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Child Rescue System from Open Borewells

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Abstract: In today's society, children falling into borewells due to negligence has become a significant concern. Existing rescue systems are often ineffective and costly. Thus, there is a need for a more efficient and cost-effective solution. This paper proposes a borewell rescue system that can navigate inside the borewell and perform necessary actions to rescue trapped individuals. Using Arduino Uno, a stepper motor driver (L298N), a robotic arm, and a stepper motor, the system aims to provide a safe and efficient solution for rescue operations. This documentation presents a comprehensive overview of the design, implementation, and evaluation of the borewell rescue system.

Keywords: Motor Driver, Stepper Motor, Arduino, Microcontroller.

I. Introduction:

In the current scenario, water scarcity is a pressing issue, and incidents of children falling into open borewells are alarmingly common. These accidents often occur due to the child's negligence or playful activities. The development of new technologies presents opportunities for innovative solutions, including robotic systems for rescue operations. This paper introduces a robotic machine designed to systematically extract trapped individuals from borewells without the need for parallel hole digging. Named as the "Child Rescue System in Open Bore-Well," this lightweight machine aims to save children in less time compared to conventional methods. The system utilizes a remotely controlled robot supported by a cable wire and a gear assembly, eliminating the need for parallel hole digging and reducing rescue time. This paper addresses the challenges of borewell rescue operations and proposes a fast, economical, and safe solution.

Overview:

This paper provides an overview of the proposed borewell rescue system, highlighting the problem statement and the proposed solution. It discusses the motivation behind the system and its potential benefits.

Objectives:

The objective of the paper is to develop an effective solution for monitoring the emotional state of trapped children in borewells and obtaining responses from them to assess their consciousness.

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Existing System:

Borewells that successfully hit water and are sealed with casing after installing motors pose no threat. However, borewells that do not hit water at maximum depths are left uncovered and abandoned. These uncapped borewells, also known as dry or dead borewells, become a threat to children. The number of incidents involving borewell-related deaths of children is increasing day by day.

Currently, the methods used to save a child who has fallen into a borewell rely on manual rescue efforts. This involves digging a large hole beside the borewell to the depth where the child is trapped. This process requires a significant number of human resources (military, paramedics, etc.) and machinery (JCBs, tractors, etc.). Any delay in gathering these resources may reduce the chances of saving the child alive.

If the area around the borehole contains rocks below a certain depth, the situation becomes even worse, especially if the size of the rock is large. In such cases, the entire rescue process may need to be restarted from a new location, drastically reducing the chances of saving the child alive. The success ratio of these rescue operations depends on factors such as the availability of machinery, the time taken for transportation of machinery to the site, the availability of human resources, and mainly the response time of various government organizations. According to the National Crime Records Bureau (NCRB) report of 2011, there are an average of 5 deaths per day due to abandoned borewells.

Disadvantages of Existing System:

- Does not provide an effective solution to monitor the emotional condition of the child.
- Does not provide a solution to effectively keep the child calm.
- The framework can be further utilized to recover the victims.

Literature Review:

1. Sumit Pandey presents a method for rescuing infants who have fallen into borewells, which have unfortunately resulted in numerous child deaths. The paper proposes using infra-red signals for communication to rescue the infant before they reach deeper depths in the borewell. When the infra-red signal breaks due to an obstructing object, a buzzer alert is triggered, and a stake closes the bore to prevent further descent. These accidents are primarily found in agricultural borewells.
2. Prof. Chandra Kumar H S discusses accidents where children fall into abandoned borewells, resulting in tragic outcomes. To address this, the paper proposes a new design with sensors placed at the top of the borewell hole to detect a child's fall. If a child is sensed, an automatic horizontal closure prevents further descent, while a monitoring system provides support for lifting the child using motor-driven mechanisms.

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3. M R Chaitra proposes a robotic system for rescuing children trapped in uncovered borewells, which is a difficult and risky process. The system utilizes pneumatic arms to attach a harness to the child for lifting, along with a teleconferencing system for communication. The technical setup is controlled based on user commands given to the Arduino, stimulating the DC motor for movement inside the borewell.

