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Article Title: **Bore Well Rescue System**

Bore Well Rescue System

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ABSTRACT

This project proposes an innovative IoT-based bore well child rescue system that integrates environmental monitoring and robotic intervention to enhance the efficiency of rescue operations. The system employs various components such as ESP8266, DHT11 sensor, gas sensor, ESP32 camera, servo motor with gripper, and an L298N driver controlling a DC gear motor for front and back rotation. The ESP8266 acts as the central communication hub, enabling real-time data exchange between the rescue system and the control center. The DHT11 sensor monitors environmental conditions inside the bore well, providing crucial data on temperature and humidity. The ESP32 camera facilitates live video streaming, offering a comprehensive view of the bore well interior. The servo motor with gripper, controlled by the ESP32, is equipped to handle delicate operations within the confined space of the bore well. To maneuver within the bore well, a robotic system is integrated with a DC gear motor controlled by an L298N driver. This configuration enables precise front and back rotation, allowing the robotic system to navigate through the narrow and complex structure of the bore well. The integration of IoT technologies ensures seamless communication, while the robotic system enhances the precision and effectiveness of the rescue process. Overall, this proposed system deals with the risks associated with bore well rescues, ultimately minimizing response time and increasing the likelihood of successful outcomes.

Keywords: ESP32 Camera, DHT11 sensor, L298N driver, Robotic System.

1 Introduction

In the current era, most accidents occur due to bore wells that are left unclosed, and many children get trapped in them. Those bore wells remain a hell to many children. This process makes it very difficult to rescue the children from the bore wells. If the area near the bore hole contains rocks below a certain depth, chances of saving the child become very low. In this case, the rate of success depends on a lot of factors, like the time taken for the transportation of machinery to the situation and mainly the response time of various government organizations. At present, there is no proper method for dealing with this problem. To avoid this critical situation, we must prevent the children from falling into bore wells.

Even though there are so many methods existing, there is still a need of more simple and sophisticated rescue equipment. Therefore in this work is developed the IOT based bore well

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rescue system. In this system, there is no need to dig a big pit parallel to the bore well up to the depth where the child is stuck. Hence, it may not depend on the huge amount of human resources (military, paramedical, etc.) and machinery (JCBs, tractors, etc.).
Therefore, the delay involved in this accumulation of resources may be reduced, and the chances of saving a child alive are increased.

1.1 Objective

To design and construct a portable bore well rescue system that is cost-effective, quick in action, and accurate. To avoid the lack of rescue operations by monitoring them regularly and saving the lives of children. To monitor the oxygen level using the oxygen sensor. To provide live video streaming of the bore well interior by using an ESP32 camera.
To control the position, speed, and torque of a mechanical system using a servo motor.

2 Aim

The aim of this project is to improve the efficiency and safety of bore well child rescue operations by providing real-time environmental data, a live video feed, and a robotic intervention mechanism.

3 Literature Survey

S.No	Title and author	Methodology Used	Advantages	Drawbacks
1	'Hand gesture base bore well rescue robot' & Gayathiri et al [2021]	A human-like hand using the inverse kinematic technique is implemented for reduce damage.	Effectively reduce the waste of resources by using Bluetooth beacons	The rescue robot system have fluctuations and discontinuities of some key actions and abrupt changes in acceleration are also encountered
2	'Child Rescue system from open Bore wells' & Agarwal et al [2019]	This paper presented design of bore well child saver machine has been made to suit every possible situation may occur in rescuing operation.	Its modularity, scalability, low-cost, and easy installation.	Lack of oxygen inside the bore well. It takes up to 30 hours to dig the parallel pit 110ft, by the time the child would have died.

