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# CHILD RESCUE SYSTEM AGAINST OPEN BORE-WELL

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## ABSTRACT

*For past few years, there have been several accidents of children falling into an abandoned bore-well which is left uncovered and get trapped. Abandoned bore wells seems to be death pits for children. These bore-wells in turn have started to take many innocent lives. In such cases normal operations of child rescue from bore-wells is very complicated process with big machines and large man power. The aim of this paper is to rescue children falling in to bore-wells, this implies a new design which has a sensor kept at top of bore-well hole which helps to sense the child if he falls inside. If the system senses the child the automatic horizontal closure kept at around 3ft dept closes and prevents the children from falling beneath, it has the facility to monitor the trapped child, and provide a supporting platform to lift up the child driven by motors. The motor placed at the top turns a gear mechanism which, in turn, pushes 3 blocks arranged at 120 degrees from each other towards the side of the bore well. The whole system is firmly to the bore-well wall. The 2nd motor placed below the plate turns the bottom shaft by 360 degrees, thereby helping to locate the gap through which the lifting rod passes.*

***Keywords: IR sensor, LPC2148 ARM Controller, DC motor, LCD Display, GSM module***

## I. INTRODUCTION

Recently, many accident reports of children (and even adults) falling in open bore-wells have appeared in the print and the electronic media. Very few of the victims have been saved in such accidents. In some of these cases the dead body of the subject could not be collected easily. Even if rescued late, most victims were reportedly injured. To overcome such problems of these rescue operations, we have an alternative (feasible) proposal. We are developing a robot machine that can take out the trapped body in systematic way. It will also perform various life-saving operations for the sufferers such as oxygen supply. A video camera to observe the actual situation closely and continuous interaction with the sufferer could also be attached. It will be a light weight machine that will go down into the bore well pipe and hold the trapped body systematically.

This machine assembly will be supported by a cable wire and this will be controlled and supported by a gear assembly. In this alternative scenario, there will be no requirement of digging any whole parallel to the bore-well. The remotely controlled robot will go down the bore well and perform the action. A lot of other hassles will also be avoided by this alternative technique. The rescue of these trapped children in an uncovered bore-well is not only difficult but also risky. A small delay in the rescue can lost the child his or her life. To lift the child out the narrow confines of the bore wells is also not very easy. The child who has suffered the trauma of the fall and is confined to a small area where, with a passage of time the supply of oxygen is also reduces. Robot for bore well rescue offers a solution to these kinds of situations. It is fast, economical and safe.

Moreover, it has the facility to monitor the trapped child, supply oxygen and provide a supporting platform to lift up the child driven by motors. The motor placed at the top turns a gear mechanism which, in turn, pushes 3 blocks arranged at 120 degrees from each other towards the side of the bore well. The whole system is firmly to the bore-well wall. The 2nd motor placed below the plate turns the bottom shaft by 360 degrees, thereby helping to locate the gap through which the lifting rod passes. This is done with the help of a wireless camera attached to the lifting rod. Once the gap has been located, the 3rd motor adjusts the radial distance of the lifting rod. When the diameter is adjusted, he 4th motor helps the lifting rod to screw its way through the gap towards the bottom of the child. Once the lifting rod reaches a safe position under the child, an air compressor is operated to pump air to the bladder attached to the end of the lifting rod through an air tube that runs downwards inside the lifting rod. The bladder provides a safe seating to the child. When the child is secure, the lifting rod is contracted to its maximum position.

The 1st motor is then reversely operated so as to unclamp the system. Simultaneously it is lifted out of the well using a chain or rope. This machine will be a light weight and easy to operate as compared to other alternative methods, that will go down into the bore well pipe and hold the trapped body systematically. This machine assembly will be supported by a cable wire and this will be controlled and supported by a gear assembly, a stand and all necessary accessories. This child rescue presents a proactive approach to prevent child fatalities at open uncapped bore-wells in India, which is based on communications using Infra-Red signals. When the signal generated by IR sensors, placed two inches below the entrance of bore-well, breaks due to any obstructing object, an alert message is dispatched through GSM and at the same time, a metal plate that is kept a few feet lower in the bore-well closes the bore in order to prevent the object from falling deeper into the well.