4. A Sumalatha addresses incidents of children being trapped in abandoned borewells, presenting a simple and effective rescue method. Instead of digging parallel pits, a mechanical system moves inside the borewell channel with a gripper arm controlled by user commands. The setup is interfaced with a PC, and Arduino is used for control.

5. Jayasudha.M and Saravanan highlight water scarcity issues leading to the digging of borewells, where children often fall unintentionally. To address this, a robot is designed to rescue and monitor trapped children using a webcam. The system consists of two modules for rescue and protection.

These research papers provide insights into various methods and technologies used for rescuing children trapped in borewells, emphasizing the need for efficient and safe rescue operations.

System Design:

System Architecture: The bore well rescue system's high-level architecture is depicted in Fig. 1 and explained in detail in Fig. 2. It illustrates the interconnections and functionalities of each component within the system.

Hardware Components: The specific hardware components required for the paper include Arduino Uno, L298N stepper motor driver, robotic arm, stepper motor, power supply, sensors, and any additional components necessary for system operation.

Software Components: The software components required for the paper include the Arduino IDE (Integrated Development Environment), the programming language used for coding, and any libraries necessary for motor control and sensor interfacing.

Control Algorithm: The control algorithm used to operate the robotic arm and stepper motor for the bore well rescue system is explained in this subsection. It outlines the sequence of steps involved in rescuing individuals from bore wells using the arm and motor.

Software Requirement:

Introduction to Arduino IDE: The Arduino IDE serves as an Integrated Development Environment for writing Arduino code. It is a streamlined text editor-like program designed to simplify the coding process. When a file is saved in Arduino, it is referred to as a sketch, where the written code is stored. Arduino code language is similar to C++, with the IDE translating human-readable code into machine-readable code during compilation.

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The IDE's compiler detects errors in the code, providing error messages to assist in debugging. Perfect syntax is crucial for successful compilation, with each statement requiring a semicolon to signify completion. Comments are used for annotating code and are ignored during compilation. Curly braces enclose instructions carried out by functions, with functions encapsulating sets of instructions for ease of use.

