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Smart Bore well Rescuing Robot

Ms. P. Suji[1], Ms. B. Shahina Farhin[2], Ms. N. Sheikh Chandini Ramijha[3] and Mr.G. Jayaraman[4]

[1,2,3]UG Scholar, Francis Xavier Engineering College, Tirunelveli, India.
[4]Associate Professor, Francis Xavier Engineering College, Tirunelveli, India.
Email: shahinafarhin@gmail.com[1], bestfrndz.sujiperumal@gmail.com[2], chandinisheikh5@gmail.com[3], icon4jai@gmail.com[4]

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ABSTRACT

Normally we have gone through many incidents of children falling into abandoned borewells. Usually the rescue team dugs a big hole parallel to the borewell which takes almost 20-60 hrs. Then trained army persons will move inside the borewell and rescue the victim. In such cases, a very small delay may also reduce the chances of saving the victim alive. To overcome this issues we proposed a system, in which the Robot can move inside the bore well and rescue the child safely. In our project we use Arduino Uno microcontroller which is used to control the Ultrasonic sensor. This Ultrasonic sensor is used to measure the distance at which the victim is present and displays it on the LCD display in both meter and centimeter. The Rescue unit consists of two DC motors, a Web camera and a LED light. Web camera is connected with the PC to view the status of the victim inside the borewell. A motor driver (L293D) is used to drive two DC motors. One DC motor is used for the horizontal and vertical movement of the rescue unit and another DC motor is used for the open and close movement of the rescue unit. Thus our project is easily portable and less expensive which can be used in any situation to rescue the victim safely and also in less time.

Key Words: Arduino UNO, Ultrasonic Sensor, Motor Driver (L293D), Rescue unit.

1. INTRODUCTION

The expected number of wells and borewells in India is now reducing and there are only twenty-seven million borewells. Growing water scarcity is one of the most important problems in India. Since the water level is decreasing day by day so more peoples are affected. Borewells are constructed to overcome water scarcity. These borewells are left opened after finding that ground water is not abundant in that place. Borewells that yielded water and subsequently got depleted are left uncovered. The bore wells in turn have started to take many innocent lives. Small children without noticing the borewell fell inside and get trapped. There is no proper technique to rescue in case of such accidents. In most cases a parallel hole is dug up and then a horizontal path is made to reach to the baby. It takes nearly 20-60 hours to dig the parallel pit, by that time the child would have lost its life.

It is a time taking process, and also risky in various ways. There is possibility of injuries to the child inside the borewell. Whatever may be the case the success ratio depends on lots of factors like availability of time taken for transportation of machinery to the situation, human resources and mainly the response time of various government organizations. In India according to the NCRB (National Crime Records Bureau) report of 2011 there are 5 average deaths per day in the license bore wells.

2. PROBLEM STATEMENT

Some of the works related to the robotic system and rescue of child from borewell is implemented a robotic hand that has the ability to identify object based on tactile sensor and can extract features from single grasp, the pressure sensors are also equipped with the robotic hand. This technique can be applied to the robotic arms involved in the rescue operation of children from borewell but this system has more sensors which makes the circuit more complex and also large power consumption. Another proposed machine which aids the rescue operation by providing

support system such as oxygen supply system and they also provide a software [1-21] which indicates the level of temperature. The above method provides an alternate approach to conventional rescue system but fails to rescue the child from the borewell moreover the child cannot survive if the rescue operation takes longer time. Then a controller based system to control [22-36] the entire rescue operations and also it uses wireless transmission as a model for communication but only the simulation of rescue operation is shown and the hardware model is not implemented.

Then a robotic machine was proposed to rescue a child from the borewell, this model consists of robotic arm which will evacuate the child from the pit. The main concern with this implementation technique is that, the arm developed to grasp the child is mechanical and it is very difficult to position the robotic arm irrespective to the position of the victim also it may harm the child while holding.