The solution presented in this project is a simple and yet easily scalable and highly reliable, utilizing the proven technology of Infra-red signaling. There is no proper technique to rescue victims of such bore well accidents. The existing technique[4] which involves digging the parallel hole to rescue the child next to the bore well in which the child has trapped actually. Moreover, it involves a lot of energy and expensive resources which are not easily available everywhere and in this process, we always need big space around the trapped bore that we can dig a parallel bore. These ad-hoc approaches involve heavy risks, including the possibility of injuries to the body of the subject during the rescue operation. Also, the body may trap further in the debris and the crisis deepens even more means death. In most cases, we rely on some make shift arrangements. This does not assure us of any long term solution. In such methods some kind of hooks are employed to hold the sufferers clothes and

body. This may cause wounds on the body of the subject. The successive technique involves manual work. It is not only a time taking process, but also risky in various ways. The advent of new high-speed technology and the growing computer Capacity provided realistic opportunity for new robot controls. Recently many accidents occurred in India. Forty five deaths of children have been reported in the country since September 2009[2], from that we have only nineteen with the proof of a newspaper(refer table no 2.1) After studying all the cases, we found a solution to do, which results a robotic machine which can go through the trapped bore well without any support.

## II. LITERATURE SURVEY

Bore-wells in India have almost eliminated the water problem in all areas (houses, agriculture and industries) in various States. Increasing demand and reduced ground water levels are the main causes to drill bore-wells even deeper and bigger in size over time. The average bore-hole size is 2.3 inches, the size has been increased to 7 inches and in 21st century it is more than 14 inches. The drilling technology available has made no compromise in depth of a bore-well to get water. However there are no such standard rules in India like bore-hole diameter, depth of the bore-well for drilling and sealing the dry bore-wells. In normal cases a truck mounted with driller, drills with a starting diameter of 4.3 inches. The size of the hole is also depends on geological structure of the area. In Rajasthan and Gujarat the diameter can go up to 20 inches starting from 14 inches. In rest of India on an average 8 to 10 inches diameter is used.

Saran et al [1], they have mentioned that, nowadays child often falls down in the borehole which is left uncovered and get trapped. It is difficult and also risky to rescue the trapped children to aid in such rescue we proposed a system of designing robots to the rescue of a child in a borehole. The robot structure consists of power supply, switch pad, gear motors, Oxygen concentrator, camera and Microcontroller. The condition of trapped child is captured with CCTV camera and monitored on a TV. A safety balloon is introduced in order to provide extra safety. Once the lifting rod reaches a safe position under the child, an air compressor is operated to pump air to the bladder attached to the end of the lifting rod through an air tube that runs downwards inside the lifting rod. The bladder provides a safe seating to the child. When the child is secure, the lifting rod is contracted to its maximum position. The motor is then reversely operated so as to unclamp the system. Simultaneously, it is lifted out of the well using a chain or rope. The programming language is Embedded C which is executed by MP lab Integrated Development Environment.

Venmathi et al [2], describes the rescue operations without human intervention. Here the wheeled leg mechanism is design to go inside the pipe and the legs are circumferentially and symmetrically spaced out 1200 apart. The robot can adjust its legs according to the pipeline dimensions. The robot has consisting of power supply, switch pad, and gear motor. The child position is captured from bore well with USB Camera and monitored on PC. The LM33 temperature sensor and 16×2 LCD are interfaced with PIC 16F877A microcontroller to sense and displays on LCD.

Albert Francis A[3] , describes the first step to visualize the child this is done by lowering the high resolution Camera inside the bore well. With the aid of high resolution camera the location (depth) and position of the

child can be determined. It is mechanical based project so this system doesn't have any intelligence and it is non atomized system.

N. Bourbakis and I. Papadakis- Ktistakis [4] descry be design of two micro- robotic structures in an effort for assisting the detection of human under debris and rescue them. These microstructures will play complementary role to existing large robotic structures, which mainly perform different rescue tasks. Here the micro- robot, called this as, is under development by a research team consisted of researchers from the ATRC- WSU (micro- design, software), the Ohio State University (micro- antennas).

K. P. Sridhar C. R. Hema S. Deepa [5] described a wireless sensor fusion system in the mechanical gripper robotic arm to assist the rescue operation and paramedical team effectively. Multiple sensors are interfaced to the wireless sensor fusion system to acquire the important parameters such as humidity, temperature, CO, and other gaseous levels from the bore well to monitor the condition of the child inside the bore well. In this system pic microcontroller is used which has low speed operation than Arm.

Navya Amin Singh and Markus Borschbach [6] described the factors influencing the accuracy of detection of obstacles using Ultrasonic Sensors in our local navigation system for the visually impaired. The findings of this paper serve as the basis for design and technical set up of the obstacle detection system. The distance between the object and the sensor, movement of the object or the sensor, change in temperature or pressure have an influence on the accuracy of the detection of obstacles as well as the estimation of distance between the obstacle and the user. Thus, placing and detecting the obstacles at an optimized distance becomes crucial to ensure safety of the visually impaired user. The results show that inaccuracy in distance estimation between user and the obstacles is considerably low thus indicating US as an optimum choice for detecting obstacles in the local navigation system. However, further improvement in the distance estimation and obstacle detection can be achieved by using a combination of other sensors along with the US sensors.