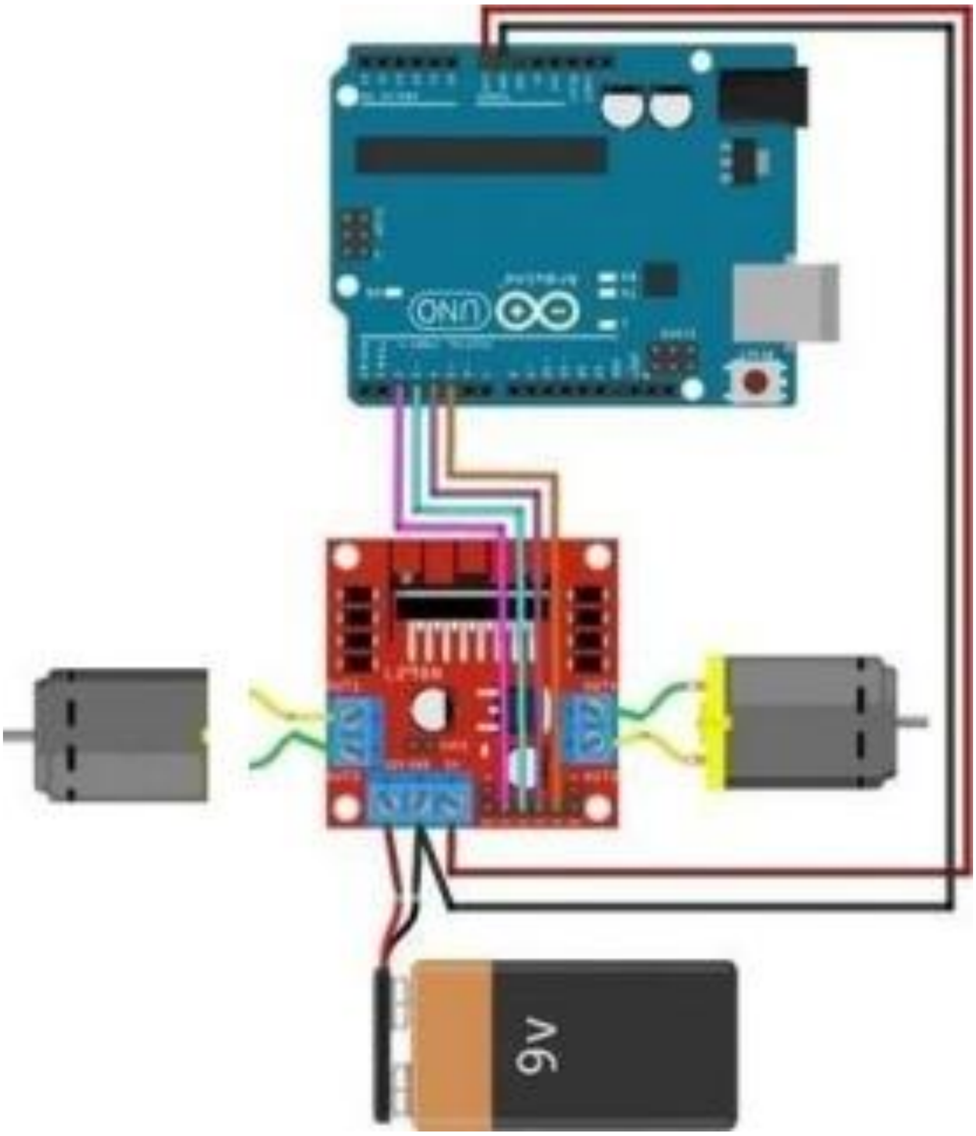

Fig. 1. System Design

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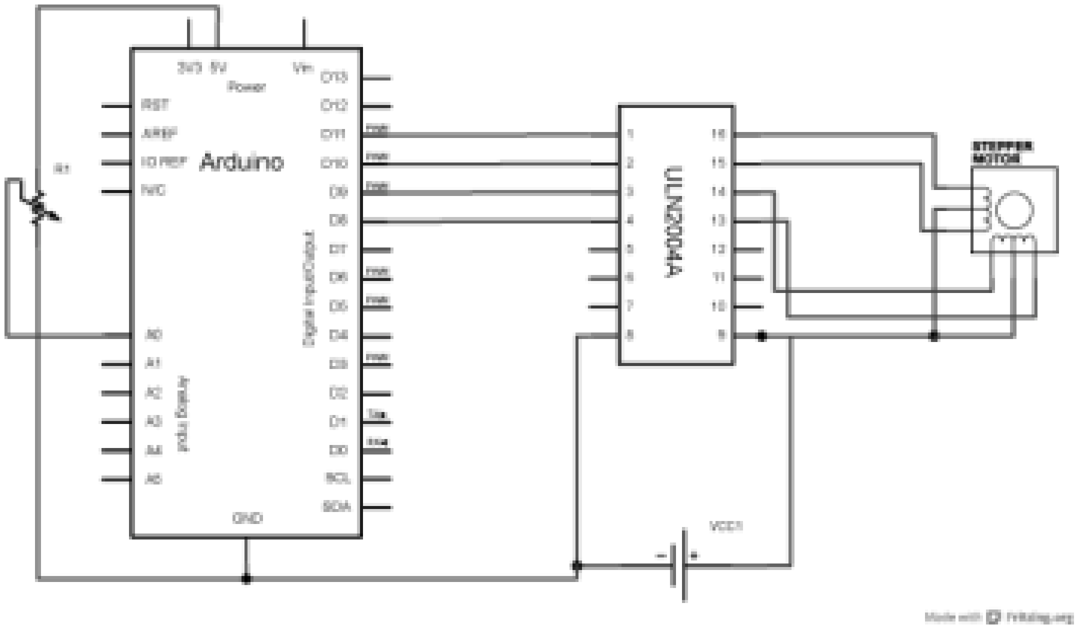

Fig. 2. System Architecture

Two fundamental functions in Arduino are void setup() and void loop(). The setup() function is executed only once to set up the Arduino board, while the loop() function continually executes the code within its curly braces. The setup() function must be the first function in the sketch and contain opening and closing curly braces.

VOID LOOP( ): The loop() function, as the name suggests, repeats the code contained within its curly braces indefinitely, creating a loop. Similar to the setup() function, loop() does not return any values, hence the word void precedes it. Despite the apparent repetition, not all code within the loop() function is executed during each iteration. Instead, specific conditions within the code trigger new actions. For example, if a temperature sensor is connected to the Arduino, the loop() function continually checks the temperature and activates a fan when it reaches a predefined threshold.