Another problem is that, failure of the arm at the top of the well will cause certain death to the child as no fail-safe mechanism is available. The existing challenges were overcome by the model proposed in our paper which is shown below, then the hardware and software setup of the system is discussed along with the implementation of the model proposed.

3. PROPOSED SYSTEM

In the proposed model the existing difficulties were overcome by introducing a special gripping mechanism which has the ability to hold the child tightly and rescue safely in less time. This work is aimed towards the construction and designing of a robotic system to work in borehole rescue operations and to detect faults inside the pipeline. The robot has arms at its front to pick and place the objects. The main objective of this project is to make it possible for a child fall inside bore well to rescue without any injury. This goal is achieved by controlling a robot to take of the child inside the bore well which is controlled by the person from outside.

As the bore well environment is a dark environment the robot will be having lights which will provide enough lighting conditions for the operation of the robot. The whole scenario will be feeded live through the communication module which will publish the images from the cameras of the robot. The family members of the victim can also see the condition where their family member is been stuck. The robot plays a vital role in rescuing operation and helpful to rescuers during the disasters.

The robot will follow the user command given from a PC. The mechanical design is done by using only two DC motors. The whole operation will take about the minimum time to complete the action. First DC motor is used for the horizontal and vertical movement of the rescue unit and the second DC motor is used for the open and close movement of the rescue unit. Motor Driver (L293D) is used to drive 2 DC motors. We also have a control system which is used to control the horizontal and vertical movement and also for the open and close movement of the rescue unit.

