

A Robotic Rescue System for Borewell Emergency Situations: Design and Implementation

Dr. Maria Gonzalez, Dr. Lars Becker, Dr. Chen Wei

Department of Environmental Sciences, University of Barcelona, Barcelona, Spain

Institute of Geophysics, University of Hamburg, Hamburg, Germany

School of Earth and Space Sciences, Peking University, Beijing, China

ABSTRACT

Now a days bore well are present in all areas, and the access rate of bore wells are been increased day by day in order to stagnate the water. Unexpectedly some of the bore wells have not been closed after digging. Some of accidents happening where children unexpectedly fall into bore well. In order to rescue the child we have many techniques. It take very long time and also complicated process to save the child from bore well, and also risk factor involved in the operation is more. Our Paper implies a new design which has a sensor kept at top of bore well hole which helps to sense the child if he/she fell inside. If the system senses the child the automatic horizontal closure kept at around five feet depth closes and prevents the children from falling beneath it. With the help of pulley system, the horizontal closure can be moved up to take out the child from well. This system also alerts by giving siren and information can be displayed with the help of LCD. Hence this system will help to protect children from falling in bore well. In this paper we propose as system architecture using LPC2148 micro controller. The proposed system is one of the smart ways to save the child from bore well.

Keywords: *LPC2148 Micro Controller, PIR Sensor, Bi-directional linear DC Motor, Buzzer.*

I. INTRODUCTION

Water shortage is the real issue confronted by the human culture. Because of dry spell and exhaustion of underground water more bore wells are penetrated on the surface of the earth. Because of water shortage more bore wells are being sunk. In numerous territories the bore wells are bored and leaved as it as open with no legitimate covering as they don't deliver any water and along these lines individuals couldn't care less to top them off or close them appropriately. This relinquished bore wells have progressed toward becoming passing pits and began taking numerous pure lives particularly little youngsters. Presently a days falling of kids in bore wells are expanding because of the recklessness and energetic exercises of the youngsters. The openings dug for the bore wells are profound around 700 feet. In these cases the safeguard of kids from such most profound bore wells is very testing. Commonly the protect framework for kids from bore wells may chance the tyke life. As of late some independent robots made advances on screen to take out the caught body methodically. In any case, the inquiry rises, why these bots are not in real life in this present reality. This brings out security issue that how securely these robot handle the casualty. The save operation mostly comprises of three procedures: Approaching the Victim, Handling the body, Taking youngster out of the well. A customary self-sufficient robot can without much of a stretch play out the first and third operations in less time. However, there is an incredible shot for damage of casualty as they take a stab at connecting body organs and materials.

As the famous saying of famous scientist Benjamin Franklin —An Ounce of Prevention is Worth a Pound of Curel. In order to overcome these hurdles a new system of preventing children from falling into bore wells is designed and named as Protection of Child from Well using LPC2148.

II. RELATED WORK

B.Bharathiet-al [3] describes the planning a robot for save a child from inside bore well, which is equipped for moving inside the drag well, as indicated by the human remark by PC and furthermore pick and setting in view of arm outline. . The robot is worked through PC utilizing remote Zigbee innovation and utilizing remote camera can see both sound and video on the TV. This robot has a powerful LED which goes about as a light source when light force inside the pipe is low. It is a minimal effort robot used to screen and the human controlled robot that gives an understanding perspective of safeguarding the infant securely taken to accomplish this.

John Jose Pattery *et-al* [6] describes the office to screen the caught youngster, supply oxygen and give a supporting stage to lift up the tyke. The first engine put at top turns a rigging component which, thusly, pushes 3 pieces masterminded at 120 degrees from each different towards the side of the drag well. The second engine set beneath the plate turns the base shaft by 360 degrees, the finding the hole through which the lifting bar passes. This is finished with the assistance of a remote camera joined to the lifting bar. The third engine changes the spiral separation of the lifting bar. At the point when the measurement is balanced, the fourth engine causes the lifting pole to screw its way through the crevice towards the base of the youngster. Once the lifting the bar achieves a protected position under, an air compressor is worked to direct air to the bladder joined to the finish of lifting pole through an air tube that runs downwards inside the lifting pole. The bladder gives a sheltered seating to the tyke. At that point first engine is then conversely worked in order to unclamp the framework. At the same time it is lifted out of the well utilizing a chain or rope.

III. EXISTING SYSTEM

In normal rescue operation, a parallel hole to the bore well is dug deep to reach the position of child and then a horizontal path is created. Then a man will be sent through the well to rescue the child from the hole. The depth of the child in the bore well can be found by using rope. Normally it takes twelve to thirty hours of time to save the child. The presence of the child in the bore well is not identified by the rescue workers. So it's the time consuming process and moreover the life of the child is not assured. The injuries during and throughout the rescue operation also leads to the death of child.

