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Smart Child Rescue System

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Abstract - A water well or borewell is an excavation or building made in the ground by digging, boring, or drilling to access groundwater in underground aquifers. Nowadays, it is rather common to observe abandoned borewells that have been left open after usage. These walls turn into a deadly trap for young children who play close to the wells without realizing their depth. The task of rescuing children who have become trapped inside the borewell is not only challenging but also dangerous. The rescue teams attempt to save these young children for hours, sometimes days, and it costs a lot of money. Consequently, technology must be used to improve the rescue effort.

Key Words: underground aquifers, abandoned , excavation .

1.INTRODUCTION

One of the prevalent problems in several regions of India nowadays is kids slipping into bore wells. Children falling into borewells most frequently occur in rural India. This reveals something about the bore hole sizes. Bore wells are drilled in cities for domestic consumption. They have a smaller diameter. Large-diameter bore wells are also dug by some manufacturing businesses. These would often be found in the villages. This, however, cannot be regarded as the main cause since in the villages, people look for groundwater for household, agricultural, and other uses. People need water, but it is not always readily available, so they dig a borewell. Consequently, groundwater is the source. And thus, work on drilling a deep borewell to reach a decent source level of ground water begins. For a number of reasons, including the summer, excessive extraction, inadequate recharge, etc., groundwater is vital. However, a large number of bore wells don't supply water and are frequently left open.

When there is no longer any water, the driller will partially plug the hole and pack up and leave. One day a wandering youngster unknowingly plunges into the borewell. considering a toddler may easily fall into a borewell due to its diameter. If the youngster is not located elsewhere, it takes a long time to realize that they have fallen into a borewell. Since there won't be any use for the borewell owing to a shortage of water, it may potentially collapse. Since some borewells may reach depths of more than 300 feet, a youngster can stay caught in the muck instead of always falling to the bottom. Finding the depth of an open borewell is a difficult undertaking since the interior is quite deep and dark. However, if the youngster has fallen into a deep borewell, a web camera is sent down there to capture images of the child.

2. LITERATURE SURVEY

V. Saritha *et al.* [1] The purpose of this study is to prevent children from falling into bore-wells, which necessitates a novel design with a sensor placed above the borehole to detect children who fall within. The automated horizontal closure, which is kept at a depth of around 3 feet, closes if the device detects a child, shielding the kids from falling below. It has the capability to keep an eye on the confined youngster and to offer a platform on which the child can be raised using motors. The three blocks, which are set at an angle of 120 degrees from one another, are pushed toward the side of the bore hole by the motor, which is mounted on top of a gear mechanism. The clipper will then be used to rescue the youngster who is trapped within the hole by picking him or her up and placing them with the aid of a remote control. The rope fastened at its hands is used to manually insert the clipper. This scenario states that constructing a second hole parallel to the bore well is not necessary. It also has a camera that is attached to the clipper and used to watch the youngster. We can see the infant and their condition thanks to this camera. This technique uses an Arduino UNO controller board, which is based on the ATMEGA328P microprocessor and a well-developed, precise hand gripping mechanism. This technology takes less time to safely extract the imprisoned youngster from the bore well.

M.Afsar Ali *et al*. [2] There is no need to construct a large trench parallel to the bore well up to the depth where the child is trapped with this method since it uses sophisticated and inexpensive rescue equipment powered by an Arduino. This system does not rely on a significant quantity of machinery and human resources (military, paramedical, etc.). (JCBs, Tractors, etc.). As a result, the time it takes for this resource build-up to complete may be sped up, increasing the likelihood that the kid will survive. They employed a highly developed microcontroller, a pickup arm with well-designed, precise hand grips, and a visual feedback system with a high-resolution camera that helps to retain any part of the kid and is removed from the bore hole in less time and with less labor.

Seeram Srinivasa Rao *et al.* [3] The system consists of two robotic hands, two gloves, Flex sensors, a microprocessor, and the SX1278 LORA wireless transmitter are all included in this system. Solid works is used for the robot's design. Using a wireless night vision camera, it is possible to see where the youngster is imprisoned in the bore hole. They employed passive sensors to monitor the radiations emitted from the victim's body, which revealed if the youngster stuck in the bore well is alive. A supply pipe is hooked to the rope to administer oxygen to the sufferer. They mostly employed ISO-standard rope and pulleys for the operation.