Preedipat Sattayasoonthorn and Jackrit Suthakorn [7] described a battery management for rescue robot battery management for rescue robots is summarized in this paper as a guideline for new developers. This paper covers the topics of power consumption, battery selection, battery charging/ discharging and battery maintenance .But this system requires more hardware and also its design is complicated so this system is costly.

Shuhai Wang [8] Designed a system Ultrasonic sensor is a component of detecting the distance. STC89C32 SCM (single chip machine) is a control component. According to the design requirements and tasks, the choice in the program must be paid attention to the operation and price. There are many tools and methods in measuring distance in present, such as laser ranging, infrared ranging, ultrasonic ranging and more advanced satellite ranging, and so on. The advantage of laser ranging is the good color, strong direction, very long distances measurement. Its disadvantage is the blind spot in 13 meters. The advantage of infrared ranging is long distance measurement. Measurement distance can reach to 1-3 kilometers. Its disadvantage is higher price than ultrasonic ranging.

Wang Chuanjiang [9] Described The framework of rescue robot is just, it is composed of rescue mechanism, anchorage set, and hoist set, manipulator, framework, control and communication system. The robot system can

undertake the rescue tasks for small caliber wells, whose diameters can change from _1mto _0.3m by replacing some mechanisms. This system can be used for small caliber well rescue system. It requires more hardware.

## III.OBJECTIVES OF THE PAPER

- To detect the child nearby open Bore well using IR sensor
- To detect the child fell down into the well
- To design and develop the metal plates to rescue the child using mechatronics model
- Provide the information to nearby person through LED and siren
- To utilize GSM technology for sending the message to land owner about child movement and information.

## IV. BLOCK DIAGRAM

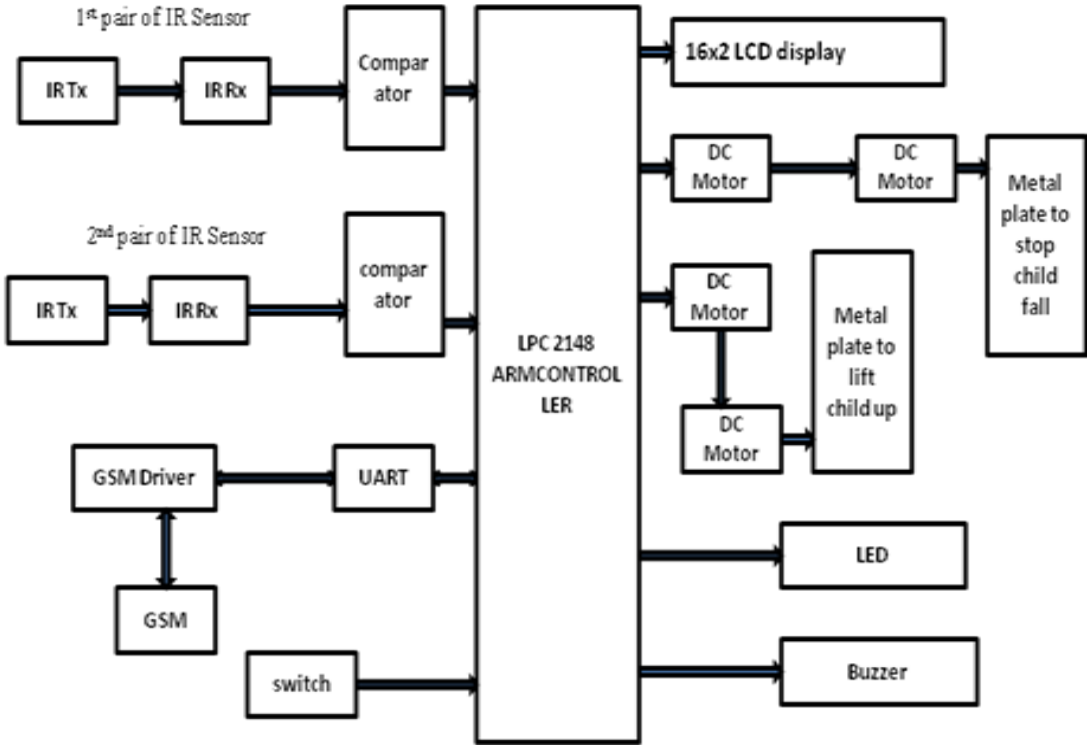


**Figure 1: Block diagram of proposed system**

## V.WORKING PRINCIPAL

Child Rescue System used if a child falls in a bore-well. In this method a metal plate or lid is placed at a distance below the entrance of the bore-well. IR technology is efficiently used to identify if a child has fallen in to a bore-well. Here, pair of IR sensors is placed in four directions. The IR transmitter and receiver are placed opposite to each other in a line of sight propagation technique. The output of the IR sensors receiver is connected to a comparator. The output of the comparator is given the input pins of the microcontroller. Whenever both the pair of IR sensors line of sight communication is blocked only then the microcontroller

sends an SMS via GSM to the child rescue center or to the police station. If one pair of IR sensors line of sight communication is obstructed then no SMS is sent by microcontroller via GSM.