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3	'Design and fabrication of pneumatic bore well child rescue system' & Ravi et al [2020]	In this work, digging a parallel line beside the open bore using machines to the depth at which the child is stuck, the child is then pulled from the depth.	The proposed model is compact, cost-effective, energy-efficient.	Improved the living quality in all residences and maintain good indoor air quality.
4	'Child Rescue System from Bore well' & Deepika et al [2020]	This paper developed the rescue system is interfaced with the PC and Arduino setup is used to control the mechanical set up.	Improved the living quality in all residences and maintain good indoor air quality.	This process is hard, lengthy, and risky. To save the child is to dig a parallel pit adjacent to the bore well.
5	'Design and fabrication of pneumatic bore well child rescue system' & Ravi et al [2020]	The presented robot control system designed for fabrication of pneumatic bore well child rescue system	This technique provides pragmatic opportunity for new robot power	Rescue robot mind does not function like the human brain, they are not able to sense danger as easily, and they might not work in all environments.
6	'Child Rescue System From Open Bore well' & V. Saritha et al [2022]	Arduino based child rescue system from bore well is presented in this work	Controller and devices provide automatic control of the fan speed, temperature, and air pollutant concentrations.	It lacks the capabilities to respond in emergencies. Suitable only for short bore wells. Maintenance is thoroughly required.

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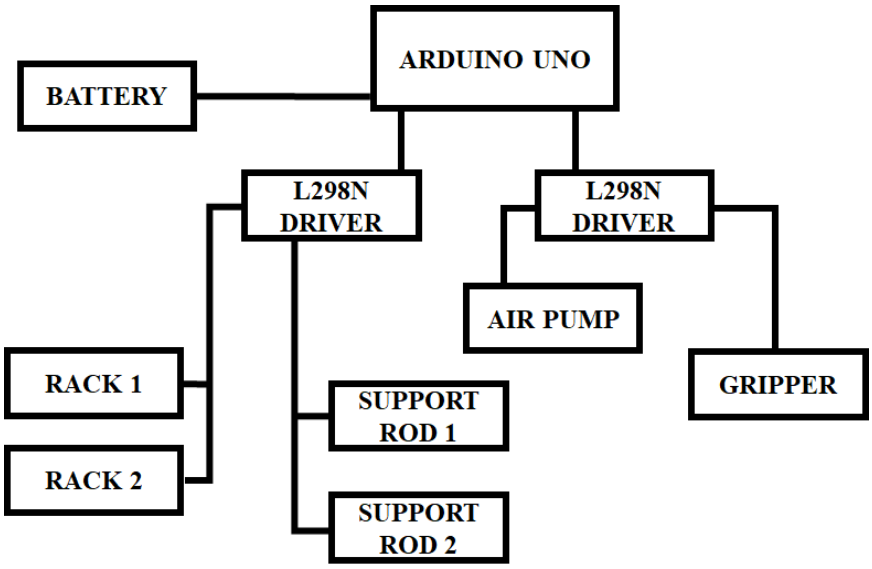
Problem Statement

- Lack of oxygen inside the bore well.
- Lack of visualization causes the major difficulty during the rescue operation.
- The currently available systems are less effective and costly too.
- It lacks the capabilities to respond in emergencies.
- Suitable only for short bore wells.

4 Existing System

- Existing system presents the development of a smart child rescue robot against a child trapped in an open bore well.
- The diameter of the bore well, which can range from 5 to 12 inches, can be accommodated by this design method.
- The airbag and locking mechanism are sent under the kid using a rack and pin mechanism.
- A camera, thermal sensor, temperature sensor, and vibration sensor will be used to continually watch the infant.
- This system will be wired and wireless at the same time. A Bluetooth module can be used to do the wireless operation. Batteries and Arduinos will be used to power the entire device.

Block Diagram of Existing System



Drawbacks

There is no such equipment for rescuing the child which had fallen into the bore well.
The implementation process is almost hard and expensive.