Nitin Agarwal *et al.* [4] There is no need to dig any parallel holes with this technology since it can obtain a picture inside the same borewell. The system is brought down into the borewell using a pulley and rope mechanism to reach the youngster while being visualized by the camera A/V output. The entire section is controlled by two DPDT switches. A camera is used to catch the live action, and a microphone and an operational amplifier 7805 are used to communicate with the youngster. In order to remove the kid securely, the system is rotated using a DC motor in accordance with the child's position.

Kavi Anand *et al.* [5] The system, according to the manufacturer, comprises of a raspberry pi controller, a pir sensor, an alarm system, and a gsm module. The PIR sensor, which is located at the top of the borewell, is used to detect human movements close to the well regardless of the surrounding environment. An alarm system is activated as soon as human movement is detected by a PIR sensor, preventing a kid from falling into a deep well and driving a horizontal closure that is mounted inside a borewell at 5 feet to prevent this from happening. The rescue squad and the local emergency personnel in the area will both receive notifications from the GSM model.

Nandhitha *et al*. [6] The child is not saved from the borewell, according to this study; rather, it is utilized to monitor the child's health. In this instance, the temperature sensor is utilized to assess the child's health. Atmega16p controller for the Raspberry Pi is the system's CPU. When a kid's facial expression indicates discomfort, an algorithm is used to determine whether the youngster needs music to settle down. Therefore, the first stage will be to collect the data that will be utilized to analyse facial emotion recognition, such as photos of faces expressing various emotions.

Tanveer *et al.* [7] In this research, a robotic arm is used to remove the youngster from the borewell. The three primary components of the suggested system are the hardware for the robot, the rescue controller, and the hardware for the borewell. The hardware unit within the borewell is used to provide the information if the youngster falls into one, notifying those in the area so that the rescue team can be summoned more quickly.

The robot and rescue controller unit's hardware unit has First, an ultrasonic sensor and camera with a high-power LED on top are lowered into the borewell. The camera shows the child's condition and location, while the ultrasonic sensor communicates the child's distance from the top of the borewell. The ultrasonic sensor determines distance using ultrasonic ranges. Ultrasonic signals are sent by the ultrasonic sensor, which then receives them after being received by the youngster. The camera records video and transmits the victim's status by projecting it onto the computer's monitor. The presence of any harmful gases is indicated by the gas sensor. The temperature sensor provides information about the local temperature. A camera is used to detect the child's hands. A DC motor is used to move the robot arm in the direction of the youngster. Robotic arms' servo motors are activated in order to properly grasp a child's hands.

Nitin *et al.* [8] In accordance with this work, a mechanical mechanism removes the youngster from the open borewell. Two plates, the top plate and lower plate, make up this arrangement. The upper plate has a mechanical system attached to it that will attempt to release two linear actuation units that will hold the system in place by pressing the bore-well wall. The bottom plate will rotate to get it in plane with the kid thanks to an additional mechanical gear system that will be connected. The lower plate of the mechanical system is joined by two arms. The lower location of the lower plate has two high quality cameras put their downward. The high-resolution cameras will offer a clear picture of the surrounding area, which will be very beneficial while communicating between the two arms. There is ample lighting inside a borewell since it is deep and dark. The two switches serve as the system's primary means of communication. While the other switch is used to control the claws, one switch is utilized to regulate a DC motor that rotates both clockwise and anticlockwise.

Vrunda *et al.* [9] The Arduino microcontroller, a wireless infrared camera, temperature sensors, passive motion sensors, smic, speakers, and ultrasonic sensors are all used in this work. If oxygen is not present in the borewell, the oxygen supply system is employed to provide oxygen to the infant. To see what the kids are doing, a wireless infrared camera is employed. The passive motion sensor is employed in this instance to determine whether the youngster is still alive. The Arduino and ultrasonic sensor are connected to measure the child's distance from the borewell to the ground. The goal is to provide the infant food and oxygen without harming them.