It is fully manual and also risky in many ways. It involves a lot of energy and expensive resources which are not easily available everywhere and in this process, Always a big space is needed around the trapped bore that can be utilized to dig a parallel bore. If the area beside the bore hole contains rocks below certain depth, in such cases the chance of saving child alive is very low. Lack of oxygen inside the bore well and lack of light sources causes the major difficulty during the rescue operation. The lack of oxygen inside the deep hole makes it impossible for the child to survive for long time .Hence this operation proves very difficult, risky and time consumptive.

In another method a light weight machine goes inside the bore well pipe and holds the trapped body systematically.

Some kind of hooks used in this method and sufferers' clothes or body organs gets caught hold of. This may cause wounds on the affected body.

IV. WORKING PROCEDURE OF PROPOSED SYSTEM

In order to overcome the drawbacks of an existing system a new system is proposed and named as Implementation of Smart Child Rescue System In Bore well Using LPC2148. This consists of PIR sensors which help to sense only humans irrespective of the external conditions. These sensors are placed at the top of the bore well pipeline which helps to sense the human being if he/she fell in the pipeline. These signals from the sensor will be sent to the ARM7 Microcontroller. This Microcontroller analyses this and immediately closes the automatic horizontal closure by the help of gear wheel system. Horizontal closure is fixed at around 5 feet depth in the bore well pipeline. The top surface of the horizontal closure is well softened for safe landing of children. At the same instant the microcontroller gives the alert siren sound to alert the neighbourhoods. With the help of pulley system the horizontal closure can be moved up to taken out the child from well. LCD can be used to display the information. Hence this system will help to save the child from bore well.

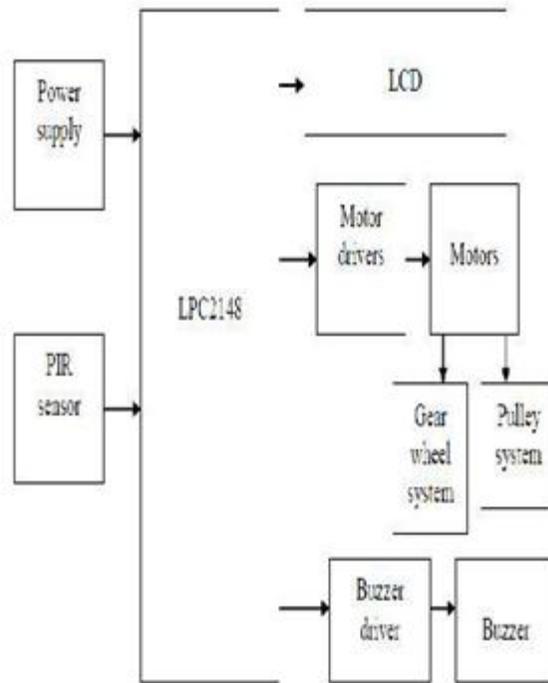


Fig 1 : Block diagram of Proposed System

V. SYSTEM ARCHITECTURE

The system architecture consists of software and hardware. The implementation on hardware is performed with the help of software i.e. program which is dumped into the hardware system.

Hardware Development

The smart Child Rescue System (SCRS) has several hardware component namely ARM LPC 2148, PIR Sensor, Stepper Motor, LCD Screen, Power supply, Buzzer. ARM LPC 2148 is considered as the Heart of the System which is main decision controller of the System which takes input from PIR sensor, and operates the modules based on the input from PIR sensor.

LPC 2148:

ARM7 is most successful and widely used processor family in embedded system applications. So we have decided to choose ARM7 TDMI based NXP controller LPC2148. Also, ARM7 is a balance between classic and new Cortex series. ARM7 is excellent to get start with in terms of resources available on internet and quality documentation provided by NXP. It suits perfectly for beginners to get in-depth idea about hardware and software implementation.

LPC2148 is manufactured by NXP Semiconductor (Phillips) and it is preloaded with many in-built features and peripherals. This makes it more efficient and reliable choice for an high-end application developer.



Fig 2. ARM7 LPC2148

PIR Sensor:

A passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are most often used in PIR-based motion detectors. PIR sensors are incredible, they are flat control and minimal effort, have a wide lens range, and are simple to interface with. A PIR or a Passive Infrared Sensor can be used to detect presence of human beings in its proximity.



Fig 3. PIR sensor

LCD Screen:

LCD stands for **L**iquid **C**rystal **D**isplay. LCD is finding wide spread use replacing LEDs (seven segment LEDs or other multi segment LEDs) because of the following reasons:

The declining prices of LCDs.

