

ROBOTICS METHOD FOR RESCUING BOREHOLE ACCIDENTS

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ABSTRACT

An innovative concept proposed in this paper is to handle borehole rescue operation. Children often falls down in borehole which is left uncovered and get trapped. It is difficult as well as risky to rescue trapped child from borehole. Bores which yielded water and subsequently got depleted are left uncovered and small children without noticing get trapped inside. To aid in such a life threatening situation. We hereby propose A Rescue Mechanism for Borehole Accidents using Robotics'.

Keywords: Digital camera, Gas Sensor, Ultrasonic Sensor, PIC Microcontroller, Robot design, Safety balloon

1. INTRODUCTION

In order to meet the ever increasing demand for water boreholes are dug. But these are usually left uncovered and children often fall down. During these accidents an immediate rescue operation is required and it is quiet challenging because the environment inside the borehole is highly unpredictable. Even though if people notice a victim trapped inside the borehole, it takes about 20 to 40 hours of time to rescue them in the conventional way. Due to their large depths, and less visibility inside the borehole decreases chance of survival. In most recent cases reported so far, parallel holes are dug and then a horizontal path is made to reach the victim by using JCB, this increases a high risk factor. Moreover, it involves a lot of energy, and expensive resources which are not easily available everywhere. After studying all the cases we found a serious issue to do, to make a robotic machine which can go through the trapped borehole without any support and grasp the trapped child out from the borehole at least minimum time. With this machine, there is no chance of damaging human body and other

minor damages. Visualization is made with help of infrared waterproof cameras and a high resolution TV monitor. This is a light weight machine that will go down into the borehole pipe and save the child's life systematically by performing the required action as commented by the operator.

2. SOCIAL ASPECTS OF CONCEPT

The government of Kerala has argued that it should be made mandatory to erect a three-foot wall around all such unused bore wells and tube wells. It has also argued that it is time to frame strict laws and penalties to ensure accountability in the event of any accident.

The government of Tamilnadu also passed the Tamilnadu Ground Water Development and Management Act in 2003. It made mandatory for people to get permission from the government before sinking bore wells, for the Water Supplies department to intimate the local authorities and for the local authorities to monitor the activity.

As many as 157 illegal bore-wells and tubewells in various colonies in Gurgaon have been dismantled and sealed and First Information Reports have been registered against their owners during the past one year.

Various cases are being encountered where people especially children are accidentally falling and trapped in the bore wells. Taking them out safely is one of the difficult challenges which involve risk and lot of human effort and time. Sometimes the bore wells are so deeper that a human cannot enter leaving the victim helpless inside the bore well. Using smart robot technologies for rescuing is one of the good solutions eliminating the human effort and time.

The paper discusses about smart robot which are designed by the authors for this purpose.

3. EXISTING SYSTEM

In existing system, a big hole is dug beside the borehole up to the depth where the child is stuck. But it takes too much time to save the life of the child. Moreover there is a possibility of damaging the child body during the rescue operation. A small delay in this resources accumulation may reduce the chances of saving child alive. If the area beside the borehole contains rocks below certain depth, in such cases the chance of saving child alive is very low. Lack of oxygen inside the borehole and lack of light sources causes the major difficulty during the rescue operation.

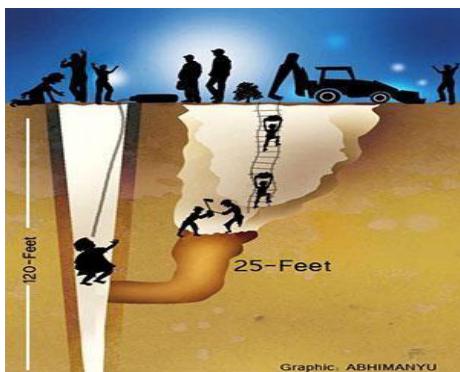


Figure 1: Army members working for the borehole rescue

In some cases makeshift arrangements are made to pull out the body of child. In such methods some kind of hooks are used to catch hold of the child clothes or body organs. This may cause wounds on the trapped child body.

4. PROPOSED SYSTEM

Robots are replacing humans in the activities of performing repetitive and dangerous tasks which humans prefer not to do due to size limitations, extreme environments, etc. This work is aimed towards the construction and designing of a robotic system to work in borehole rescue operations and to go down into the borehole pipe and hold the trapped body systematically. The robot has arms at its front to pick child.