Talekar *et al.* [10] This approach deals with both the safe handling of the victim and the rescue of a trapped person from a borewell. This technology is designed to be a lightweight device that keeps a child's hands within the borewell in a methodical manner. a cable rope, a gear assembly, a stand, and two plastic claws support and operate the system. This system's structural layout enables modification to the diameter of the borewell and the walls of the hole. With the use of a wireless camera and a personal computer, the confined child's status is monitored. The microprocessor and temperature sensor have been connected, and the LCD display shows the temperature inside a borewell. Since the microprocessor is unable to deliver enough current to the several gear motors, the switch pad is used to provide a direct supply to the gear motors, allowing the robot to operate without interruption. By assessing the scenarios, the initiative aims to lower the danger associated with the kid rescue operation.

Kaur *et al.* [11] This system performs rescue operations automatically. The legs of the wheeled leg mechanism are constructed with a 1200 circumferential and symmetrical spacing between them. The robot's legs may be automatically adjusted to fit the borewell's specifications. The robot was made of a gear motor and switch pad. Using a USB camera, the child's position is recorded from the borewell and tracked on a computer. The PIC 16F877A microcontroller is interfaced with the LM35 temperature sensor and 16x2 LCD to sense the temperature and show it on the LCD. The microcontroller obtains the sensed data and uses the LCD to display it. The power supplied to the microcontroller is not sufficient to give the sufficient amount of current to the multiple gear motors, so in spite of using motor drivers a direct supply is given to the gear motors using switch pad as its control Centre enables the robot for work smoothly.

Raj *et al.* [12] In this system architecture, it is difficult to perform rescue operations when the borewell's diameter is too small for any adult to get through and the interior is dark. A robotic apparatus is created that uses pneumatic arms to pick up the infant and fasten a harness on them. For communication with the youngster, a teleconferencing device has been added to the robot. The basic components of the proposed system are two circular plates. Two linear actuation units that retain the robot's position by pressing the borewell wall are held in place by a mechanical system that is fastened to the system's upper plate. The apparatus has been upgraded with a mechanical gear system that will spin the bottom plate in order to approach the victim. The lower plate has two arms linked to it. Two high-resolution cameras that have been mounted downward in the lower position of the lower plate make up the system. The robotic system's oxygen supply will be delivered by oxygen pipes that move with it.

Pattery *et al.* [13] A robotic apparatus that can be used to rescue children stuck in borewells is designed and operated in this system. The design was motivated by taking into account the causes of the failure of the earlier techniques. This system's capacity to raise a kid using a safety cage rather than a gripping mechanism is a vital component. The ability to monitor the trapped infant, administer oxygen, and offer a platform on which to hoist the youngster up also helps. Three blocks are positioned at 120 degrees from one another and are pushed toward the side of the bore hole by the first motor, which is located at the top. The bottom shaft of the second motor, which is positioned below the plate, is rotated by 360 degrees, assisting in locating the opening through which the lifting rod passes. A wireless camera that is mounted to the lifting rod facilitates this.

Saran *et al*. [14] In this system, servo motors are employed to hold the youngster while safety balloons are placed underneath the child to give additional protection. The entire system is controlled by a person. In this project, the entire process is developed, starting with hand-drawn drawings, and ending with computer-generated design. Since the system serves a life rescue function, current equipment is installed for various system components. The system operations are carried out by the use of lightweight servo motors. A long-range CCTV camera is positioned to locate a youngster. For the system to be positioned perfectly, a second fork system has been used.

Nitin *et al.* [15] This system displays the architecture on an accessory-filled machine assembly that is supported by a cable wire and may be operated by a gear assembly. The borewell input is used by the robot self-operating system to function. The IR sensor and camera are mounted on the bottom, and they are used to measure the child's distance from the ground. The rescue robot will then be modified to fit within the borewell. The rescue robot sets up an oxygen conduit via which oxygen is supplied. The rescue robot will detect the child's location and deploy a long aiding pipe so that the child may ascend them. Robot is built with three degrees of flexibility and is capable of adjusting its posture for the child's comfort and safety. The youngster is quickly and safely lifted upward on the three legs of the rescue robot with the assistance of motors. The handling system's design ensures that the kid never suffers harm, and the robot itself administers some pre-treatment to ensure that the infant survives through the entirety of the procedure.

