BORE WELL RESCUE ROBOT MODIFIED

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Introduction:

Open borewells pose a significant **safety hazard**, especially to children, leading to tragic **accidents** that highlight the need for an efficient rescue solution. The existing methods, which involve digging parallel holes or employing improvised tools, are **not only time-consuming** but also risky, often exacerbating injuries and increasing the chance of fatalities. This project introduces a Borewell Rescue Robot, a lightweight and remotely **controlled robotic system** designed to facilitate safe and effective rescues from borewells.

Fig: rescue operation of human kid

The robot operates by **descending** into narrow **borewell pipes**, utilizing a robotic **arm** equipped with a gripper to securely hold and retrieve trapped individuals. The system

also includes features such as oxygen supply for life support and **real-time video** and **audio transmission** to aid rescuers in assessing the situation and ensuring precise operations. Controlled via wireless communication technology, the robot eliminates the need for extensive excavation, reducing time, labour, and associated risks.

Designed with a focus on portability, **low power consumption**, and ease of use, the Borewell Rescue Robot leverages **advanced embedded systems** and DC motor mechanisms for precise and reliable functionality. By integrating safety features and an efficient rescue process, this project aims to provide a **revolutionary solution**

to a long-standing societal issue, **ultimately saving lives** and reducing the complexities of borewell rescues.

Objectives 1:

The objective of the project includes:

- Wireless controlling of Robot through using **advanced communication** technology.
- **Live Audio** and **video** can be seen on pc.
- Implementation of **pick** and **place** concept to the robot.
- DC motor-based gripper operation for **robotic arm.**
- Highly efficient and **user-friendly design**.
- **Low power** consumption.

Objectives 2:

The objective of the project includes:

- Designed to **rescue individuals (especially children)** trapped in deep, narrow borewells.
- Aims to offer a **safe, efficient, and technologically advanced** alternative to traditional rescue methods.

- Operates in **varying borewell dimensions and harsh conditions**.
- Offers **remote control capability** to minimize human risk.
- Equipped with **real-time monitoring** using integrated **cameras and sensors**.
- Focuses on reducing **rescue time, operational cost, and human effort**.
- Built to be **portable, lightweight**, and **easy to deploy** during emergencies.

Methodology:

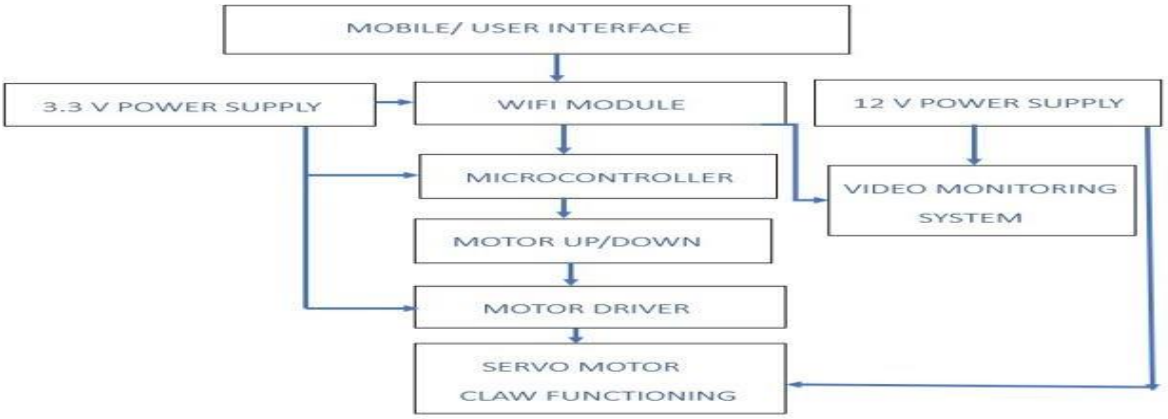

Fig: Logic diagram

The project has both mechanical design and software implementation:

- **1. Problem Analysis and Requirement Gathering:** Analyse borewell rescue scenarios to identify challenges like narrow diameters, varying depths, and environmental conditions.
- Define requirements for dimensions, weight, mobility, and functionality of the robot.
- **2. Design and Development:**
- **Mechanical Design:** Create a compact and lightweight structure to fit into narrow borewells.
- Develop a modular mechanism with arms or claws to securely hold the trapped individual or object.
- **Electronic System Design:** Integrate sensors for depth detection, temperature monitoring, and obstacle detection.

- Include a camera for real-time video feedback to guide the operation.
- **Control System:** Design a remote-controlled or semi-automated system to operate the robot safely from a distance.
- **3. Material Selection:** Use durable materials such as aluminium or lightweight alloys to withstand environmental stresses while maintaining portability.
- **4. Assembly and Integration:** Assemble mechanical components, electronics, and control systems into a functional prototype.
- Ensure seamless integration between sensors, actuators, and the control interface
- **5. Testing and Calibration:** Conduct initial tests in controlled environments to evaluate functionality and efficiency.
- Calibrate sensors and actuators for precise operation in varying borewell conditions.
- **6. Implementation of Safety Features:** Add padding or cushioning to prevent injuries during the rescue process.
- Implement fail-safe mechanisms to ensure the robot remains operational under challenging conditions.
- **7. Field Testing:** Test the robot in real-world scenarios to validate performance, adaptability, and reliability.
- Identify and address any limitations or issues encountered during testing.
- **8. Optimization:** Improve the design and software based on test results to enhance efficiency, speed, and safety.
- **9. Deployment and Training:** Develop user manuals and train rescue teams to operate the robot effectively.
  Ensure the robot is ready for rapid deployment in emergencies.

