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CHILD RESCUE SYSTEM FROM OPEN BOREWELL USING IOT

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ABSTRACT

The Child Rescue System from Open Bore well Using IoT is designed to prevent and respond to tragic incidents of children accidentally falling into uncovered bore wells. The proposed system uses IoT-enabled sensors and automated alerts to detect the presence of a child and monitor borewell conditions in real time. When an incident occurs, the system immediately sends alerts to the concerned authorities and rescue teams through a cloud platform, ensuring timely intervention. This system integrates various sensors, a microcontroller, and a wireless communication module to provide an efficient, reliable, and automated rescue support mechanism, reducing human dependency and improving response time.

Keywords: Borewell Rescue, Child Safety, Real-Time Monitoring, Cloud Alert System

I. INTRODUCTION

Uncovered borewells have become a major safety hazard, especially for children in rural areas. Despite several awareness campaigns, numerous incidents of children falling into borewells continue to occur. Rescue operations are often time-consuming and lack real-time information about the trapped victim's condition. The integration of Internet of Things (IoT) technology offers a modern solution to this problem by enabling continuous monitoring, quick detection,
and efficient coordination during rescue operations.

The IoT-based Child Rescue System aims to automate the detection process using sensors to sense movement, temperature, and sound inside the borewell. Data collected from these sensors is transmitted wirelessly to a cloud server, allowing authorities to track the incident and act immediately. This intelligent system not only minimizes manual intervention but also improves accuracy, safety, and response efficiency.

II. LITERATURE SURVEY

1. Kumar et al. (2020) proposed a microcontroller-based rescue system using gas and temperature sensors to detect human presence and air quality inside borewells.

   Kumar et al. proposed an IoT-based system for monitoring borewell conditions and detecting human presence using infrared and ultrasonic sensors. Their design aimed to identify any unusual activity within borewells and alert authorities automatically. The system was built around an Arduino microcontroller, integrated with GSM and sensor modules to send notifications in case of an emergency.
2. Reddy and Bhat (2021) designed a semi-automatic robotic arm for borewell rescue operations controlled through a wireless camera system.

   Reddy and Bhat developed a semi-automated robotic arm system designed to perform borewell rescues efficiently. The system used mechanical components controlled by a microcontroller to reach and lift a trapped child safely. A camera module attached to the robotic arm provided live video feedback to rescue operators above ground.
3. Singh et al. (2022) implemented an IoT-based monitoring device using

NodeMCU to detect motion and temperature changes within borewells, transmitting live data to cloud servers.

Singh et al. presented an IoT-enabled monitoring system using NodeMCU (ESP8266) to provide real-time surveillance of borewell environments. The system incorporated a combination of ultrasonic, gas, and temperature sensors to detect the presence of a child or hazardous conditions such as low oxygen or toxic gases.

4. Ali and Khan (2023) introduced a GSM-enabled alert system that sends messages to emergency services when a fall or abnormal activity is detected in a borewell.

   Ali and Khan proposed a GSM-based child rescue alert system that detects motion or sound within borewells and automatically informs local authorities via SMS. The system used an Arduino microcontroller connected with PIR motion sensors and temperature sensors to detect any unusual activity.

5. Sharma et al. (2024) developed a smart borewell monitoring prototype integrated with AI-based image recognition to identify humans and automate alerts.

   Sharma and Gupta presented an advanced AI-integrated IoT system designed to monitor open borewells and detect the presence of children using image recognition and motion sensors. Their prototype used NodeMCU with a camera module and cloud connectivity to transmit live images and sensor data.

III. EXISTING SYSTEM

In the existing system, rescue operations are performed manually after an incident is reported. The process involves inserting cameras and ropes into the borewell to identify and locate the victim. However, these manual methods are time-consuming, risky, and lack accurate real-time monitoring. Additionally, there is no automated system for early detection or alert generation, which often delays rescue operations and reduces the chances of survival. Existing models also lack environmental sensors to monitor air quality, temperature, and oxygen levels inside the borewell, which are crucial for the safety of the trapped individual.

IV. PROPOSED SYSTEM

The proposed IoT-based Child Rescue System introduces an automated mechanism to detect and alert authorities in case of a child’s fall into a borewell. The system employs multiple sensors, including a motion sensor**,** temperature sensor, and gas sensor, to continuously monitor the borewell environment. These sensors are interfaced with a NodeMCU (ESP8266) microcontroller, which processes the sensor data and transmits it to a cloud server via Wi-Fi. When abnormal activity such as motion or heat signatures is detected inside the borewell, the system immediately sends notifications to registered users and authorities through mobile applications or SMS alerts. Real-time environmental data like air quality and temperature are also displayed on a web dashboard. The proposed system can be further integrated with a camera module for live streaming to assist rescue teams in planning safe retrieval operations.

