RESCUE ROBOT FOR BOREWELL

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Introduction

A borewell is a narrow shaft dug vertically into the ground. It may be constructed for various purposes, such as the extraction of water for daily human usages, or in other cases, other liquids (such as petroleum) or gases (such as natural gas). It is a well-known fact that India has been facing a severe ground water crisis over the past few years. There is no efficient and fast way to rescue the victims of bore well accident. Conventional methods need to dig out a parallel hole through which the victims can be rescued, but this is long procedure and victim may not survive till the rescue operation completes, also the procedure poses huge risk of potential collapse of hole and victim may get injured. It should also be noted that the pressure varies as we go deep down to the core of the earth, and structure of the soil also plays a crucial role in the rescue operation. Situations where robots have to perform rescue operations above 600 feet from sea level may also arise. After factoring in all these parameters, an optimal design for a bore well rescue robot was prototyped and tested with the concept of embedded IOT. Where a robot controlled by the webapp is used to rescue the child. Report says current rescue system is only 30% effective in bringing out victims alive. So, there is wide scope for the development of new robot which can saves lives of the victims.

Objectives

The primary aim is to develop a borewell rescue robot to swiftly and effectively rescue individuals trapped in borewells or confined spaces. Engineered with specialized sensors and robust communication systems, its objectives include precise detection and localization of trapped individuals, establishing communicationfor reassurance and guidance, and potentially offering initial aid.

- Developing a portable, accurate, and cost-effective solution is the main objective of this project. In addition, this system can provide oxygen, which can be lifesaving.
- Detecting the child after falling into the borewell.
- By sending commands to the Borewell Rescue System, it performs operations within the well.
- A mobile application or personal computer is used to operate the system based on continuousobservations made with a camera.

- By sending appropriate commands and activating the appropriate motors, you communicate with thesystem.
- Pick up the child from the borewell.

Methodology

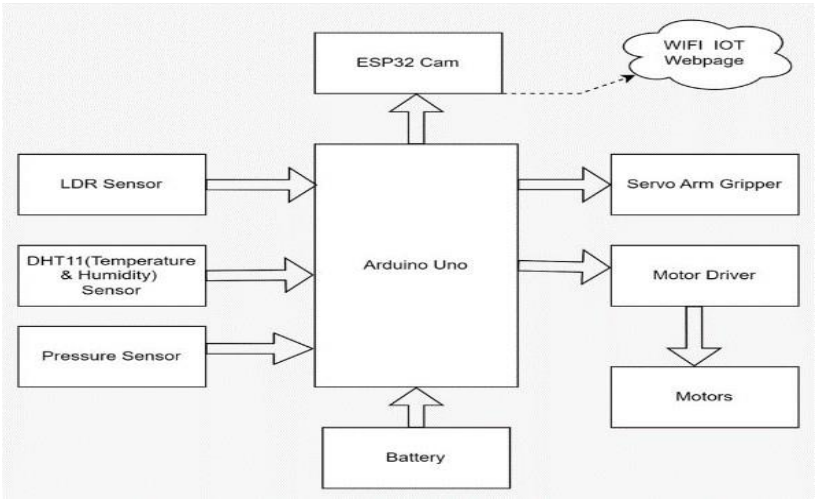
Components used for this rescue robot for borewell are ESP32, Arduino uno, Motors, Motors Drivers, various sensors, and grippers.

ESP32 is the brain of our system all the sensors and motors are interfaced with the esp32, power supply to the entire system is given by 7.4v li-ion battery which is also rechargeable. Arduino Uno, since esp32 cam has fewer output pins, Arduino will act as extended processor to connect sensor which sends data to esp32 cam. Motor driver, since we cannot directly connect motors to esp32 a motor driver (ln239d) is used which takes signal from esp32 and controls the motor. Dc motors are used to climb up or drop down the robot via guid rope. LDR sensor is used measure the light intensity inside the bore well. Temperature sensor (dht11) is used to measure the temperature levels inside the bore well. Pressure sensors measure the pressure and send it to the microcontroller. Robotic arm gripper is used to hold and grab the kid while rescuing. High power led is used to light up the area inside borewell. Camera is used to take live video stream and scan be viewed onphone or laptop.

