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DESIGN OF LONG RANGE MI-WI BASED BOREWELL CHILD RESCUE SYSTEM

N.Jothy[1], S.Ranjith[2], J.Rajesh[3], S.Surjith[4]
Department of Electronics and Communication Engineering,
Sri Manakula Vinayagar Engineering College, Puducherry, India.

Abstract
Children and animals are in danger of dying due to abandoned open borewells in rural and agricultural settings. Drilling multiple borewells on agricultural lands is a usual practise because the Indian agricultural system depends on borewells for its water supply. To prevent youngsters from falling unexpectedly, the dried-out or abandoned borewells must be securely secured. In numerous occurrences across the nation, children who were trapped in borewells were unsuccessfully rescued. The rescue team's standard procedure in such situations is to excavate the ground parallel to the borewell to reach the trapped youngster. Lately, a number of methods have been put forth to create borewell child rescue devices.From the overall findings, it can be inferred that estimating the borewell's atmospheric condition aids in estimating the child's health status and the amount of time needed for the rescue operation. By creating geographic standards for the atmosphere parameters, the time needed to measure the real-time environment parameters is eliminated.
Keywords: Borewell, Child, Mi-Wi, Wireless, Communication system.

1. Introduction

The borewell's environment has a significant impact on how long a child can survive there until the borewell is filled in. The amount of air that is available in the borewell, as well as changes in temperature and humidity, have an impact on the well-being of the children there. Estimating the duration of the rescue operation is made easier by being aware of the borewell's atmospheric parameters. Additionally, understanding the child's position in the borewell aids in choosing the right holding device to lift the youngster from the borewell. As a result, diverse soil types, including clay, red soil, and black soil, were chosen for the present research work's recording of atmospheric characteristics at various geographic locations. With the use of a sensor fusion system, data was acquired from borewells in three distinct locations throughout the day in the Andhra Pradesh state's Giddaluru, Rajampeta, and Ananthapuram regions. In order to create standard charts, the data was evaluated next. Bore wells are built to supply the water that is required on an ongoing basis. However, kids frequently trip and fall because they are frequently left unprotected. A parallel pit is dug to save the youngster in a typical rescue operation, and holes are constructed next to the bore well's walls. But doing these takes time and could endanger the child's life. It is possible to quickly rescue a child using the robotic framework we suggest in our study.

This issue can be resolved with a robot for borewell rescue. It is quick, inexpensive, and secure. It has the capability to watch over stranded children and offer a platform on which to lift them. By picking up the infant with robotic arms, this device will fasten a harness on them. For picking and positioning, the robotic arm has a motor linked to it. In a short amount of time, the suggested system will successfully rescue the child. This task-specific manipulator model is multipurpose, reprogrammable, and intelligent. The child's life will be saved by this lightweight device when it descends into the bore well pipe and goes about taking the necessary steps to do so. Waterproof infrared cameras and a high-definition TV monitor can be used to see the child.

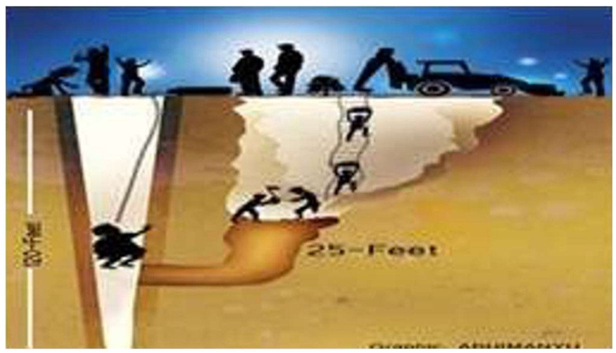

Fig.1 Borewell Human Rescue Process

Fig.1. describes the current human resource-based child rescue approach. The child's removal from the borewell took longer time.