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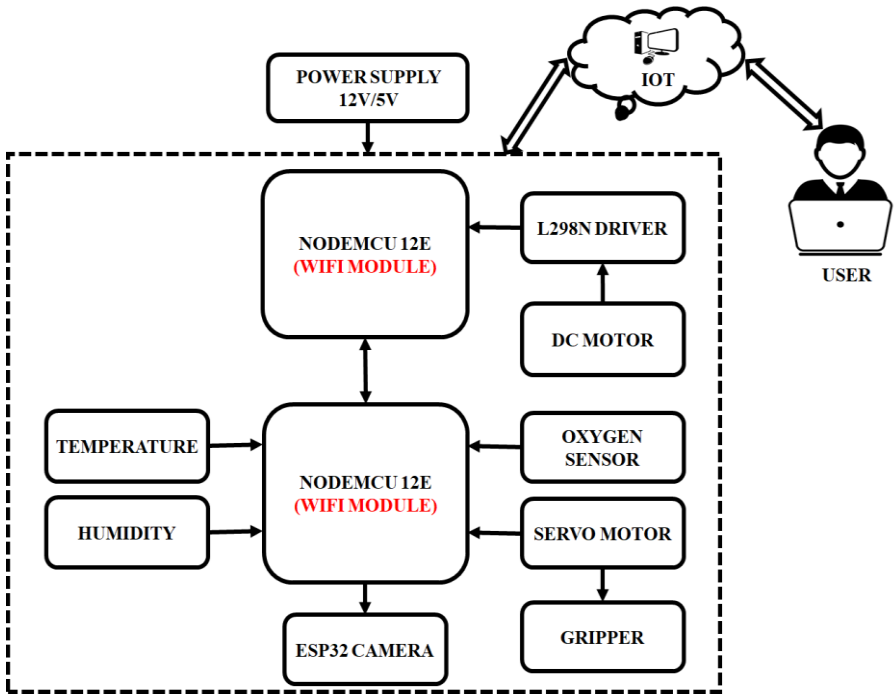
Block Diagram of Proposed System



5 Proposed System

In this project, an innovative IoT-based bore well child rescue system is proposed and implemented on the open-source Arduino electrical platform. This system consists of components like sensors, an ESP32 camera, a servo motor, a DC motor, a gripper, a motor driver, and a node MCU. This system consists of two arms, which are very soft so that they do not hurt the child while gripping. Then the system is rotated using a DC motor according to the child's position. The sensor unit includes sensors like an oxygen sensor, a temperature and humidity sensor, etc. The oxygen sensor is connected to the NodeMCU module, which is used to monitor the oxygen level inside the bore well.

DHT11 sensor is a temperature and humidity sensor that is used to measure the temperature and humidity in the bore well.

The gripper allows rescuers to grasp and lift the child safely. To maneuver within the bore well, a robotic system is integrated with a DC gear motor controlled by an L298N driver. The motor driver L298N is used, which acts as an interface between the motors and node MCU. In addition, servo motors are frequently employed in robotic systems and offer fine-grained control over a mechanical system's position, speed, and torque. The ESP32 camera is used to offer a comprehensive view of the bore well interior. This visual feedback aids rescuers in making informed decisions.

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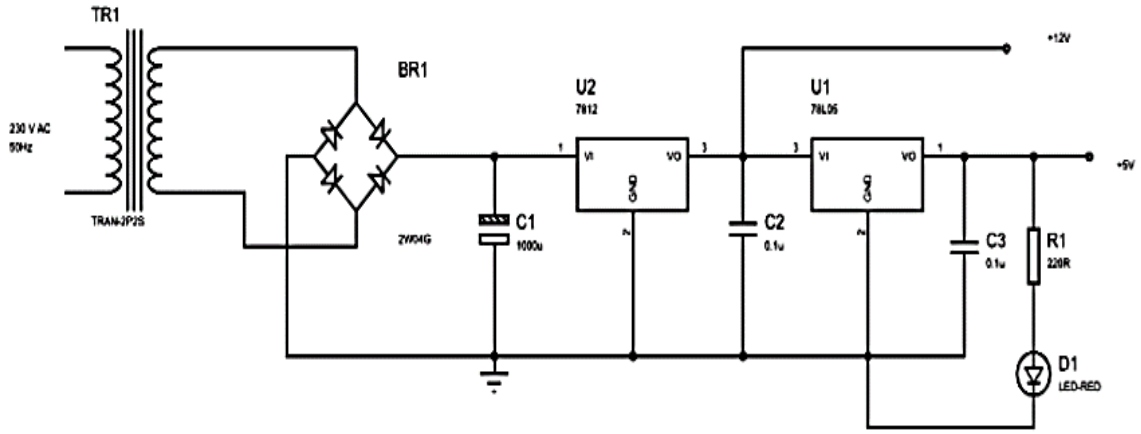
5.1 Power Supply

The power supply section is very important for all electronic circuits. A power supply can by broken down into a series of blocks, each of which performs a particular function. Here the AC supply main is given to the step down transformer. The transformer having the different voltages. The 230V, 50Hz AC mains is stepped down by transformer X1 to deliver a secondary output of 12V, 500 mA.