V. SYSTEM ARCHITECTURE

1. **Sensors:** Motion sensor, temperature sensor, and gas sensor for real-time monitoring inside the borewell.
2. **Microcontroller (NodeMCU):** Collects data from sensors and controls communication with the cloud.
3. **Wi-Fi Module:** Enables wireless data transfer to the IoT cloud platform.
4. **Cloud Platform (ThingSpeak/Blynk):** Stores and visualizes real-time data for monitoring.

5. **Alert System:** Sends notifications or SMS to authorities in case of emergencies.
6. **Power Supply:** Provides continuous power to sensors and microcontroller units.

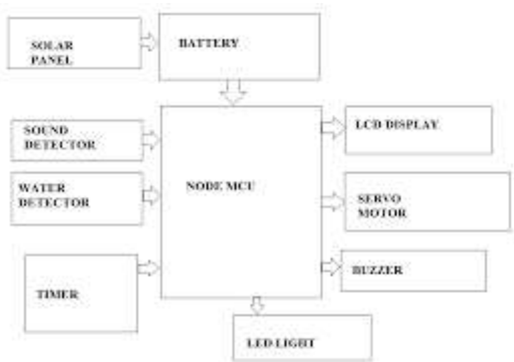

Fig.5.1: Block diagram for proposed model

NODE MCU:

NodeMCU is a low-cost open source IoT platform. It initially included firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which was based on the ESP-12 module.[6][7] Later, support for the ESP32 32-bit MCU was added

OVERVIEW:

NodeMCU is an open source firmware for which open source prototyping board designs are available. The name "NodeMCU" combines "node" and "MCU" (micro-controller unit).[8]. The term "NodeMCU" strictly speaking refers to the firmware rather than the associated development kits.[citation needed].Both the firmware and prototyping board designs are open source.

The firmware uses the Lua scripting language. The firmware is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson[10] and SPIFFS.[11] Due to resource constraints, users need to select the modules relevant for their project and build a firmware tailored to their needs. Support for the 32-bit ESP32 has also been implemented. The prototyping hardware typically used is a circuit board functioning as a dual in-line package (DIP) which integrates a USB controller with a smaller surface-mounted board containing the MCU and antenna. The choice of the DIP format allows for easy prototyping on breadboards. The design was initially was based on the ESP-12 module of the ESP8266, which is a Wi-Fi SoC integrated with a Tensilica Xtensa LX106 core, widely used in IoT applications.

VI. IMPLEMENTATION

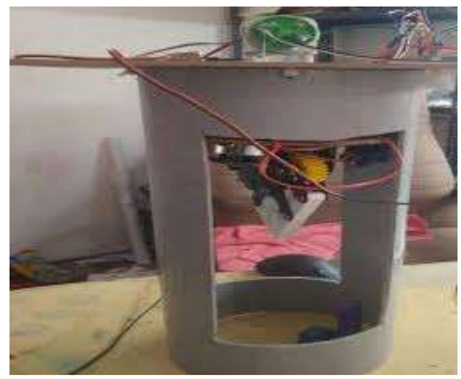

FIG. 6.1: Implementation of prototype

FIG. 6.2: Post assembling of prototype

The Child Rescue System from Open Borewell using IoT is designed to provide an intelligent and automated solution for rescuing children who accidentally fall into open borewells. The system integrates IoT technology**,** robotic mechanisms**,** and real-time monitoring to ensure a safe and efficient rescue process. It employs a robotic module equipped with a camera, sensors, and mechanical arms that can be lowered into the borewell to detect and safely lift the trapped child. The live video feed captured by the

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camera is transmitted to a remote monitoring unit through the NodeMCU or Raspberry Pi via Wi-Fi, allowing rescuers to analyze the situation and control the robot's movement remotely. Sensors such as temperature, gas, and position sensors continuously provide environmental data inside the borewell, ensuring the child's safety and preventing hazardous conditions. Additionally, the system can alert authorities and rescue teams automatically through an IoT-based cloud platform or mobile application. This innovative approach minimizes rescue time, enhances coordination, and increases the chances of saving lives by providing a real-time, precise, and automated rescue solution.

VII. CONCLUSION

The Child Rescue System from Open Borewell Using IoT provides an innovative, reliable, and time-efficient solution to detect and respond to borewell accidents. By integrating IoT sensors and wireless communication, the system can continuously monitor borewell conditions and send immediate alerts during emergencies. This automation reduces human dependency, enhances response accuracy, and can save precious lives through early intervention. The system demonstrates how IoT can effectively bridge the gap between detection and rescue operations in critical real-time scenarios.

VIII. FUTURE SCOPE

In the future, the system can be upgraded with AI-based image recognition and robotic arms to assist in autonomous rescue operations. Adding GPS tracking can help authorities quickly locate the borewell site. The integration of voice sensors and cameras can provide real-time two-way communication with the trapped victim. The use of solar power modules can make the system more sustainable and suitable for rural areas. Furthermore, a centralized IoT-based alert network can connect multiple borewells across a region, providing early warnings and ensuring preventive safety.

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