2. Related Work

Author [1] creating a device to rescue a youngster from inside a bore well This system has the ability to move inside the bore well. PIR sensors are used in this Smart Child Rescue System to detect people regardless of the environment. In this setup, a Raspberry Pi is employed, which is more expensive than an Arm microcontroller. Further ancillary equipment is needed. In order to successfully support the rescue operation and paramedical team, [2] designed a wireless sensor fusion system in the mechanical gripper systemic arm. In order to gather crucial data from the bore well, including humidity, temperature, CO, and other gaseous levels, multiple sensors are interfaced to the wireless sensor fusion system. This data is used to track the health of the child who is inside the bore hole. Pic microcontrollers, which operate at lower speeds than Arm, are employed in this system.

A battery management system for rescue has been detailed by [3]. This document provides a summary of battery management for rescue systems as a suggestion to novice programmers. This paper addresses the themes of power consumption, battery selection, battery charging and discharging, and battery maintenance; nonetheless, this system is expensive due to the additional hardware requirements and complex design.The "Child Rescue System against Open Bore Well" by [4] features a design with a sensor to detect the child within. The sensor triggers the lock, keeping the kid from falling lower than three feet. With the aid of a motor, which pushes the blocks that are aligned at an angle of 120 degrees towards the side of the bore well, the gear mechanism is started. The child is saved after another motor completes a 360-degree revolution to help find the opening that the lifting rod fits through. The limitations are motor cannot run by 360 degree possible to tilt only upto 120 degree.

The rescue efforts without human intervention are described by [5]. According to the pipeline dimensions, the system's legs can be adjusted. Actuators, a dc motor, a servo motor, and a power supply make up the system. The position of the youngster is recorded using a camera module in the bore well and is then monitored on a computer. Arduino was interfaced with by the ultrasonic sensor.The construction of two complementary roles to current bigger systemic structures, which primarily carry out various rescue duties, is represented by [6]. Here, the ATRC-WSU (micro-design, software), Ohio State University, and other researchers are working together to construct the micro-system. This as micro-systemic structures in an effort to aid in the identification and rescue of those trapped under debris.

[7] described An anchorage set, a hoist set, a manipulator, a frame, a control system, and a communication system make up the basic framework of the rescue system. With the replacement of a few mechanisms, the system is capable of performing rescue operations for small-caliber wells with diameters that range from 1 to 0.3 meters. You can use this technology as a small-caliber well rescue system. More hardware is needed.

A self-moving and self-sustaining autonomous system was created [8]. In order to fit inside the pipe, this design uses a wheeled leg mechanism. The circumferential and symmetrical spacing between the legs is 120. In order to measure and display the temperature within the bore hole, a PIC 16F877A microcontroller is interfaced with an LM-35 temperature sensor.In their paper "Child Rescue System against Open Bore Well [9] expressed an IR signal that, when put two inches diametrically beneath the ground surface of the bore well and breaks owing to any obstructing object, activates a buzzer as an alert on a mobile phone. Closes the bore once the youngster has descended a few feet into the bore well to stop them from tumbling down.

Author [10] is based on a rescue device that can enter the same bore well and take specific steps to save the child. Both the CCTV camera and a strong LED light source are employed. They used computer design and hand-drawn sketches to build a number of processes for their project. They have installed contemporary machinery with lightweight servo motors in their system. Their initiative is run by humans. The rescue efforts without human intervention are reported in [11]. According to the pipeline's dimensions, the system's legs can be adjusted. Actuators, a DC motor, a servo motor, and a power supply make up the system. The position of the youngster is recorded using a camera module in the bore well and is then monitored on a computer. Arduino was interfaced with the ultrasonic sensor. Due to the fact that the Arduino employs a microcontroller rather than an application processor, it is unable to run any operating systems. On the Arduino, there is no Ethernet or video output available.

Author [12] outlines the design of a robot to rescue a child from a bore well that can move inside the bore well depending on human input from a computer and can also pick up and place objects based on arm design. Using wireless Zigbee technology, the robot is controlled by a laptop, and a wireless camera allows it to observe audio and video on a TV. When the light level inside the pipe is low, this robot's high-power LED serves as a light source. Authors [13] says the work of rescue in those circumstances is difficult because the bore well's diameter is too small for any adult to fit through and the interior is dark. In order to communicate with the child, a teleconferencing system will also be attached to the robot. Author[14] provides an account of the rescue efforts conducted without human assistance. Here, the mechanism for the wheeled legs is built to fit inside the pipe, and the legs are circumferentially and symmetrically spaced apart by 1200. The robot's legs can be adjusted to fit the pipeline's specifications. The robot is made up of a power source, a switchpad, and a gear motor. The child's position is recorded from the bore well using a USB camera and checked on a computer. In order to sense and display data on the LCD, the PIC 16F877A microcontroller is interfaced with the LM35 temperature sensor and 16*2 LCD.