3.1. BLOCK DIAGRAM

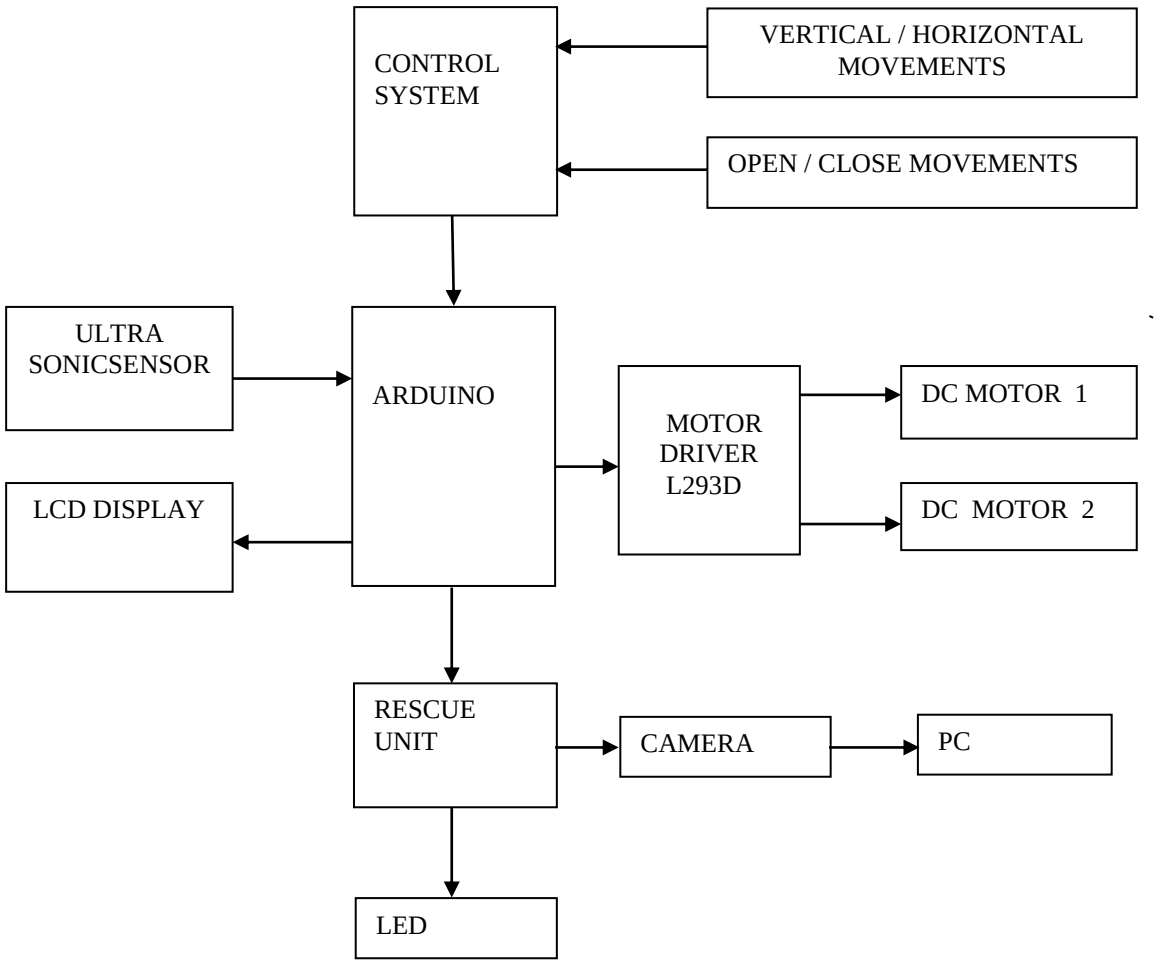

Figure1. Block diagram of Borewell Rescue Robot

The 230V AC power supply is given to the step down transformer and this step down transformer converts the 230V AC into 5V AC. Then the output of the transformer is given to bridge rectifier and it is converted into pulsating DC. The pulsating DC is converted into pure DC by the capacitor filter. The voltage regulator converts the incoming 12V DC into 5V DC. The 5V signal is then given to Arduino. Another step down transformer converts 230V AC to 12V AC which is given to motor driver to drive 2 DC motors.

DC motor 1 is used for the vertical and horizontal movement of the whole setup and DC motor 2 is used for the open and close movement of the rescue unit. Initially ultrasonic sensor is used to identify the distance at which the victim is present and displays it on the LCD display. The ultrasonic sensor converts the distance in both centimeter and meter.

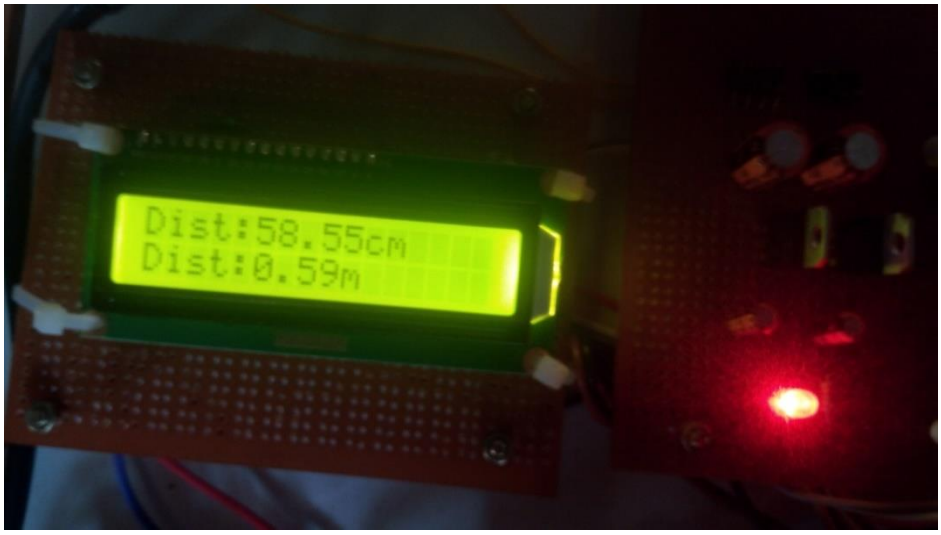

Figure 2. Distance measurement using Ultrasonic sensor

Here the ultrasonic sensor measures the distance at which the victim is present and displays it on the LCD display in both cm and m.HC - SRO4 is low cost, high accuracy altitude sensor. Ultrasonic ranging module HC - SR04 provides 2 - 400 cm non- contact measurement function and the ranging accuracy can reach to 3 mm. The modules includes the ultrasonic transmitters, receiver and control circuit. Here the rescue unit is nothing but the robotic arm which contains ultrasonic sensor, LED display and a web camera. LED display is used for the purpose of visualization during night time.

