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Pipeline Inspection and Borewell Rescue Robot

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ABSTRACT: The aim of this proposed system is to give an innovative concept to handle the bore well rescue operations without human intervention and to inspect any type of leakage in the pipe. Normal operation of child rescue is done by using big machines with large manpower involvement. It takes more time to rescue a child from the bore well and to check any kind of irregularities in pipe. The three finger mechanisms are employed in this design to go inside the pipe. The three finger mechanism is circumferentially and symmetrically spaced out 120^{o} apart. The robot is made adaptive so that it can adjust its three finger mechanism according to the pipeline dimensions. This structural design makes it possible to have the adaptation to the diameter of pipe and to have adjustable attractive force towards the walls of pipe. In this proposed system, the condition of trapped child is captured with USB Camera and monitored on laptop. LM-35 Temperature Sensor is interfaced with Atmega 16 microcontroller to sense the temperature inside the bore well and to display it on terminal display on laptop. The robot structure consists of power supply, development board of atmega 16 and gear motors. Adding a claw or gripper was the initial hurdle for which additional power supply and DC gear motor were needed. The proposed system is intended to reduce the risk involved during the child rescue operation by analysing the situation and also to provide an option detect any leakage inside the pipe.

KEYWORDS: Bore well rescue robot, Life savoir robot, Child trapped inside borehole

1. INTRODUCTION

To improve security and efficiency of piping networks in industrial units, continuous inspection, maintenance, cleaning and repairing of pipelines are strongly demanded because due to aging problems, a lot of troubles like corrosion, cracks and mechanical damages are possible in pipes [1]. These operations are quite expensive, so robots prove an efficient solution in this situation. A robot is an intelligent, re-programmable and multifunctional manipulator designed to work in inaccessible environment to do variety of tasks which are laborious, threatened and risky [three]. Along with pipeline inspection, the concept of rescuing the trapped child from the borehole is also implemented in the robot design.
Since water level is decreasing day by day so more people put ever increasing demands on limited supplies [2]. To fulfill the needs, bore wells are constructed, but these are usually left uncovered. Many innocent children without noticing the hole have trapped and lost their lives.

Fig 1 Miraculous escape of small child in bore well

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In normal rescue operation, a parallel pit is dug deep to achieve the child and adjacent holes are made to the walls of bore well. A common method used to find the depth of child is the use of rope [3].

Fig 2 :Image of a baby fell into borehole and Army members working for the baby rescue operation

The injuries during and throughout the rescue operation also leads to the death of child. 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. As we have made survey over Maharashtra & found .In Haryana three children's fell into bore well & only 1 was alive. In Jaipur on 7th Jan, 2014 a child of age three years recovered alive but died in hospital. Also found that in Bhopal, Gurgaon, Tamil Nadu, Dheera Village child's fell into bore well & were not recovered alive .As per the survey we found that the ratio of dead and alive children is 15:1. This shows that frequency of those trapped children in bore well has increased who get died in the hole due to insufficient amount of oxygen or injuries throughout the whole process. The alternative solution to this problem is the use of robotic systems which can move down the pipe and bring the subjected body out of it properly and safely. This will take lesser time than the normal operation. 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 the arm at its front to pick and place the objects. It has camera that is interfaced with laptop for the visual display. The motion of the robot is controlled through a keypad of a laptop and also the temperature inside the pipe sensed by the robot is monitored outside on the display of laptop. The proposed system is intended to reduce the risk involved during the child rescue operation by analysing the situation and also to provide an option detect any leakage inside the pipe.