As soon as both the pair of IR sensor is blocked, then depending on the program embedded within the microcontroller the D.C motor connected to a metal lid/plate begins to block the passage of the bore well, thus preventing the child from further falling into the depths of the bore well.

After sometime, the microcontroller activates another D.C motor to pull the child out of the hole. In the project demonstration LCD is used to display the working of every unit in this project.

**VI.HARDWARE AND SOFTWARE REQUIREMENTS**

- ARM7 lpc2148 Microcontroller
- 2 pairs of IR- Transmitter and Receiver
- DC Motors and relays
- Piezo electric Sensor
- Comparator
- LCD
- GSM Module
- Metal plate

**ARM 7**

**ARM7** is a group of older 32-bit RISC ARM processor cores licensed by ARM Holdings for microcontroller use.[1] The ARM7 core family consists of ARM700, ARM710, ARM7DI, ARM710a, ARM720T, ARM740T, ARM710T, ARM7TDMI, ARM7TDMI-S, ARM7EJ-S. The ARM7TDMI and ARM7TDMI-S were the most popular cores of the family. Since ARM7 cores were released from **1993 to 2001**, they are no longer recommended for new IC designs; instead ARM Cortex-M or ARM Cortex-R cores are preferred.

**Infrared Sensors**

IR sensors have two parts:

1. Transmitter
2. Receiver

**Transmitter**:

Transmitter Sends out a wave at a certain frequency, mostly being an LED type of component since light is part of the heat wave of infrared rays.

**Receiver:**

The receiver is designed to pick up a reflected wave, or to sense a change in the area like the motion detector shown in Figure 2.

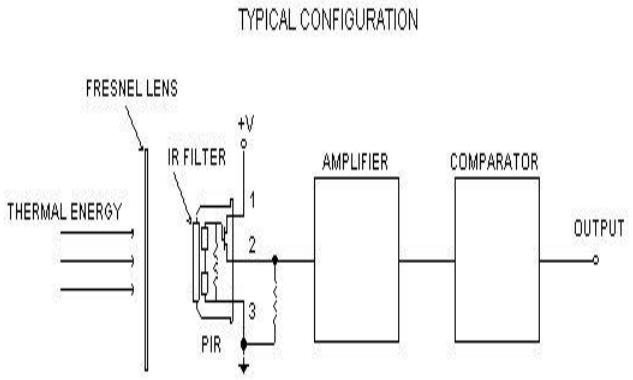


**Figure 2: Motion Detector**

**LCD (Liquid Crystal Display)**

The LCD and LED are the most widely used display in embedded systems. Embedded indicates a combination of hardware and software. LCD is a 16 pin connector.

LCD can operate in two modes:

- Four bit mode
- Eight bit mode

**Software components**

- Embedded C programming
- Keil V4
- Flash Magic Programmer
- Express PCB

**Keil version 4 MDK-ARM Microcontroller Development Kit**

The MDK-ARM is a complete software development environment for Cortex™-M, Cortex-R4, ARM7™ and ARM9™ microcontroller-based devices. MDK-ARM is specifically designed for microcontroller applications, it is easy to learn and use, yet powerful enough for the most demanding embedded applications.

**Flash Magic**

Flash Magic is an application developed by Embedded Systems Academy that allows you to easily access the features of a microcontroller device. With this program you can erase individual blocks or the entire Flash memory of the microcontroller.

**Embedded C**

Embedded C is a set of language extensions for the C Programming language by the C Standards committee to address commonality issues that exist between C extensions for different embedded systems. C compilers are available for almost all embedded devices in use today, and there is a large pool of experienced C programmers.

## VII. APPLICATION OF PROJECT

1. This system used at agriculture field to prevent child fall.
2. Also used in small town and industries related to manufacturing.

## VIII. ADVANTAGE

1. This system presents a proactive approach to prevent child fatalities at the open uncapped bore-wells.
2. It saves time.
3. Manual operation has been reduced to major extent.
4. Less man power required

## XI.CONCLUSION

In this paper, we have developed a prototype module to rescue children falling in to bore-wells, this implies a new design which has a sensor kept at top of bore-well hole which helps to sense the child if he falls inside. If the system senses the child the automatic horizontal closure kept at around 3ft dept closes and prevents the children from falling beneath. In future, this paper can be taken to the product level as a project which is user friendly and durable; we need to make it compact and cost effective. Going further, most of the units can be embedded along with the controller on a single board with change in technology, thereby reducing the size of the system.

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