Author [15] describes the rescue efforts without human involvement Here, the mechanism for the wheeled legs is built to fit inside the pipe, and the legs are circumferentially and symmetrically spaced apart by 1200. According to the dimensions of the pipeline, the robot's legs can be adjusted. The robot is made up of a power source, a switchpad, and a gear motor. The child's position is recorded from the bore well using a USB camera and checked on a computer. In order to sense and show data on the LCD, the PIC 16F877A microcontroller is interfaced with the LM35 temperature sensor and 162 LCD.

In the reported literature the drawbacks are the device cost is more and it is less compact to handle. In order to overcome modified borewell rescue system is discussed proposed and its implementation part is discussed in the subsequent section.

3. Implementation of Borewell Rescue System

Several sensors are used by sensor fusion systems to collect data on variables including temperature, humidity, and gas composition inside a borewell. A sensor fusion system can also be used to keep tabs on the condition of the child who is stuck in a borewell. The air quality/gas detector sensor module and the RH-temperature sensor are the two main parts of the sensor fusion system used in the current investigation. The conductivity of the air is detected by the air quality/gas detector sensor module. Higher concentrations of gases and airborne particles can be understood if a higher conductivity is measured. To record temperature and humidity information, the temperature sensor employed in this study combines a thermistor and a humidity sensor. Apart from gathering information to evaluate bore-well characteristics, it's also necessary to study the child's location to determine the space between the trapped child and the borewell wall. The Proteus software has been used to mimic the prison environment in this case, with the imprisoned youngster in various postures.

The proposed model block diagram is show in Fig. 2. It includes power supply, PIR sensor, relay and gas sensor. The output of a power supply remains constant even when the voltage varies. When the load is less than about 7 amperes, "fixed" three-terminal linear regulators are frequently available to provide fixed voltages of plus 3 V and plus or minus 5 V, 9 V, 12 V, or 15 V. An electronic sensor called a passive infrared sensor (PIR sensor) monitors the infrared (IR) light that objects in its field of view emit. Their primary application is in PIR-based motion detectors. Security alarms and automatic lighting systems frequently employ PIR sensors. In order to prevent any impact, this relay supplies the necessary voltage to the DC motors.

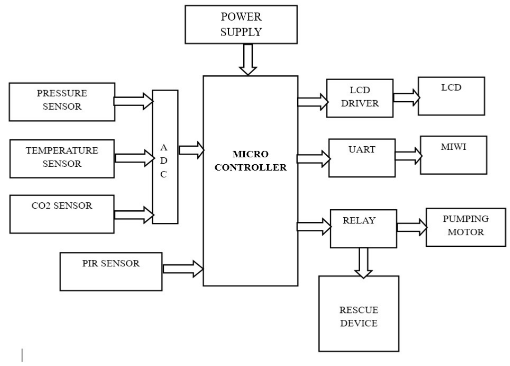

Fig. 2 Block Diagram of the Proposed Model

Monitoring the gases produced is crucial in the contemporary technological environment. Monitoring of gases is particularly important for anything from household products like air conditioners to industrial safety systems and electric chimneys. A crucial component of these systems are the gas sensors. Gas sensors are tiny, resembling a nose, and respond impulsively to the gases they detect, informing the system of any changes in the concentration of molecules in the gaseous state.

3.1 Controller Unit

The PIC 16F877A microcontroller serves as the central processing unit for this device. This RISC-based microcontroller is equipped with analogue input channels, analogue comparators, and additional timer circuits. It is responsible for storing and displaying the data gathered by the robot, including the temperature readings obtained by its built-in temperature sensor. The microcontroller communicates with the PC via serial communication, facilitated by the MAX-232 interface. To ensure compatibility between the TTL-compatible microcontroller and CMOS-compatible PC, the MAX-232 interface is utilised to verify and adjust the baud rate and voltage levels.

