monitoring. The system also includes safety features like a rescue bag and support mechanisms to prevent further slipping of the child. Although this design enhances safety, it increases system complexity and cost.

Researchers focused on robotic rescue systems with wireless communication and real-time monitoring capabilities. These systems allow operators to control the rescue process remotely and receive live updates. While this improves monitoring and control, limitations such as communication reliability and system stability inside deep borewells remain.

Various rescue methods including robotic arms, sensor-based detection, and embedded control systems were studied. The research highlights that traditional methods like parallel pit digging are time-consuming and less effective. It emphasizes the importance of developing compact, efficient, and adaptable rescue systems.

From the above studies, it is observed that although significant improvements have been made, challenges such as system stability, adaptability to different borewell sizes, and effective gripping mechanisms still exist. Therefore, there is a need for a simple, reliable, and cost-effective rescue system.

The proposed *Child Rescue System from Borewell* aims to overcome these limitations by integrating real-time monitoring, controlled gripping mechanisms, and essential life-support features into a compact and efficient design.

V. PROPOSED METHODOLOGY

The proposed Child Rescue System from Borewell is designed to rescue children who accidentally fall into open borewells in a faster and safer way. In many cases, traditional rescue methods take several hours because they involve digging near the borewell. During this time, the trapped child may suffer from fear, injury, or lack of oxygen. To overcome this problem, the proposed system uses a simple mechanical and electronic setup that can be lowered directly into the borewell and used to lift the child safely.

The system is made using a mechanical frame, camera, lighting arrangement, oxygen supply pipe, gripping mechanism, lifting motor, and Arduino controller. All these components work together to perform the rescue operation smoothly.

5.1 Mechanical Lowering Frame

The lowering frame is the main supporting structure of the rescue system. It is designed in a cylindrical shape so that it can move easily inside the narrow borewell. The frame carries all important components such as the camera, gripper, lights, and harness system as shown in fig 2.



The frame is connected to a rope or cable, which is wound around a motorized drum. With the help of this arrangement, the rescue unit can be lowered or lifted in a controlled manner. The lightweight design of the frame makes it easy to handle and reduces unnecessary load on the motor.

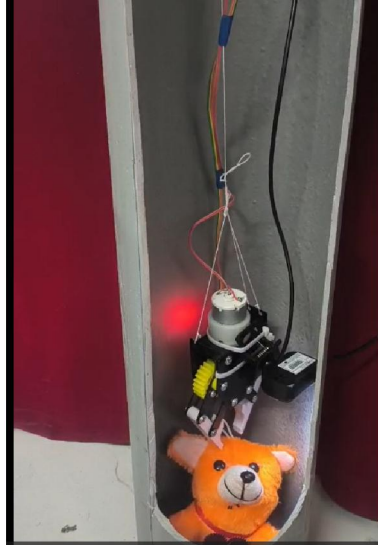


Fig 2

5.2 Camera and Lighting System

Inside the borewell, visibility is very poor because there is no natural light. Therefore, a small camera is attached to the rescue unit to provide live video of the trapped child. This video helps the operator monitor the child's position and guide the rescue system accurately.

LED lights are placed near the camera to illuminate the inside area of the borewell. The lighting system makes the rescue process easier and safer, especially in deep borewells.

5.3 Oxygen Supply Unit

A trapped child may face breathing difficulty because of limited air inside the borewell. To solve this issue, an oxygen pipe is connected from the surface to the rescue unit. Fresh oxygen is supplied near the child during the rescue process. This arrangement helps the child remain conscious and reduces the risk of suffocation while rescue work is being carried out.

5.4 Robotic Gripper Mechanism

The system uses a robotic gripper as shown in (fig 3) or arm mechanism to hold the child safely. In the prototype, a motor-driven gripping unit is used. Once the rescue unit reaches the child, the gripper is carefully positioned and closed to provide support.

The gripping mechanism is designed in such a way that it can hold the child firmly without causing injury. This step is very important for safe lifting.



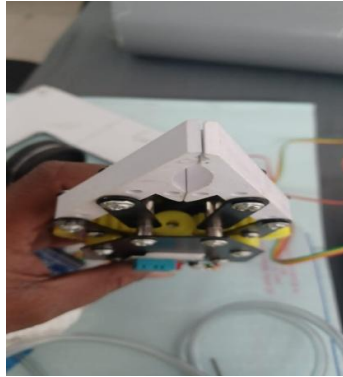


Fig 3

5.5 Control Unit

An Arduino UNO microcontroller is used as the main control unit of the system. It controls the movement of motors, operation of the gripper, camera power supply, and lighting system Refer to fig 4.