Arunkumar *et al*. [16] This system comprises of a robot that has four motor drivers built into it and is positioned at a 90-degree angle to the other drivers. Two of the four arms serve as grippers to hold the youngster, with the remaining two functioning as backup arms. It has grippers that can move in a horizontal manner so that they may grasp the kid and make it suited to fit according to the child's measurements. A gripper arm is added to the rack and pinion system to allow for mobility while holding the youngster. The motor used to move the gripper may be turned on and off using a limit switch. When the limit switch hits the child's head, the motor is made to turn on, and it is made to turn off when the rack travels to a particular place. Four arms on the robot, which may hold the infant and protect him or her, make up the machine. Three of the arms are the same length, while the backup arm is noticeably longer than the other arms.

Sakhale *et al.* [17] In this approach, keeping a child alive in a bore requires taking into account the absence of oxygen, elevated temperatures, and humidity that cause hyperthermia. To distribute fresh air into bores, a hand-powered device is being developed. The temperature is lowered using this mechanism. Using infrared cameras and a portable high quality TV monitor, the youngster may be seen. A 200-foot wire is used to reposition the camera. The device is made to run off the system's 12-volt battery. The portable device that will lower itself into the borewell pipe and keep the corpse imprisoned in place. A grasped type and rope pulley drive, a stand, and other essential accessories will support this machine assembly. The remotely operated robot will descend the borewell and carry out the prescribed series of actions. This robot-style contraption can quickly and securely extract a body trapped inside a borewell.

Navya *et al.* [18] A borewell rescue robot construction and design are shown in this system (i.e., to rescue a trapped baby from borewell). This technology, which is a robot that can be controlled by humans, offers the safest method for saving the infant. The goal of the project is to create a "Robot to Rescue of a Child in a Borehole" that can move within the pipe in response to human orders from a personal computer. This project may also be used to choose and arrange the things in accordance with this design. The robot is controlled by a personal computer using wireless radio frequency technology, and we can see both audio and video on a TV by utilizing a wireless camera.

Palaniswamy *et al.* [19] A live rescue mechanism was created for this system. The method is straightforward and is simple to understand. Infrared cameras and a portable high quality TV display make it possible to see the youngster. With the use of graspers, which may grab the baby's shoulder, wrist, or ankle, a youngster can be pulled. These graspers are custom made, with open and shut controls, and the ability to be extended by connecting more pipes. The grasper is held steady by a safety rope. The grasper may be lowered within the borewell up to 40 feet, and pipes can be added to extend the grasper's depth of reach. Making the grasper retain the kid's body posture while keeping an eye on the child's location on the monitor, you may guide the youngster off the platform by manipulating the connecting rod assembly. The youngster is now safely picked up by the grasper and raised to the safety level. The entire procedure takes around 10 minutes to complete.

Vrunda *et al.* [20] This system includes a machine for borewell rescue that has cutting-edge tools and gadgets. The gadget has extra safety features and is a computerized machine controlled by a person. A robotic device with the ability to enter a confined bore hole alone and quickly grip a trapped body while offering amenities including an oxygen tank, a food support system, a water supply system, a microphone, an infrared light emitting diode, a speaker, and an LCD screen. There is a lower possibility of harming the human body and other small damages using this technique. There will be no need to drill a hole parallel to the bore-well in this situation. The robot will enter the bore well and carry out the instructions given to it via a remote control. This alternate method will also save you from a tonne of additional headaches. The suggested system's design goals include saving the child's life methodically and removing the victim as quickly and safely as feasible while providing water and food to the victim trapped inside the bore hole and providing oxygen to the victim trapped within the bore well.