3.2 Audio Play Record (APR)

If sound can be recorded and stored in a manner that protects digital data, it can provide comfort to a child trapped in a bore well by allowing them to hear the reassuring sound of their parents' voices at regular intervals. Our digital audio recorder is capable of capturing a single (mono) analogue audio channel at a sampling rate of 22.05 kHz and an 8-bit sample depth. The recording is then saved as a Windows WAV file on a micro-SD flash card with a maximum file size of 4 GB. It is important to note that this is achieved using a 16 MHz processor with only 2KB of RAM and 32KB of programming space.

3.3 Temperature Sensor

Arduino has the ability to not only receive data from various sensors but also to control lights, motors, and other actuators to manipulate its surroundings. The LM35, a high-precision IC temperature sensor, produces an output that is proportional to the temperature (in °C). The sensor's circuitry is sealed, preventing oxidation and other environmental factors from affecting it. Compared to a thermistor, the LM35 provides more precise temperature monitoring. It also has a low rate of self-heating and does not raise the temperature of still air by more than 0.1 °C. The LM35 can operate within a temperature range of -55 °C to 150 °C.

3.4 Mi-Wi

Mi-Wi utilizes the 2.4 GHz UHF and 5.8 GHz radio bands as its primary communication channels. However, due to the wireless nature of the network, anyone within range with a wireless network interface controller can attempt to gain access, making Mi-Wi more vulnerable to attacks compared to wired networks. To address this issue, the Mi-Wi Protected Access family of technologies was developed, providing security solutions for both home and business networks to protect information transmitted across Mi-Wi networks. The security features of Mi-Wi Protected Access are continuously updated with new and improved defences as the security landscape evolves.

3.5 Motor Driver

A motor driver is utilised in order to facilitate the movement of the robot's arms. The motor driver consists of a standard DC motor, a gear reduction unit, a position-sensing device (typically a potentiometer), and a control circuit. Upon application of a control signal reflecting the desired output position of the servo shaft, the DC motor of the servo is powered, thereby enabling rotation of the servo shaft to the intended position. The position-sensing device plays a vital role in determining the rotational position of the shaft, which in turn facilitates the identification of the direction of motor rotation required to move the shaft towards the desired position. Unlike a typical DC motor, the servo shaft is capable of performing a limited range of back-and-forth motion of approximately 200 degrees. The servo is connected via three wires, namely power, ground, and control. Because the internal driving electronics of the servo draw current from the power lead to power the motor, a continuous supply of electricity to the power source is required. Despite the fact that the control signal is pulse width modulated, the duration of the positive-going pulse serves to determine the location of the servo shaft (PWM). A 1.520-millisecond pulse corresponds to the centre position for a Futaba S148 servo. Longer pulses result in clockwise rotation from the centre, while shorter pulses facilitate anticlockwise rotation. The servo control pulse is repeated every 20 milliseconds.

The primary utilization of this machinery is to facilitate the rescue of children trapped in bore wells. Additionally, it possesses the capability to perform various other functions, such as:

Machine for cleaning pipes-This device exhibits the potential to effectively clean lengthy pipes by traversing through them. The end effector positioned at the front of the machine comprises a rotating brush that aids in the cleaning process of contaminated pipes. The high-calibre wheels of the machine can firmly grip onto the wet surface within the pipes, even if it is slick and damp. The various applications can also make use of this kind of robot are industrial sector, for space programmes, in settings that are radioactive or extremely dangerous.while operations are under way at sea.

4. Results and Discussion

In this paper, a design model for a robot that can rescue a child who has become trapped inside a bore well is proposed. Together with altitude, it can also measure temperature. The following is how the suggested model design is meant to appear. Together with altitude, it can also measure temperature. The level of oxygen is constantly being checked, and if it rises above a particular point, oxygen will automatically be pumped. For the child's protection, measurements of temperature and pressure are also made. PIR is used to determine the extent of the child's availability. Measured values are transmitted to a Computer for monitoring.