INTRODUCTION TO ARDUINO LIBRARIES: Libraries are collections of code designed to simplify interfacing with various components such as sensors, displays, and modules. For instance, the built-in Liquid Crystal library facilitates communication with character LCD displays. While the Arduino IDE includes several built-in libraries, additional libraries can be downloaded from the internet. These libraries are managed in different locations within the IDE installation, including the IDE installation folder, core folder, and libraries folder inside the sketchbook.

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INSTALLING A LIBRARY: To install a new library into the Arduino IDE, the Library Manager can be utilized. Access the Library Manager by navigating to the "Sketch" menu, then selecting "Include Library" -> "Manage Libraries." From the Library Manager, users can browse a list of available libraries, select the desired library, choose the version (if applicable), and install it. Once installed, the new library will appear in the "Sketch" -> "Include Library" menu.

CONNECTING AN ARDUINO BOARD: When using a serial board, power it with an external power supply (6 to 25 volts DC, positive core connector). Connect the board to a serial port on the computer via USB. The power source selection for USB boards is determined by the jumper position between the USB and power plugs.

UPLOADING A PROGRAM: To upload a sketch to an Arduino board, follow these steps:

1. Connect the Arduino to the computer using a USB cable.
2. Choose the appropriate board type under the "Tools" menu.
3. Select the correct serial port for the board.
4. Click the "Upload" button in the Arduino environment, or use the keyboard shortcut (Ctrl+U for Windows, Cmd+U for Mac OS X).

IMPLEMENTATION

1. **L298N Stepper Motor Driver:**
   - It's a popular motor driver module used for precise motor control.
   - Key features include dual H-bridge configuration, wide motor voltage support, high current capability, built-in protection, logic voltage compatibility, and a built-in heat sink.
   - The operation involves receiving control signals from a microcontroller to control motor direction and speed.
   - External power supply is required within the specified voltage range for motor operation.
2. **Robotic Arm:**
   - It's a mechanical system mimicking the movements of a human arm, consisting of segments or links, joints, servo motors, and an end effector.
   - Operates based on servo motors actuating each joint for precise movements.

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- Applications include industrial automation, medical and healthcare, research and development, and education and training.

3. **Stepper Motors:**
   - Electromechanical devices converting electrical pulses into mechanical rotation.
   - Types include Variable Reluctance (VR), Permanent Magnet (PM), and Hybrid Stepper Motors.
   - Operate on the principle of controlling current flow through windings for discrete step movements.
   - Advantages include precise positioning, open-loop control, high torque at low speeds, and versatility in applications.
4. **PWM (Pulse Width Modulation):**
   - Method for controlling average power delivered by an electrical signal.
   - Useful for running inertial loads like motors and reducing power loss in switching devices.
   - Switching frequency selection is critical for smooth control without premature failure or oscillations.
   - Integrated into modern microcontrollers for various applications like DC motor control and power supply regulation.
5. **Hardware Setup and Software Development:**
   - Detailed instructions on connecting components, wiring diagrams, and precautions.
   - Software development involves programming logic, code structure, and algorithms for controlling robotic arm, stepper motor, and servo motor using Arduino Uno.
   - Provided code snippets demonstrate how to control stepper and servo motors using Arduino and respective libraries.
6. **Integration and Testing:**
   - Describes the process of integrating hardware and software components.
   - Testing methodologies ensure proper functioning of the bore well rescue system, including test cases and results.

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Overall, the text offers a comprehensive guide for implementing Arduino-based projects involving motor control, robotics, and automation.

ChatGPT can make mistakes. Consider checking important information.