The transformer output is rectified by a full-wave rectifier comprising diodes D1 through D4, filtered by capacitor C1 and regulated by ICs 7812 (IC2) and 7805 (IC3). Capacitor C2 bypasses the ripples present in the regulated supply. In this rectifier circuit the AC voltage is converted to DC voltages. The rectified DC voltage is given to the regulator circuit. The output of the regulator is depends upon the regulator IC chosen in the circuit.



5.2 NodeMCU Wifi Module

NodeMCU is an open-source Lua based firmware and development board specially targeted for IOT based Applications.

It includes firmware that runs on the ESP8266 Wi-Fi SOC from express if Systems, and hardware which is based on the ESP-12 module.

The NodeMCU ESP8266 development board comes with the ESP-12E module containing ESP8266 chip having Tensilica Xtensa 32-bit LX106 RISC microprocessor.

NodeMCU has 128 KB RAM and 4MB of Flash memory to store data and programs.

5.3 NodeMCU

- Microcontroller: Tensilica 32-bit RISC CPU Xtensa LX106.
- Operating Voltage: 3.3V.
- Input Voltage: 7-12V.
- Digital I/O Pins (DIO): 16.
- Analog Input Pins (ADC): 1.

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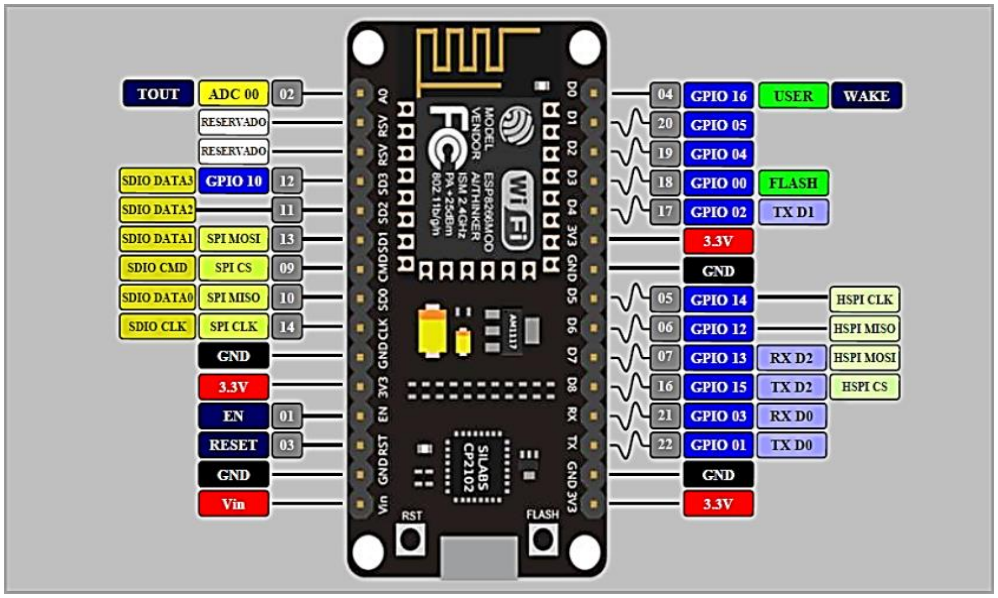

5.4 Oxygen Sensor

The Gravity: I2C Oxygen Sensor is based on electrochemical principles and it can measure the ambient O2 concentration accurately and conveniently. It can be widely applied to fields like portable device, air quality monitoring device, and industries, mines, warehouses and other spaces where air is not easy to circulate. It is compatible with many mainboards like Arduino Uno, esp32, Raspberry Pi and so on. Its effective range is 0~25%Vol, and resolution can reach to 0.15%Vol. It supports wide range input voltage: 3.3V to 5.5V.