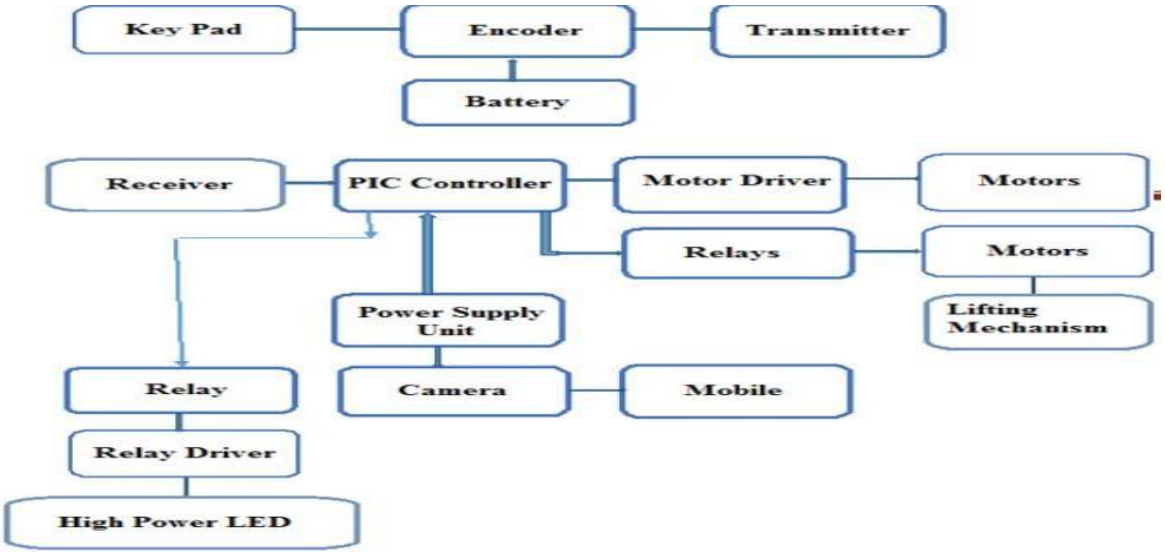

Fig: working diagrams of components

1. **Keypad** – A user input device with multiple buttons, typically arranged in a matrix. When a button is pressed, it sends a corresponding signal to the encoder.

2. **Encoder** – Converts the digital input from the keypad into a coded signal that can be efficiently transmitted. It ensures that the data is formatted correctly for the transmitter.

3. **Battery** – Provides the necessary power to all components in the system, ensuring they function properly.

4. **Transmitter** – Sends the encoded signal wirelessly (e.g., RF, Bluetooth, or IR) to a receiver, which then processes the data for further actions.

5. **Receiver** – Receives and decodes the transmitted signal, sending it to the PIC controller.

6. **PIC Controller** – Processes inputs and controls components like the motor driver, relay, and camera.

7. **Motor Driver** – Acts as an interface between the PIC controller and motor, regulating power and direction.

8. **Motor** – Converts electrical energy into mechanical movement for lifting mechanisms.

9. **Power Supply Unit** (**PSU**) – Provides required voltage and current to all components.

10. **Relay** – Works as an electrically controlled switch for high-power devices.

11. **Camera** – Captures real-time images or video for surveillance or feedback.

12. **Lifting Mechanisms** – Use motors and mechanical structures to raise, lower, or move objects.

Result and Conclusion:

The robot designed can give the conceptual scenario in the situation of rescuing child from borewell which can be made in use by the government. By using this concept, robots for this situation can be made on the large scale for saving the life of child. It can see the irregularities of pipe by giving the insight view. The manipulator designed was tested over a pipe having 8-10 inches width and 3–4-foot height. The robot manipulator had adjusted according to these dimensions. Small objects having weight 200-300 grams was put inside the pipe. The robot moved inside the vertical pipe and controlled by the operator using switch pad. Then it perceived the target which was viewed on PC. Then according to the instructions, it brought that object with the help of gripper safely out of it. Hence this concept is applicable in pipeline inspection and borewell rescue operations and can save many innocent lives with safety and low risk

1. Successful Rescue Operations: Safe and efficient retrieval of individuals, especially children, trapped in narrow and deep borewells.

2. Reduced Response Time: Faster rescue operations compared to traditional methods, minimizing risks associated with prolonged entrapment.

3. Enhanced Safety: Elimination of risks to rescue teams by using remote-controlled or automated systems.

4. Cost-Effective Solution: Reduction in costs by avoiding the need for complex

manual interventions like digging parallel shafts.

5. Improved Precision and Monitoring: Real-time video and sensor feedback ensure precise control and safe handling of victims during the rescue process.

6. ortable and Ready-to-Deploy System: A lightweight and easily transportable solution for quick deployment in emergency scenarios.

In last 10 years, a lot of lives have been lost due to falling in the bore well because it involves digging a pit beside a bore well which is very time consuming. The proposed system is to overcome all these difficulties. This project is used to reduce human efforts for rescuing operations from bore well. It performs rescue operations in very less time as compared to humans. It can do the pipeline inspection which is beyond of human reach. Humans. It can do pipeline inspection which is beyond of human reach.

Fig: Kid stuck in deep hole

Future Scope:

The project can further be improved by adding or modifying by following features:

1. An additional feature of air bag can be used to provide support underneath the child which prevents the child from falling further deep.
2. Oxygen sensor and oxygen supplier can be installed.
3. Smoke sensor can be added to sense the dangerous gases concentration inside the pipe.
4. It can also be made waterproof.
5. It can be extended adding bomb diffusion, GPS to set location and digital compass to self-navigation.