BORE WELL RESCUE SYSTEM BY USING ARDUINO CONTROL

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Abstract

This paper deals with a device to save a child who is stuck in a bore well. There is a decline in groundwater levels during times of drought. In most of the dried-up bore wells, the motors along with casing pipe are removed and the outer surface of the bore well is not insulated properly. As a result of this, the children who are playing near the bore well accidentally fall into the bore well. This paper deals with the rescuing process involved in lifting a child who has fallen into a bore well using Arduino Controlled Mechanical Grippers (ACMG) with a camera and an LED light to monitor the position of the child and also serve to operate the system. The linear actuators help to fix the device in the bore well. The Arduino controlled device will go down the bore well and act, also gas in the bore well is detected by the sensor. The child can be saved within a short period of time without facing any difficulties. This device will not cause any damage to the child as the device will function accurately and efficiently.

Key words: *Arduino Systems, Mechanical Grippers, Linear Actuators, bore well, DC motor, Sensors*

Introduction

The incidents of children or even adults falling in the bore well are increasing. These accidents mainly happen due to uncovered openings of bore well. The existing technology is digging of parallel hole nearer to the bore well. We have developed a machine that can take out the trapped body in a systematic way. It will also perform various life-saving operations for the sufferers such as oxygen supply, an LED camera is used to observe the actual situation closely, and have continuous interaction with the sufferer. It will be a light weight machine that will go down into the bore well hole and hold the trapped body systematically. The machine assembly will be supported by the rope and this will be controlled by the Arduino. The Arduino controlled machine will go down the bore well and act. The rescue of the children from the bore well is not only difficult but also risky. The existing systems consume more energy and are time consuming. To lift the child through the narrow hole of the bore well is also not very easy. Our system has the facility to monitor the trapped child and provide a supporting platform to lift the child driven by motors. Whatever may be the case, the success ratio depends on lots of factors like availability of human resources, time taken for transportation of machinery to the location, and mainly the response time of various government organizations. In India, according to the NDRF (National Disaster Response Force) report most of the accidents occur in Tamil Nadu.

Table 1 Statistics of Bore Well Incidents in India

S. No.	State	Percentage of Bore well Accident
1	Andhra Pradesh	5.9%
2	Assam	2.9%
3	Gujarat	17.6%
4	Karnataka	8.8%
5	Madhya Pradesh	5.9%
6	Maharashtra	5.9%
7	Rajasthan	11.8%
8	Tamil Nadu	17.6%

Problem Identification in Parallel Pit Method

There are no proper rescue techniques or methods for such accidents. In most cases, a parallel hole is dug up and then a horizontal path is made to reach the child. It takes nearly 30 hours to dig the parallel pit, by that time the child would have died. It is a time taking process, and also risky in various ways. Moreover, it requires a lot of energy and expensive resources which are not easily available everywhere. There is a possibility of injuries to the child inside the well and in most of the cases this kind of child rescue operation ended futile.

Literature Review

Sakhale et al (2015) designed a machine to rescue a child from the bore well. The robotic machine operates at 12 volt battery and controlled by a remote system. This system is supported by a gripped tyre and rope pulley drive and essential components. The infrared waterproof CCD camera and high resolution monitor are used for visualizing the situation inside the bore well. This machine goes down into the bore well and holds the trapped body systematically. **Palwinderkaur et al (2014)** described the rescuing a trapped child from the bore well without human intervention. In this rescuing process, the robot consists of gear motor, camera, and a sensor. USB camera is connected to the monitor of PC. The temperature sensor is used to sense the temperature in the bore well. The robotic system is designed with wheeled leg mechanism. This mechanism helps the robot go inside the bore well and the legs are circumferentially and symmetrically spaced out apart.

Bharathi et al (2013) described designing a robot for rescuing a trapped body from bore well. The rescuing robot is fully operated through PC by using the Zigbee technology This Zigbee module provides a control of sensor and control system. It is a bi directional wireless technology of short distance. Microcontroller is a device used to control the whole device. This robot is operated by servo motor. In this robot camera, LED lights are provided to visualize the situation.

John Jose Pattery et al (2017) described the facility of reusing a trapped child. This system consists of motors, gear mechanism, lifting rod, and air pump. First, motor is placed with gear mechanism and arranged at 120 degree from each other. The second motor is placed below the plate, and it turns the bottom shaft by 360 degrees. The third motor is used to adjust the lifting rod. The

fourth motor helps to lift the rod screw its way through the gap towards the bottom of the child. The end of the lifting rod is fixed with air bladder. It is operated through air pump. The total system is lifted out of the well using rope. **Manish Raj et al (2017)** described the rescuing robot using pneumatic system. This method consists of pneumatic and telecommunication systems. In this robotic system, the pneumatic arm is placed in the bottom of the system. The telecommunication system would also be attached to the robot for communicating with the child.

Saran et al (2014) designed a human-controlled computerized robot. This robot is used to rescue the child from bore well. It consists of servo motor, and safety balloon. The servo motor is used to hold the child. The safety balloon is used to hold the child and provides an additional safety to the child.