5.5 DHT11 Sensor

DHT11 is a Humidity and Temperature Sensor, which generates calibrated digital output.
By using the exclusive digital-signal-acquisition technique and temperature & humidity sensing technology, it ensures high reliability and excellent long-term stability.
This sensor includes a resistive-type humidity measurement component and an NTC temperature measurement component.

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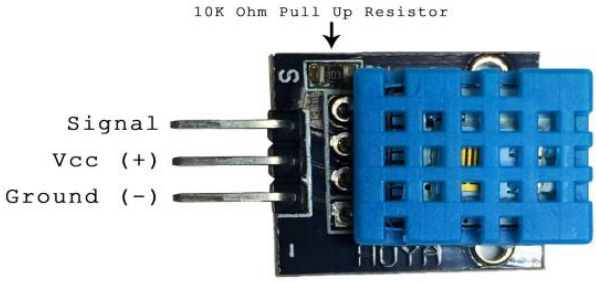
It connects to a high performance 8-bit microcontroller, offering excellent quality, fast response, anti-interference ability and cost-effectiveness.



DHT11 Specifications

- Operating Voltage: 3.5V to 5.5V
- Operating current: 0.3mA (measuring) 60uA (standby)
- Output: Serial data
- Temperature Range: 0°C to 50°C
- Humidity Range: 20% to 90%
- Resolution: Temperature and Humidity both are 16-bit
- Accuracy: ±1°C and ±1%.

5.6 ESP 32 Camera

The ESP32-CAM is a small size, low power consumption camera module based on ESP32.
The ESP32-CAM can be widely used in intelligent IoT applications such as wireless video monitoring, WiFi image upload, QR identification, and so on.
It supports WiFi video monitoring and WiFi image upload and also multi sleep modes, deep sleep current as low as 6mA.
It control interface is accessible via pinheader, easy to be integrated and embedded into user products.

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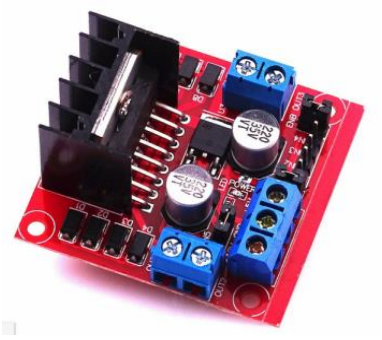
5.7 Dc Motor

A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy.
The most common types rely on the forces produced by magnetic fields.
Nearly all types of DC motors have some internal mechanism either electromechanical or electronic, to periodically change the direction of current flow in part of the motor.

5.8 Motor Driver L298N

The L298N 2A-Based Motor Driver is a high-power motor driver perfect for driving DC motors and stepper motors.
It uses the popular L298 motor driver IC and has an onboard 5V regulator, which it can supply to an external circuit.
The L298N is a dual H-Bridge motor driver that allows speed and direction control of two DC motors at the same time.
This motor driver is perfect for robotics and mechatronics projects and for controlling motors from microcontrollers, switches, relays, etc.



5.9 Bluetooth Module

Bluetooth Module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Its communication is via serial communication which makes an easy way to interface with controller or PC.

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Bluetooth serial modules allow all serial enabled devices to communicate with each other using Bluetooth.

Advantages

- Long working life of the equipment.
- Improved workers' security.
- It is scalable and cost effective.
- Easy to track the gas level and detect the sewage blocks at their initial stage.

Applications

- Air pollution detection.
- Waste monitoring system.
- Water level sensing system.
- Home monitoring system

4 Conclusion

The design and implementation of an IOT-based bore well system were accomplished, with the purpose of saving human beings.

This system is mainly used for rescue child from bore well. A high resolution camera is used in the system to identify the position of the baby.

With the use of an ESP32 camera, regular inspection of the framework provides a reasonable view of the bore well. It also keeps things secure with the use of a temperature sensor, an oxygen sensor, and a camera with a gripper.

The rescue operation team using this technology is so safe, and the rescue operation time is very short. Using highly advanced IC's with the help of growing technology, this project was successfully implemented.

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