II. LITERATURE SURVEY

The field of search and rescue robotics, while growing rapidly in this decade, is still relatively very harmful have been proved[2]..Outside of controlled environments, humans have only performed sophisticated manipulation tasks when operated for rescue operation [3] .In normal rescue operation, a parallel pit is dug deep to achieve the child and adjacent holes are made to the walls of bore well. A common method used to find the depth of child is the use of rope [3]. One particular aspect of the rescue robotics domain eases the fruitful combination of highly challenging basic research and application oriented developments for large markets. This is the fact that rescue robots strongly benefit from autonomy while there is a human in the loop [4]. The alternative solution to this problem is the use of robotic systems which can move down the pipe and bring the subjected body out of it properly and safely . Robots have been very successful at manipulation in simulation and controlled environments.It will be a light weight machine that will go down into the bore well pipe and hold the trapped body systematically. In this alternative scenario, there will be no requirement of digging any hole 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. This proposed system consist of a light weight machine that will go down into the bore well pipe and hold the trapped body systematically. In this alternative scenario, there will be no requirement of digging any hole parallel to the bore-well. The remotely controlled robot will go down the bore well and perform the action of trapping baby outside the bore-well using 3

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finger mechanism. The 3 finger mechanism is controlled using laptop. We are also using temperature sensor to measure the temperature of the baby trapped surrounding.

III. PROBLEM DESCRIPTION

As the proposed system is being inspired by in-pipe inspection robot mechanism, some modifications are required that enable the robot to be used for child rescue operations from the borehole

IV. OBJECTIVES

Following are the aims and objectives of the proposed design:

1. To make an adaptive robotic design having three finger mechanism cylindrical structure so as to move smoothly through the bore well
2. Add gripper or claw to it which can contract and expand according to necessity and can grasp the target inside the pipe.
3. To interface it with the controller unit, sensor unit and display unit and camera is mounted over it. Also laptop is interfaced for visual display.
4. Software implementation.

To control the whole system with keypad and to bring the target out of the pipe safely

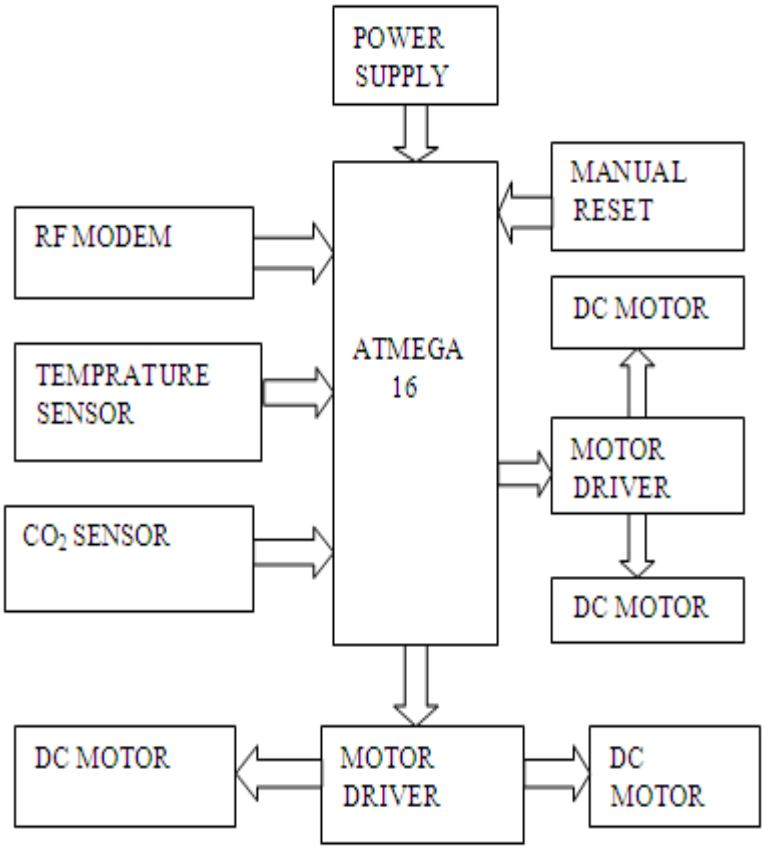

Fig 3:Block Diagram

The whole system consists of the following parts:

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Robotic Unit

This unit comprises of 12V power supply, dc motors. The PC has been interfaced to the microcontroller I/O pins through serial communication. When any key is pressed that particular port is supplied with high logic. The microcontroller always monitors these key in real time (i.e. in continuous mode). Also four dc motors are used for performing the robotic action. One motor is for moving the robot up and down, three motors for the contracting/expanding of the gripper.

