Far East Journal of Electronics and Communications

Published: December 2016
http://dx.doi.org/10.17654/EC016040909
Volume 16, Number 4, 2016, Pages 909-916 **ISSN: 0973-7006**

AUTOMATED BORE WELL RESCUE ROBOT

Joselin Retnakumar G., Raghu Varma Ratnala, N. Showme[*] and Pradeep Kumar D.

Department Electronics and Instrumentation Engineering
SRM University
Kattankulathur, Chennai, India

[*]Department of Telecommunication Engineering
SRM University
Kattankulathur, Chennai, India

Abstract

This paper mainly focuses on the automatic rescue operation of the children struck in bore well environment. As the statistics suggests in the consecutive years starting from 2006, still more than 30 deaths occurred while stuck in bore well. Earlier method of rescuing a child from bore well takes more time and involvement of much man power. A technique for rescue task in bore well environment has been proposed in our model. Our model requires very less time for the rescue operation of child and no involvement of manpower. A DC motor is placed at ground level in which the shaft of the motor is connected to a rod, rolled with rope. It consists of a clamp claw arrangement setup for holding the target (Victim) which is operated automatically based on Ultrasonic distance sensor. Based on the ultrasonic sensor distance the motor at ground level, clamp claw setup is operated automatically. In order to visualize the condition of child

Received: July 25, 2016; Accepted: August 19, 2016
Keywords and phrases: clamp claw setup, ultrasonic distance sensor, blower setup, temperature sensor.

inside the bore well a camera with transmitter is attached to the robot and receiver with visual display at ground level is placed. An LM35 Temperature sensor with 16*2 LCD display is attached to the robot. Based on the temperature inside the bore well a blower is operated automatically from ground and sends the oxygen and cool air along with the robot. Our robotic system which will attach a harness to the child using robotic arm for picking up and bringing the child out of the bore well safely.

1. Introduction

In India, we are having the most helpless situations where children below the age of 5 fall under the bore well and found dead. As the statistics suggests in the consecutive years starting from 2006, still more than 30 deaths occurred while stuck in bore well. This happens because of the improper covering of the bore well head after digging it. This lead to the children slip suddenly inside the bore well and shouting out for help but because of lack of oxygen and increased temperature inside the earth's crust the child life will go slowly. A decade ago the existing way [1] of rescuing the child was, people start digging the whole parallel to the bore well deep inside the earth and then move horizontally to bring the child out. But this way of rescuing is a very risky operation because it takes many hours to dig deep till 100feet. Moreover, if there are any rocks while digging then chances of saving the child will be less. While digging as we go deep inside the earth's surface lack of oxygen and light, increased temperature will also become the challenging situations. An adaptive robot having three legs parallelogram in structure which are placed 120 degrees apart with grippers attached to its legs and controlled manually from the ground level have also been proposed [2]. Our model for rescue operation is fully automatic and we can also control our robot manually from ground level by turning on manual mode. At starting of the rescue operation we should choose the mode (Auto or Manual) of operation. If we select auto mode, the robot will start functioning automatically and brings the child out. If we choose manual mode then we can able to operate the robot manually from ground level.

2. Objectives

The objectives of our design are as follows:

• Making a robot to function automatically for bringing the child out of bore well.

• Temperature display unit and controlling the flow of oxygen from ground through pipe based on the displayed temperature.

• Making the robotic system to function in automatic and manual mode.

• Developing audio and video systems for communicating with the child.

3. System Description

Our system is mainly divided into two types, one part is the robotic unit that goes inside the bore well and other part is the manual controller unit which is present at the ground level. The robotic unit consists of clamp claw setup, two circular disc, Arduino controller, temperature sensor with 16*2 LCD display, ultrasonic distance sensor, audio receiver and the camera with transmitter. The robot is tied through a wire and the other end of the rope is attached to the motor shaft, such that if the motor rotates in clockwise direction then the robot moves inside the pipe and if it rotates in anticlockwise direction then the robot moves outside of the pipe [3].

At the top surface of the bore well pipe a pulley arrangement is made and both the pulleys are separated 90degrees apart. These pulleys are attached to the “Y” shaped ends fixed to the pipe. The rope is made to pass through the pulley arrangement such that the robot moves smoothly inside the bore well pipeline [4].