Satyaprasad Tadavarthy et al (2014) designed the rescuing robot consisting of 3 wheels with rubber grip and robotic arms. The wheels are connected with motor having spring suspension mechanism. The rescuing robot enters into the bore hole, and then the wheels will exactly fit to the walls of the hole which make the robot to move inside down without any sliding. This type of robot is used to pick up the baby from the borehole.

Block Diagram of Proposed System

Description of Components

Linear Actuator

Linear actuator is a device that converts rotational motion of an AC or DC motor into linear motion. It can provide push or pull movement. By pushing and pulling it is possible to lift, adjust, the robot by using simple buttons. Here, four linear actuators are used to hold the system at stationary position, and one actuator is used to up and down position of arm.

Figure 3 Linear Actuator

Arduino System

Arduino is an open source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs. By connecting L298 Bridge IC to an Arduino, we can control a DC motor. So, here we used Arduino board to control the DC motor to perform the rescue operations inside the bore well. It can transmit the signals up to 1 Km.

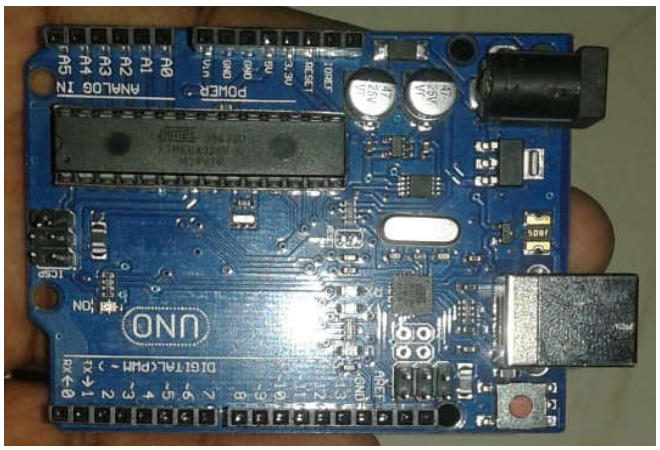

Figure 4 Arduino System

Gripper Unit

A mechanical griper is used at the end of the system for grasping the trapped child with its mechanically operated arms. Here, two grippers are used for safe and comfortable grasping.

Figure 5 Mechanical Grippers

Sensor Unit

Sensor is a device that detects and responds to some type of input from the physical environment. In this robot, we can use to measure distance, temperature, and oxygen level. We can use different types of sensor such as oxygen, pressure, temperature, pulse, and infrared sensor etc.

Proposed System

The rescue robot works mainly on the Arduino system. Here, Arduino acts as the main part of the system for the rescue process. The Arduino is used to control the system. The command will be given to Arduino and it will control the total system.

It consists of two plates to rescue a child from bore well. The first plate is attached with hook used for lifting the device. The second plates are attached with actuators. In between two plates, four actuators are circumferentially and symmetrically spaced out at 90^0 apart. Then a fifth actuator is fixed below the second plate of the system. The end of the fifth linear actuator is fixed with the rotating circular plate. The rotating circular plate contains the gripper mechanism. In the proposed system model, the existing difficulties are overcome by introducing a special gripping mechanism that has the ability to hold the child firmly and rescue safely in less time. The main purpose of this system is to make it possible for a child fallen inside a bore well to rescue without any injury. This goal is achieved by controlling a robot to take off the child from the bore well which is controlled by the person from outside.

As the bore well environment is a dark environment, the robot will have LED lights attached to it which will provide enough lighting conditions for the operation of the robot. The whole scenario will be fed live through the camera. The system will follow the command from HC-12 Arduino. The whole operation will take a minimum time to complete the rescuing process. The mechanical design is done by using five linear actuators and one DC motor. The first four actuators are used to fix the system at a distance of 1m above the victims. The fifth actuator is used for the vertical movement of

the system. DC motor is used to rotate the gripper. Motor Driver (L293D) is employed to drive the actuators and DC motors.

Here, the oxygen sensor is used to measure the oxygen level and the temperature sensor is used to measure the temperature at which the victim is present. The Pulse sensor is a well-designed plug-and-play heart-rate sensor for Arduino. Arduino HC-12 long-range noncontact measurement function and the ranging accuracy can reach to 1 kilometer. Here, the rescue unit contains LED light with a camera and sensor Arduino is used to transmit the signal to an LCD display or for visualization during night time.

Figure 6 Cad Modeling of Proposed System

Conclusion

Human life is precious. Our bore well child rescue system is a significant attempt to save the life of the victims of bore well accidents. The simple technique to rescue children has been explained. Our main intention is to save the life of innocent children who fall in bore well. Thus, our system will be of utmost safe and low cost for the rescuing operation. To augment the efficiency of our system, we have planned to include a Gas sensor which will be used to check any toxic gas present inside the bore well. Sponge kind of soft material can be used at the inner arms of the gripper, taking care that it will not hurt the child while holding. To conclude with the help of our proposed system, we will be able to rescue without causing any damage to the victim.

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