The operator can control the complete rescue setup using switches or remote controls connected to the Arduino. This makes the operation simple and efficient.

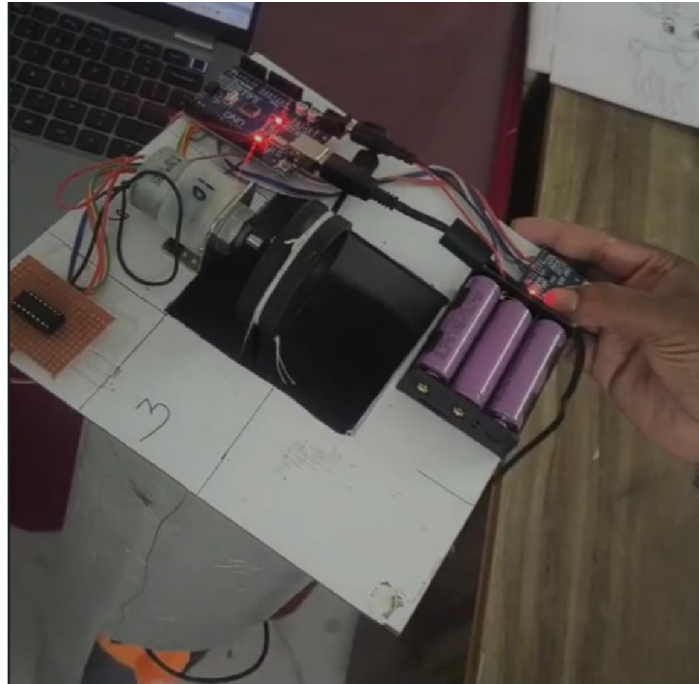


Fig 4

5.6 Lifting Mechanism

The lifting mechanism consists of a geared DC motor and rope drum arrangement. The motor rotates slowly to lower the rescue unit into the borewell. After the child is secured, the motor rotates in reverse direction to lift the child carefully to the surface.

The geared motor provides enough torque to carry the load smoothly without jerks, ensuring safe rescue.



VI. WORKING PROCEDURE

The working procedure of the proposed child rescue system is simple, safe, and effective. First, the rescue device is placed above the borewell opening and carefully lowered inside using the rope and motorized lifting mechanism. The unit is lowered slowly to maintain proper balance and control during the rescue operation.

As the device moves downward, the camera mounted on the rescue unit provides a live video feed to the operator. With the help of this camera, the exact position of the trapped child is identified. LED lights attached to the unit improve visibility inside the dark borewell.

Once the child is located, oxygen is supplied immediately through the connected oxygen pipe. This helps the child breathe properly and reduces the risk of suffocation during the rescue process.

After that, the operator controls the robotic gripper or claw mechanism using a joystick or remote control panel. The gripping arms are carefully positioned near the child and gently adjusted to hold or support the child securely.

The grip position is confirmed through the live camera feed to ensure that the child is held safely before lifting. This step is very important to avoid slipping or sudden movement during extraction.

Finally, the lifting motor is activated. The motor slowly pulls the rope upward, raising the rescue unit along with the child toward the surface. The lifting is carried out carefully and at low speed to maintain safety and stability.

Once the unit reaches the top, the child is safely removed from the rescue mechanism and given immediate medical assistance if required.

VII. COMPONENTS USED

Sr. No.	Component Name	Quantity	Specifications / Rating	Use in Project
1	Arduino UNO	1	ATmega328P, 5V	Main controller
2	L293D Motor Driver	1	Dual H-Bridge	Motor control
3	DC Geared Motor	2	12V	Lifting and gripping
4	Wired Camera with LED	1	USB / Wired Camera	Live monitoring inside borewell
5	LED Lights (Attached with Camera)	Inbuilt	5V	Visibility in dark borewell
6	Battery	3	3.7 V	Power supply
7	Rope & Pulley	1 Set	Quilting thread	Lowering/lifting
8	Mechanical Gripper	1	Metal / Acrylic	Child holding support

All these components are integrated together to form an efficient and low-cost child rescue system capable of reducing rescue time and improving safety.

ADVANTAGES AND LIMITATIONS

Advantages

The proposed child rescue system helps reduce rescue time by lowering the device directly into the borewell without digging nearby pits. It improves safety through camera monitoring and controlled gripping operation. The system is compact and portable, making it useful in rural and remote areas. It is battery operated and can work during emergency conditions where power supply is not available. The project is also cost-effective and requires less manpower compared to traditional rescue methods.