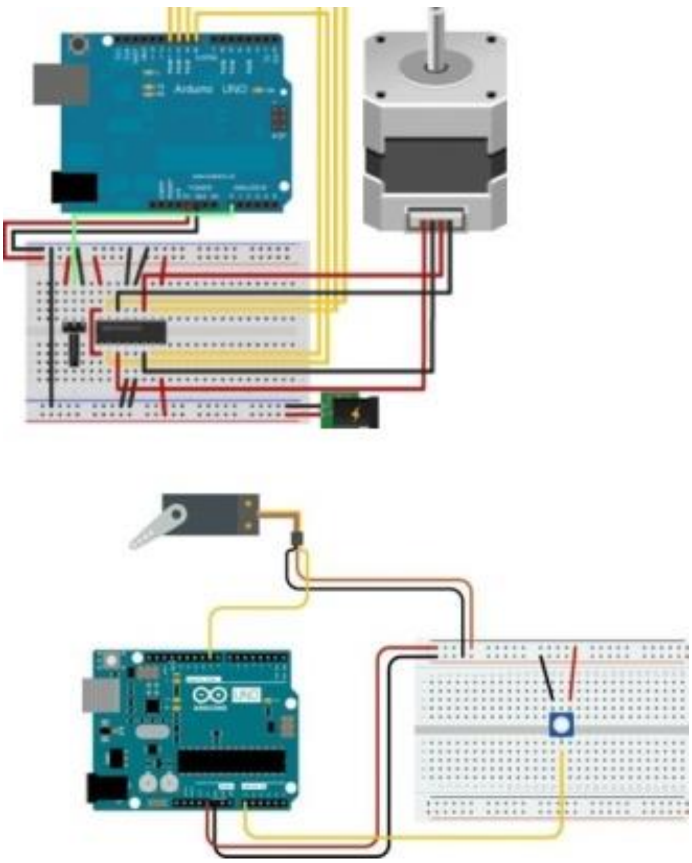

Fig. 3. Arduino Function

VII. CONCLUSION

Summary: This section provides a summary of the paper, highlighting the key achievements and outcomes. It reiterates the significance of the developed bore well rescue system.
Achievements: In this section, the specific accomplishments of the paper are listed and discussed. These include the successful integration of the robotic arm, motor control, and rescue operations.
Lessons Learned: Reflecting on the lessons learned during the paper, this subsection discusses the knowledge gained, challenges faced, and recommendations for future papers.
In conclusion, the bore well rescue system represents a critical and innovative solution designed to address emergency situations, especially involving individuals, such as children, falling into bore wells. This system combines various components such as cameras, sensors, robotic arms, and communication systems, enabling informed decision-making and effective rescue operations. The deployment of the bore well rescue system signifies a significant advancement in safeguarding human

lives, emphasizing the importance of proactive measures in addressing emergency situations. It showcases the potential of technology as a valuable tool in saving lives and mitigating risks in critical scenarios. However, the implementation and effectiveness of the bore well rescue system depend on various factors, including infrastructure, resources, training, and coordination among stakeholders. Continuous research, development, and improvement are essential to enhance the system's capabilities and ensure its reliability in real-world scenarios. Overall, the bore well rescue system represents a remarkable innovation with the potential to profoundly impact public safety, particularly in situations involving bore well accidents. It underscores the power of technology to contribute to the greater good and serves as a reminder of the importance of prioritizing the safety and well-being of individuals in all aspects of engineering and technological advancements.

REFERENCES

1. S. Vimalraj, Gausalya.R.B, "GSM Based Controlled Switching Circuit Between Supply Mains And Captive Power Plant," International Journal Of Computational Engineering Research, Vol. 03, Issue 4, April 2013.
2. Henrik Arleving, "Ways To Cut Power Generator Maintenance," The Journal, December 2013.
3. Chetan Patil, Channabasappa Baligar, "Base Transceiver Station (BTS) Safety And Fault Management," International Journal Of Innovative Technology And Exploring Engineering (IJITEE), ISSN: 2278-3075, Volume-3, Issue-7, December 2013.
4. Y. Jaganmohan Reddy, Y. V. Pavan Kumar, K. Padma Raju, Anilkumar Ramsesh, "PLC Based Energy Management And Control Design For An Alternative Energy Power System With Improved Power Quality," International Journal Of Engineering Research And Applications (IJERA), ISSN: 2248-9622, Vol. 3, Issue 3, May-Jun 2013.
5. Amit Sachan, "Microcontroller Based Substation Monitoring And Control System With GSM Modem," IOSR Journal Of Electrical And Electronics Engineering, ISSN: 2278-1676, Volume 1, Issue 6 (July-Aug. 2012).