The clamp claw consists of a clamp and claw separately. Using the gears the clamp and claw opens and closes. These gears are attached to a 12V DC motor. The circular discs are placed just above the clamp claw setup. Both the circular discs are separated with some space between them for placing the Arduino board and 4 channel relay module. The circular discs are having a

diameter lesser than that of the bore well pipeline such that the robot can move freely inside the pipe. To the bottom of the circular disc the clamp claw setup is placed and at the top surface wire from the main motor are attached.

The Arduino UNO is the controller used in this system. The controller does the following operations in our project:

(1) The temperature measurement system and displaying it on a 16*2 LCD display.

(2) Receiving the voltage signals from ultrasonic sensor and giving outputs to the clamp claw setup motors and the main motor through relays.

(3) Based on the temperature, operating the blower to supply cool air through pipe inside the bore well.

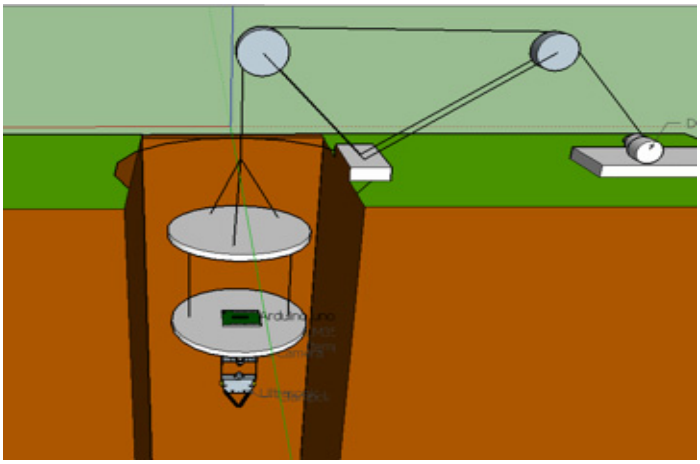

Figure 1. Overview of the automated bore well rescue robot.

LM35 is the temperature sensor used in our project. This sensor is attached to the clamp of the robot. This sensor senses the temperature inside the bore well and converts that signals to voltage and gives it to the Arduino. The Arduino process the signals according to the code and displays the temperature on a display which can be seen through camera placed inside the robot. HCSR04 ultrasonic sensor is placed inside the claw and it gives the signals to the Arduino [5, 6].

Camera is attached to the lower end of the disc for having a clear vision of what is happening inside the bore well. A flashlight is also attached to it. The camera is having a transmitter, through which it transmits the signals the signals. The receiver at the ground level receives the signals and displays the video on the screen. There is also an audio transmitter fitted inside the robot for communicating with the child.

The manual controller unit based at the ground level consists of a motor holding the entire robotic unit through wire and shaft with pulley, bidirectional switches for operating the robot manually, a blower with pipe attached.

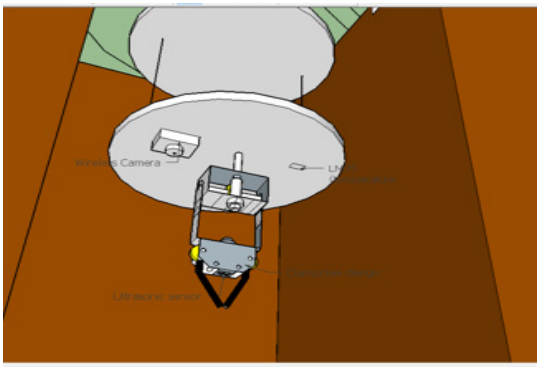

Figure 2. Bottom view of the robot with clamp claw and camera.

The main motor is capable of holding a weight of the robot and the child and it can pull it up. To that motor a shaft is attached and the wire is rolled on to that shaft such that based on motor the robot moves up or down. The bidirectional switches are placed and attached to the clamp claw setup and the main motor for operating them manually. The signal from the Arduino based on the temperature is sent to the relay on ground level such that the voltage is stepped up through a transformer to 230V and given to blower.

4. Operation

(A) Auto operation

At first the robot is kept inside the bore well which is tied with the rope.