4.1 BLOCK DIAGRAM

The system is divided into two separate units, one is Transmitter (controller) unit and another one is Receiver (Robot) unit. The unit which is inside the bore well is controlled by the keypad controller. In this robot, low-power digital radios based on the IEEE 802.15.4 ZigBee standard for Wireless Personal Area

Networks (WPANs) is used and it transmit 1 to 1000meters (about 3 to 3.280 feet) signals. Here the poisonous gas detectors is used to find the proportion of hydrocarbons, methane, volatile organic compounds in parts per million (ppm). These measured values of poisonous gases are shown in PC.

During the rescue operation the robot setup is sent into the borehole till the victim is found, Later the parameters are sensed by the sensors. The transmitter in borewell is used to send the signal about distance between the robot and the child and poisonous gaseous present inside. Using ZigBee these signals are transmitted to controller setup. These processes are monitored with help of camera. The camera along with high power Light Emitting Diode (LED) torch is provided to visualize and monitor the child movement inside of borewell in a clear manner.

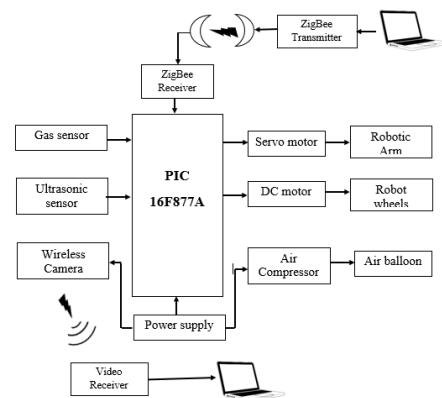


Figure 2: Block Diagram

The whole system has been controlled by PIC and the operator using keypad controller. The vertical movement of the robot has been controlled by which it is operated by DC motor. An angle of left and right movement is controlled by which is operated by Stepper motor since all the actions are controlled by this unit it is known as Transmitter (controller) Unit. Finally the overall process is monitored with the help of PC display unit. After that the victim can be taken out with the help of robot arms.

5. METHODOLOGY

The robot will perform the following steps for performing the task:

1. The robot firstly goes down the pipe with by adjusting its two finger mechanism according to the dimensions. It is controlled by the operator using keypad of laptop
2. The video camera mounted on it gives the insight view of the position and location of the target. This video will be monitored on laptop.

3. The robot then grasps the target by contracting or expanding its gripper according to the requirement.
4. An additional feature of air bag can be used to provide support, underneath of the child.
5. The robot holds the target tightly and brings it out of the pipe safely.

This whole method is lesser time consumptive and risky than the normal operation.

6. APPLICATIONS

As borehole child saver:- - The main application of the machine is in the rescue operation of the child from the borehole.

As Pipe cleaning machine:- This machine can be used in pipe cleaning. It can drive through long pipes and with a rotary brush as an end effector fitted at front will serve the cleaning operation of dirty pipes. As the inside surface of the pipes may be wet and slippery the high quality wheels are capable to grip on the wet surface.

As Pipe inspection machine:- In pipe manufacturing industries the final product is required to go through inspection process for quality control and prevent any leakage in pipes or any oil, gas pipe lines are to be surely free from any kind of leakage and damage as it may cause huge destruction if any kind of accidents takes place. This inspection machine loaded with special inspection instruments like sensors, x-ray are capable to inspect pipes, thus can detect any kind of defect which may be the reason for a serious accidents.

Miscellaneous Application:- This type of robot capable of climb vertical pipes or drive through horizontal or inclined pipes may be used in the following areas.

- In space programs.
- In radioactive or highly hazardous environment.
- In under water operation

7. RESULT AND DISCUSSION



Figure 3: Excepted Output

We hereby propose a design model as borehole rescue robot which is able to rescue a child trapped inside borehole. It can measure temperature as well as the altitude. The proposed model design is supposed to look like the following:

8. CONCLUSION

A lot of lives have been lost due to falling in the borehole because it involves digging a pit beside a borehole which is a time consuming process. The proposed system is to overcome all these difficulties. This project is used to reduce human efforts for rescuing operations from borehole. It performs rescue operations in very less time as compared to traditional methods. Thus, it has been designed keeping the entire obstacle in mind that may arise during the operation. We like to conclude with the help of my research project I am able to rescue without any damage.

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