1. The ability to display numbers, characters and graphics. This is in contrast to LEDs, which are limited to numbers and a few characters.
2. Incorporation of a refreshing controller into the LCD, thereby relieving the CPU of the task of refreshing the LCD. In contrast, the LED must be refreshed by the CPU to keep displaying the data.
3. Ease of programming for characters and graphics.



Fig 4. LCD display

Bi-directional linear DC Motor:

Dc motors are increasing in popularity due to their performance advantages over ac motors. Advantages of DC motors include Speed control over a wide range both above and below the rated speed, High starting torque- have a starting torque as high as 500% compared to normal operating torque, Accurate steep less speed with constant torque, Quick starting, stopping, reversing and acceleration, Free from harmonics, reactive power consumption and many factors which makes dc motors more advantageous compared to ac induction motors.

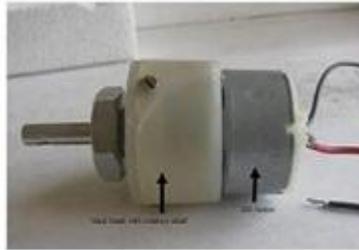


Fig 5. Bi-directional linear DC Motor

Buzzer:

A Buzzer is an audio signalling device which may be electro mechanical or piezo electrical. The uses of Buzzers includes alarm devices, timers and confirmation of user input. Sounds commonly used to indicate that a button has been pressed are a click, a ring or a beep. A piezo electric element may be driven by an oscillating electronic circuit or other audio signal source driven with piezo electric audio amplifiers.



Fig 6. Bore well rescue system

VI. CONCLUSION

Implementation of Smart Child Rescue System In Bore well Using LPC2148 is installed on Bore well which is under construction or under working. The PIR sensor in SCRS checks regularly for if any child fell inside the Bore well hole. If once the PIR sensor senses the child then it gives signal to the Microcontroller which is the heart of the system. Then this Microcontroller operates the Horizontal Closure and makes it to close. The Child will land safely in the Horizontal Closure which is in around 10 feet. The horizontal closure is worked by means of a gear well system. And then the pulley system is activated to move the horizontal closure up to come out of the child from the well. The neighbourhoods will get alert by the alarm system placed at the top of the bore well. The entire information can be displayed on the LCD. With the help of this system the child can be rescued safely in short duration of time. This system will be useful for preventing child from falling into bore well.

REFERENCE

1. Kavianand G, Gowri Ganesh K, Karthikeyan P Smart Child Rescue System from Bore well (SCRS) 2016 International Conference on Emerging Trends.
2. Manish Raj, Arpit Bansal, A. Makhal International Conference on Communications and Signal Processing (ICCSP), 3-5 April 2014
3. B. Bharathi, B. Suchitha Samuel—Design and Construction of Rescue Robot and Pipeline Inspection Using Zigbee International Journal Of Scientific, Engineering and Research (IJSER) Volume 1 Issue 1, September 2013.
4. Palwinder kaur, Ravinder kaur, Gurpreetsingh —Pipeline Inspection in Engineering and Technology(IJRET) Volume issue:03 Issue:04 April 2014.
5. Manish Raj, P.Chakraborty and G.C.Nandi —Rescue robotics in bore well Environment Cornell university library [v1] Mon, 9 Jun 2014 10:51:44 GMT (244kb).
6. John Jose pottery —robot for bore well rescue amaljothi college of engineering vol 10, Jun 2009.
7. Gopinath, S., T. Devika, L. Manivannan, and N. Suthanthira Vanitha. "Rescue Child from Bore well using Embedded System." (2015).
8. Venmathi, V., E. Poorniya, and S. Sumathi. "Bore well Rescue Robot." International Journal of Computer Applications 113.14 (2015).
9. Dr. C.N. Sakhale, 2D.M. Mate 3Subhasis Saha, Tomar Dharmal, Pranjit Kar, Arindam Sarkar, Rupam Choudhury, Shahil Kumar, An Approach to Design of Child Saver Machine for Child Trapped in Borehole, International Journal of Research in Mechanical Engineering, October-December, 2013, pp. 26-38.

10. *G. Nithin, G. Gowtham, G. Venkatachalam and S. Narayanan, School of Mechanical Building Sciences, VIT University, India, Design and Simulation of Bore well rescue robot– Advanced, ARPN Journal of Engineering and Applied Sciences, pp. MAY 2014.*
11. *Sridhar Palaniswamy — Life Saving Machine\ the first International*
12. *Conference on Interdisciplinary Research And Bore well Rescue Robot International Journal of Research and Development, 31 May-1 June 2011, Thailand.*