When we press the auto mode for its operation the ultrasonic sensor which is attached to the claw of the robot starts emitting the ultrasonic waves. Until the robot does not find any object the motor rotates continuously so that the robot attached to motor with rope moves down. Whenever any object is found inside bore well then the motor in the ground stops. Then the clamp starts adjusting its position in straight way and the claw opens completely. If the child is conscious through audio signals we can ask the child to place his hand inside the claw. Then as soon as the child places his hand inside the claw. The claw holds the child hand and now the motor at ground level starts rotating in anticlockwise direction. If in case the child is unconscious then we can instantly switch to manual mode and by looking into visual of child we can pull the child manually by operating the robot from ground level. Based on the temperature inside the bore well the cool air and oxygen through pipe from blower is sent inside.

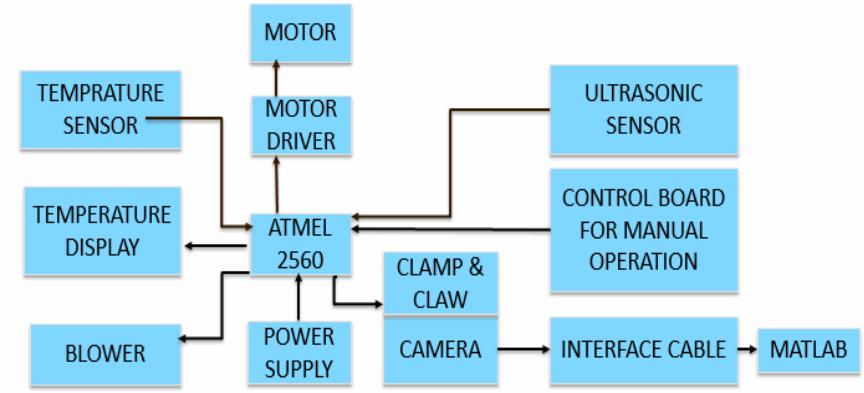

Figure 3. Block diagram of the overall system.

(B) Manual operation

In this mode, the robot is kept inside the bore well which is tied with rope as usual. When we turn on manual mode the robot does not operate automatically. Using the bidirectional switches connected to the motor we can make the robot to move upwards and downwards. By seeing into the visual in display we can make the robot to reach till the position of child. If

the child is conscious, we can communicate with the child by saying him to place his hand inside the claw and bring him till ground level. If the child is found unconscious, through bidirectional switches operated from ground level we can operate the clamp claw and pick the child up. Similarly here also based on the temperature inside the bore well the cool air and oxygen through pipe from blower is sent inside.

5. Conclusion

The existing way of child rescue operation is time consuming and also a risky operation. With the help of our system we can make the robot to function in both automatic and manual mode. The operation requires very less time and we can save the child by using this robot. This robot is tested on a 10feet height bore well by lifting a weight of 3kg automatically in very less time. The operation of supplying oxygen and air also functioned properly based on temperature. Finally by this way of operation can be implemented in real life for rescuing the child struck in bore well environment.

References

[1] Sridhar Palaniswamy, Life saving machine, The First International Conference on Interdisciplinary Research and Development, 31 May - 1 June 2011, Thailand.

[2] M. Wegmuller, J. P. von der Weid, P. Oberson and N. Gisin, High resolution fiber distributed measurements with coherent OFDR, Proc. ECOC’00, 2000, paper 11.3.4, p. 109.

[3] Palwinder Kaur, Ravinder Kaur and Gurpreet Singh, Pipeline inspection and Bore well rescue robot, International Journal of Research in Engineering and Technology 3(4) (2014), 726-729.

[4] S. Gopinath, T. Devika, L. Manivannan and N. Suthanthira Vanitha, Rescue child from Bore well using embedded system, International Research Journal of Engineering and Technology (IRJET) 2(3) (2015), 269-273.

[5] Sanket Arun Talekar, Suraj Bhimrao Katkar and Pooja Kumari, Rescue system for borewell accidents, International Journal of Recent Advances in Engineering and Technology (IJRAET) 3(2) (2015), 23-27.

[6] M. Raj, A. Bansal, A. Makhal, P. Chakraborty and G. C. Nandi, An approach towards rescue robotics in bore well environment, 2014 International Conference on Communications and Signal Processing (ICCSP), 2014 Melmaruvathur, 2014, pp. 1097-1100.