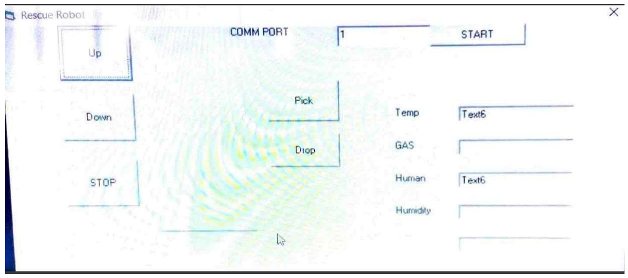

Fig.3 Control Software

Fig. 3 shows the software helps to control the bot's hand. It controls the bot's hand to move up, down, pick and drop. It also displays the temperature level, humidity level, gas level inside the borewell. When pick button is pressed, it picks the child. When we press drop it drops the child. When the child is picked up we press the up icon to pick the child up from the borewell.

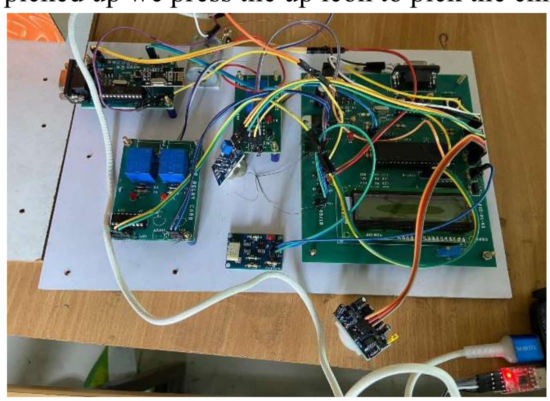

Fig.4 Hardware Sensor Board Set-up

A platform that offers all the hardware required to quickly prototype applications based on the Mi-Wi standard is the Microchip MRF89XA 915 MHz Mi-Wi Development kit is shown in Fig. 4. A demonstration software and the Mi-Wi protocol stack are already pre-programmed in the kit. The kit includes two Mi-Wi boards that can be used to create a basic two-node Mi-Wi wireless network. With the addition of more Mi-Wi boards, the network may easily be expanded. The two board acts as a transceiver. It can both send and receive signals. It connected to the software which is on the pc.

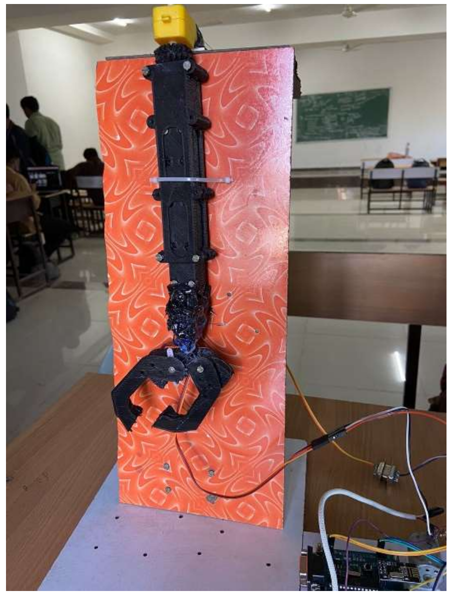

Fig.5 Robot hand

Fig. 5 shows bot hand will help the child to pick from the borewell. It is controlled by the dot net software which is on the pc. This bot hand will pick the child from the borewell easier when compared to man-made process. The advantage of the proposed is cost effective and portable to any place.

6. Conclusion

Excavating a pit adjacent to a bore well is a time-intensive undertaking that has resulted in the loss of numerous lives as individuals fall into the well. The proposed system addresses all of these challenges. The primary objective of this research is to reduce the reliance on human labour during bore-well rescue operations. When compared to traditional methods, the proposed system completes rescue missions at a significantly faster pace. Thus, every possible obstacle that may arise during the operation was considered during the design phase of the system. To enhance the proposed model, it is possible to incorporate the airbag functionality that can be utilised to provide additional support to a child from below, thus preventing any further fall.

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