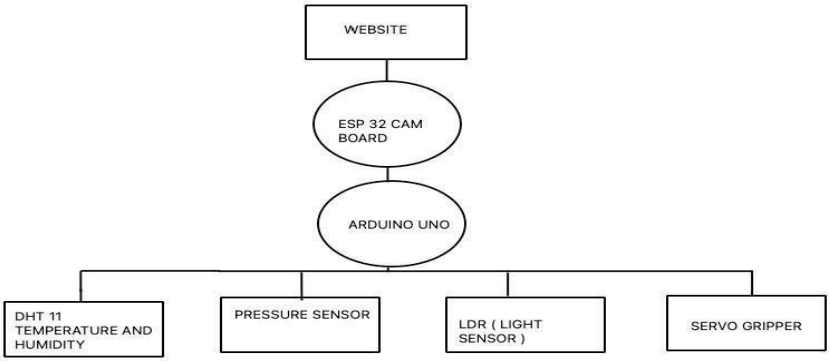
The system comprises several interconnected modules, each with specific responsibilities crucial for the successful execution of rescue operations. The User Interface Module serves as the primary interface for userinteraction, facilitating the reception of commands to control the robot and initiating rescue operations. Directing the overall orchestration of the system is the Control Module, housed within an ESP32 microcontroller, which coordinates interactions among various components such as sensors, motors, and the robotic arm. Sensor data, including inputs from Light Dependent Resistors (LDRs), temperature sensors, and pressure sensors, are managed by the Sensor Module, which then forwards this information to the Control Module for decision-making. Movement of the robot is facilitated by the Motor and Motor Driver Module, responsible for controlling DC motors and interfacing with the L293D motor driver to translate commands issued by the Control Module. The Robotic Arm Module oversees the operation of the robotic arm gripper, executing commands received from the Control Module to grasp and securely hold victims. Meanwhile, the Camera Module captures real-time video feed, managing live-streaming data and providing crucial visual information to the User Interface for monitoring purposes. Ensuring uninterrupted functionality of the entire system is the task of the Power Supply Module, which oversees power distribution to sustain continuous operation throughout rescue missions. Together, these modules synergize to form a comprehensive rescue system designed to efficiently navigate and respond to emergency scenarios.

Diagrams

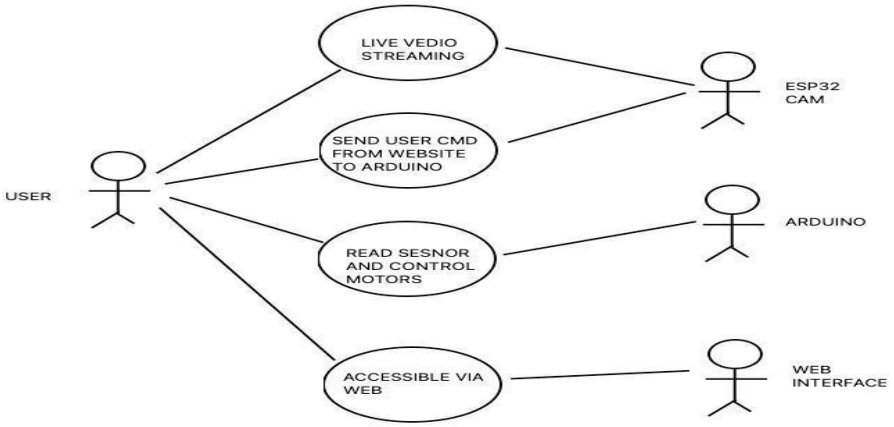
System Architecture:



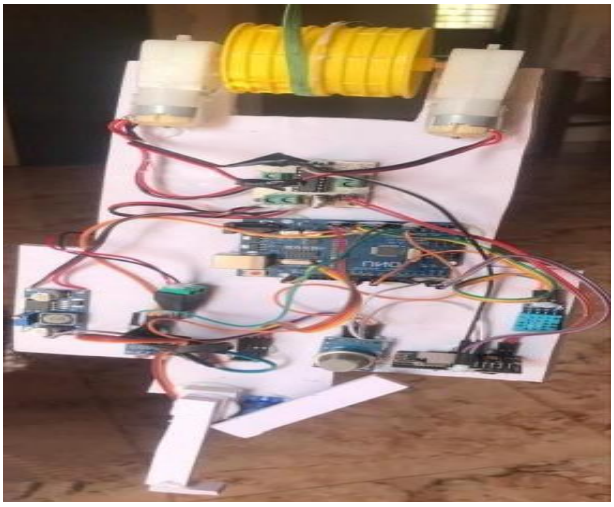
Block Diagram

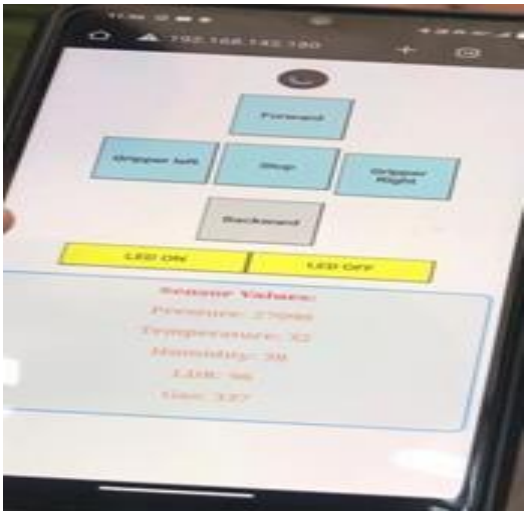


Use-Case Diagram:



Model Implementation





The borewell rescue robot, which is used to extract the kid from the borewell, is first fastened to the surface hub and then gradually lowered into the borewell. The web application is used for the robot's entire operation can be utilized with a mobile phone or a laptop. TCP/IP is used for communication between the webapp and the esp32, the robot's central processor unit. By using commands from the web application, the motors are turned on when the power supply is turned on. To prevent any unintentional movement, the commands to move forward or backward for entering and exiting the borewell must be followed by a stop command. The live streaming camera records the entire process. There is a high power led that can be turned on or off based on our needs to help illuminate the borewell hole. The robot's numerous sensors installed within give the operator access to the internal environment's current values, such as the CO gas levels, light intensity, pressure, and temperature. The Arduino Uno gathers these sensor values and transforms the real-time data into values that the operator can understand. In addition to serving as an extender for the esp32, the Arduino Uno lowers operational overhead that would otherwise be placed on the esp32, increasing overall efficiency. The entire working code is written in C++, which is subsequently integrated into web programming languages to enable web applications for the entire operation. The robot is gradually lowered after the operator locates the victim, and it must maneuver to find a suitable spot to seize a victim. With the aid of grippers that are command-driven by the servo motor and can move left or right, the victim is grasped. The victim is then pulled to the surface when the motors are turned on. Compared to the convectional process, which can take several hours, the entire process should only take about 20minutes

Result and Conclusion

The rescue robot for bore well stands as a technological marvel with the potential to revolutionize and significantly improve the efficiency of rescue operations in challenging scenarios. This innovative system, designed with a user-friendly interface and operated remotely by non-technical personnel, caters to the critical need for swift and effective borewell rescues. Its integration of advanced features such as a DC motor, servo motor, and specially fabricated robotic grippers underscores its commitment not only to technological sophistication but also to the safety and comfort of the victims. The robot is also embedded with a number of sensors that used to monitor the environment inside the borewell and take the necessary action. This robot is designed to be cost-effective, so that it can be deployed in all rural areas to rescue victims in emergency situation.

References

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Future Scope

Our main idea is to control the robot either through a mobile phone or a laptop. The borewell rescue robot project holds significant potential for future enhancements and advancements. One avenue for future development lies in the realm of autonomous navigation, where the integration of sensors and machine learning algorithms could enable the robot to navigate borewells independently, reducing the need for constant operator supervision. Moreover, the incorporation of obstacle detection sensors could enhance the robot's ability to identify and avoid obstacles within the borewell environment, ensuring safer traversal and minimizing the risk of entanglement or damage. Additionally, there is scope for improving the gripping mechanism, with the development of advanced gripping mechanisms that offer adjustable grip force and dexterity to securely grip victims

of various sizes and shapes, thereby enhancing the efficiency and reliability of the rescue process. Furthermore, exploring the integration of aerial drones equipped with cameras and sensors could provide valuable aerial reconnaissance and real-time situational awareness, complementing the capabilities of the borewell rescue robot for comprehensive rescue operations.