4. RESULT AND DISCUSSION

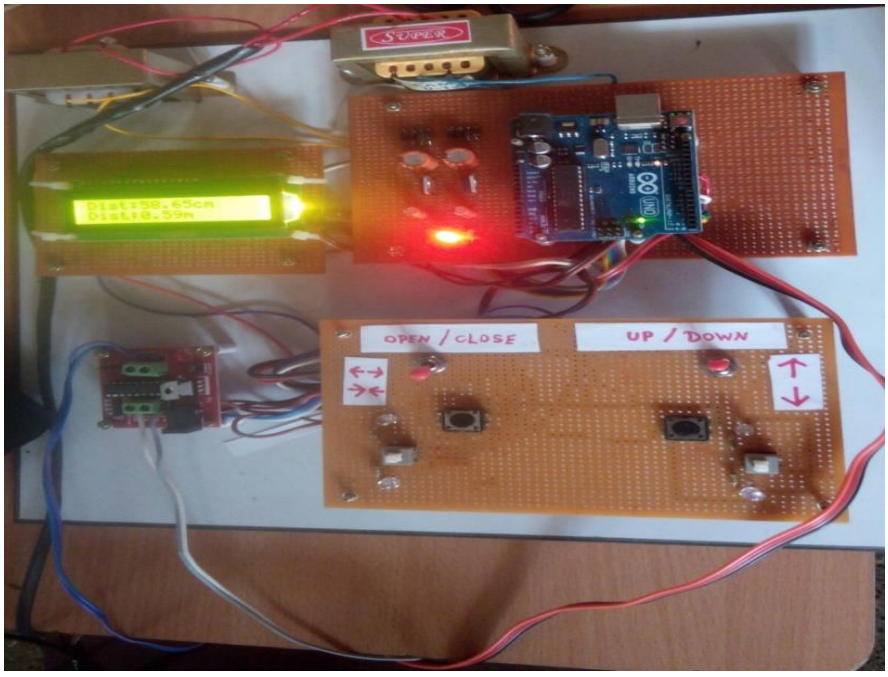

Figure. 3 Hardware setup of Arduino

This is the Hardware setup of Arduino Kit consisting of LCD display, 2 step down transformers, arduino, motor driver and control system. This arudino kit is connected to the mechanical setup and it controls the 2 DC motors present in mechanical setup.

5. MECHANICAL DESCRIPTION

Figure Mechanical Setup of Bore well with 2 DC motors

Figure Structure of Rescue Unit

Figure 5.2 describes the mechanical setup of our project consisting of the rescue unit system and the bore well setup. Figure 5.3 shows the structure of robotic arms which is used to rescue the child.

6. CONCLUSION AND FUTURE ENHANCEMENT

The main purpose of our project is to rescue the victim from bore well with more safety and in less time. If delay happens in the rescue of the victim then there are more chances for the victim to lose life. In order to avoid that we are using ultra sonic sensor to measure the distance at which the victim is present so that we can easily get through the victim. In addition our project consists of 4 limbs in the rescue unit which provides better grip for the victim during rescuing operation. Thus our project will be of high safe and low cost for the rescuing operation.

The future enhancement of our project is to include Gas sensor which is used to check any toxic gas present inside the borewell. In addition to this an oxygen probe can be connected which is used to supply oxygen to the child .A small vacuum unit with appropriate pressure could be used to suck the mud particles that have been accumulated over the baby and disturbing the proper acquisition of the images. Sponge kind of soft material can be used at the inner arms of the Robot, taking care that it will not hurt the child while holding. A mesh structure can be designed in order to prevent the falling of mud over the child.

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