Poorniya *et al.* [21] This system outlines the robot's structural architecture, which includes a power source, switch pad, gear motors, an oxygen concentrator, a camera, and a microcontroller. A camera and TV are used to document the confined child's condition. The youngster can sit safely in the bladder. The lifting rod is constricted to its tightest point after the youngster is safely in place. Additionally, the motor was driven in reverse to release the system clamp. It is simultaneously pulled out of the well using a rope or chain. The MP Lab Integrated Development Environment uses the embedded C programming language. This robot-like device can quickly and safely extract a body trapped inside a borewell.

Venmathi *et al.* [22] The kid rescue in the borewell served as the basis for this approach. These days, a toddler accidentally enters an abandoned borewell that has been left exposed and becomes imprisoned. Digging another trench next to the borewell is the standard procedure to save the youngster. The current conventional approach makes it challenging and extremely dangerous to free the confined infant. The process of removing the youngster from the borewell requires more time. Inside the uncontrolled borewell, a mechanical system is in motion. The hardware that is coupled to the personal C to stimulate the DC motor is controlled by the mechanical setup in accordance with the user commands issued to the Arduino. This method makes it easier to quickly and safely remove the imprisoned infant from the bore well. A web camera and a pneumatic cylinder are carried by the robot. Three DC motors are all that are needed to complete the mechanical design. The machine's top has a first motor that rotates 120 degrees away from each other in the direction of the borewell's side. The second DC motor, which is positioned beneath the plate, rotates the bottom shaft 360 degrees to aid in locating the gap. The web camera that is fastened to the lifting rod allows users to see the visualizations. The third DC motor is utilized to lift the youngster once the gap has been located.

Tadavarthy *et al.* [23] This system shows the design of a rescue robot that can be operated via a joystick or a computer using MATLAB and ZigBee technologies. The robot may enter a borewell to save a kid. The PIC Microcontroller is the controlling device in use. The data associated with each command that a user delivers using MATLAB on a personal computer is transferred over ZigBee. The ZigBee receiver in the robot system will receive this data and feed it to the microcontroller input, which determines the appropriate direction to drive the robot, which is attached to DC motors. Live photos captured by the camera and transferred to the robot system's AV system may be seen on TV. The embedded C language is used to program the microcontroller, creating a productive environment for carrying out the project's tasks.

Preeti *et al.* [24] The three finger mechanisms that are used in the design to move inside the borewell are implemented using this technology. Circumferentially and symmetrically, the three fingers of the mechanism are 120 degrees apart. The robot's construction is adaptable so that it may change the length of its three-finger mechanism to fit the pipeline. This structural layout enables both an adjustable attractive force toward the borewell as hole as adaption to pipe diameter. The suggested device uses a camera to record the captive child's status and a laptop to display it. To measure the temperature within the borewell and show it on a laptop terminal display, an LM-35 Temperature Sensor is interfaced with an Atmega16 microprocessor. The power source, an Atmega16 development board, and gear motors make up the robot's construction. Where the first barrier requires an extra power source and a DC gear motor, the claw or gripper is added. Through scenario analysis and borewell leak detection, this technology aims to lower the danger associated with kid rescue operations.

Aravind *et al.* [25] This technique uses a manipulator, controls for sensory devices, and a power conversion unit. In order to save the infant, this technique does not require a parallel hole. The manipulator, which functions like a robotic arm, aids in holding the kid. Sensory equipment aids in updating the controller on the situation, and this sensor also aids in determining the borewell's oxygen level. All of these parts are attached to a rope, and a tripod stand that rests on the ground supports the complete setup. By using virtual pictures, the complete system is guided into the borewell. Once it has located a human body, it pauses just above the kid and provides the depth information from the earth. The system's motor makes it possible for the lifting rod to remove the youngster from the borewell in a very safe manner. Instead of having to manually handle every aspect of the system, they offer extra comfort features like cooling and the option for the system to be totally automated.

3. CONCLUSIONS

The Smart Child Rescue System from Borewell (SCRS) is a system created specifically to quickly rescue children from borewells. The shortcomings of the current traditional systems for rescuing children from borewells were addressed in the creation of this method. The youngster is stopped by this device before it plunges far down into the borewell. All of the devices are powered by the Raspberry Pi Controller, which is the best, newest, least expensive, and least power-hungry and offers the best performance. Thus, many children's lives can be spared by using this approach.

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