Controller Unit

This unit comprises of ATMEGA 16 microcontroller. This is RISC (Reduced Instruction Set Computing) based microcontroller having analog input channels, analog comparators and additional timer circuits. The microcontroller stores the information captured by the robot and display it. The temperature and CO_2 percentage sensed by the robot is firstly stored in microcontroller and then get displayed on terminal. The video captured by the USB camera is displayed on laptop.

Sensing Unit

The unit consists of LM-three5 temperature sensor for sensing the temperature inside the pipeline having range from -55^o C to +150^o C. It is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature.. It is suitable for remote applications. Ii has very low self heating. The CO2 sensing unit consist MG811 sensor that it used to detect the CO2 percentage inside the pipeline the detection range is 0 to10000ppm.

Display Unit

The temperature sensed by the robot is displayed on the terminal of laptop. Also the video captured by the USB camera is monitored on the laptop which gives the insight view of the borehole to perceive the location and position of the child and also able to detect any fault inside the pipeline.

V. METHODOLOGY

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

1. The robot firstly goes down the pipe with by adjusting its three 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. Temperature sensing is also done by the robot which is monitored on terminal display.
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.

VI. SIMULATIONS & RESULTS

Thus in this scenario we have designed the robot mechanism which can rescue the baby out of the borewell The stimulated results on proteus .The proteus result shows the actual overview of the motors which are operated through key pressed mechanism for the gripper operation .T he temperature & CO_2 level was also displayed on virtual terminal of proteus.

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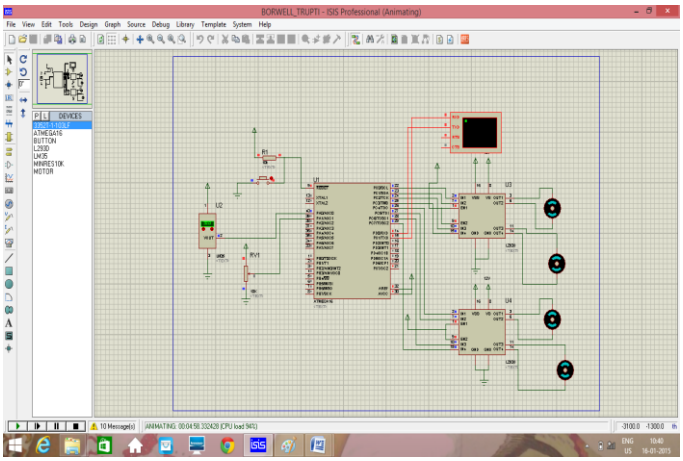

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Fig 4:Simulation result on proteus.

The robot designed is able to give the conceptual scenario in the situation of rescuing child from borehole which can be made in use by the government. By using this concept, robots for this situation can be made on the large scale for saving the life of child. It is able to see the irregularities of pipe by giving the insight view.

Fig 5: Photograph of system operation .

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VII. CONCLUSIONS

In last 10 years, a lot of lives have been lost due to falling in the bore well because it involves digging a pit beside a bore well which is very time consuming. Small objects having weight 200-300 grams was put inside the, pipe.The robot moved inside the vertical pipe and controlled, by the operator using keypad .Then it perceived the target which was viewed on laptop. Then according to the instructions it brought that object with the help of gripper safely out of it. Hence this concept is really applicable in pipe line inspection and borehole rescue operations and can save many innocent lives with safety and low risk.

VIII. FUTURE SCOPE

The proposed system can further be improved by adding or modifying
By following features:

1. An additional feature of air bag can be used to provide support, underneath of the child.
2. Oxygen sensor & Oxygen supplier can be installed.
3. Smoke sensor can be added to sense the dangerous
   Gases concentration inside the pipe.

REFERENCES

[1] 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.
[2] Tatar, D. Mandru, "Design of in-pipe modular robot ic systems", Vol.147-149, pp.49-54, 2009.
[3]A new product design and construction of pipe line inspection and rescue robot International journal of research sciences and advanced engineering vol.2, issue 8 ,2014.
[4] 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