Limitations

The system may face difficulty in very narrow or deep borewells. Proper operation requires a trained person to control the device safely. The rescue process depends on battery backup for continuous operation. If the child is stuck in an



unusual position, gripping and lifting may become difficult. Camera visibility may also reduce due to dust or moisture inside the borewell.

IX. RESULTS AND DISCUSSION

The proposed *Child Rescue System from Borewell* was tested in a controlled environment to study its working performance and reliability. The results showed that the system was able to perform the main rescue functions effectively, including monitoring, positioning, gripping, and lifting operations.

The camera unit provided clear live visuals, which helped in identifying the location of the trapped object inside the borewell model. The LED lighting system improved visibility in low-light conditions. Sensor readings were found useful for measuring distance and guiding the movement of the rescue mechanism.

The gripping and support mechanism successfully held the test object in a stable manner and assisted in safe lifting. The oxygen support arrangement also operated properly and can help maintain air supply during emergency rescue situations.

When compared with traditional rescue methods, the proposed system can reduce operation time, decrease manual effort, and improve safety during rescue missions. Its compact design makes it suitable for narrow borewells and difficult rescue environments.

Overall, the results confirm that the proposed system is an effective and economical solution for borewell rescue operations. Further development can improve its performance for practical field applications.

X. CONCLUSION

This paper presented an effective Child Rescue System from Borewell developed to solve the serious issue of children getting trapped in open borewells. The proposed system uses embedded control technology, sensors, real-time camera monitoring, and a mechanical rescue unit to perform safe and quick rescue operations.

The system is designed to enter narrow borewells, identify the child's position, provide oxygen support when needed, and carefully lift the child using a controlled gripping or support mechanism. Compared to traditional rescue methods such as digging parallel pits, the proposed model reduces rescue time, lowers risk, and increases the possibility of saving lives.

The compact structure, remote operation, and adaptability to different borewell sizes make the system practical for emergency situations. Test analysis shows that the proposed method can improve rescue efficiency while requiring less manpower and equipment.

In conclusion, the system offers a reliable and low-cost rescue solution. With future improvements such as automation, AI, and wireless monitoring, it can become a more advanced and widely useful rescue technology.

XI. FUTURE SCOPE

The proposed Child Rescue System from Borewell can be further enhanced through the following improvements:

- Mobile application-based monitoring and control
- GPS-based real-time rescue location sharing
- Cloud-based storage of rescue data and operation history
- AI-based child position detection and movement analysis
- Automatic gripping and rescue arm alignment system
- Advanced obstacle detection inside borewell
- Heartbeat, temperature, and oxygen level monitoring sensors
- Wireless communication for live status updates
- Encrypted communication for secure operation
- Lightweight and high-strength material design
- Voice communication system for child interaction



- Fully automated rescue mechanism with minimal human effort
- Integration with disaster management and emergency rescue services

XII. ACKNOWLEDGEMENT

We would like to express our heartfelt gratitude to Prof. M. B. Avhad for his valuable guidance, continuous encouragement, and insightful suggestions throughout the course of this project. His support played a crucial role in shaping the quality and direction of this work. We also thank the faculty members of the Department of Electronics and Telecommunication Engineering, Padmashri Dr. Vithalrao Vikhe Patil College of Engineering, Ahilyanagar, for providing the necessary resources and academic support.

REFERENCES

- [1]. The New Indian Express, “Child falls into 65-feet deep borewell in Madhya Pradesh, rescue operation launched,” Online News Report, 2026.
- [2]. Arduino Official Documentation, *Arduino UNO Board Description and Datasheet*, Arduino.cc.
- [3]. Texas Instruments, *L293D Quadruple Half-H Driver Datasheet*, Texas Instruments Inc.
- [4]. DHT11 Sensor Datasheet, *Temperature and Humidity Sensor Technical Specifications*.
- [5]. M. Karthikeyan et al., “Design and Development of Borewell Rescue Robot,” *International Journal of Engineering Research and Technology (IJERT)*, Vol. 6, Issue 4, 2017.
- [6]. S. Prasad, R. Kumar, “Robotic System for Borewell Rescue Operations,” *International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering*, 2018.
- [7]. R. Ramesh, “Embedded System Based Child Rescue System from Borewell,” *IEEE International Conference on Robotics and Automation*, 2016.
- [8]. Atmel Corporation, *ATmega328P Microcontroller Datasheet*.
- [9]. S. N. Singh, “Applications of Robotics in Disaster Management,” *Journal of Robotics and Automation*, 2019.
- [10]. Lithium-Ion Battery Technical Manual, *Rechargeable Battery Characteristics and Safety*.
- [11]. Wikipedia contributors, *Borewell Accidents and Rescue Operations*, accessed for general background study.

