Child Rescue System Againist Open Bore-Well in India

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Abstract- **In past few years, there have been several accidents of children falling into abandoned bore-wells in India. A lot of money and time is also spent in these missions. The rescue team tries to approach the victim from a parallel well that take about 20-60 hours to dig. This complicated process makes 70% of the rescue operations fail. Very few of the victims have been saved in such accidents. The rescue operation mainly consists of three processes: approaching the child, handling the body, taking the child out of the well. A regular autonomous robot could easily perform the first and third operations. These robots can make up these two steps within few minutes, but there is a great chance for injury of victim as they try hooking up body organs and cloths. Our project deals with extreme safe handling of the victim.**

1. INTRODUCTION

In Urban and Rural areas, falling of children or even adults in bore well are increasing. These accidents are mainly happened due to carelessness or playful activities of the child. Moreover most of the bore wells are drilled and leaved as it as open without any proper coverings. When a child fall into the bore well the rescue operations in such cases are more risky and become a non-safe to the rescue team members. A small delay in this resources accumulation may reduce the chances of saving child alive. If the area beside the bore hole contains rocks below certain depth, in such cases the chance of saving child alive is very low. 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. At present there is no proper solution for this problem. Bore wells in India almost diminished the water problem in all areas (houses, agriculture and industries). Increasing demand and reduced ground water levels causes to drill bore wells even deeper and bigger in size over time. In the year of 1970 the average bore-hole size is 2.5 inches, in 1980 it is 4 inches, in 1990 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 wells 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 truck mounted driller, drills with a starting diameter of 4.5 inches. The size of the hole is also depending on geological structure of the area. In Rajasthan and Gujarat diameter can go up to 20 inches starting from 14 inches.

II. PROPOSED METHOD

The main objective of this design is to reduce the time for reaching the child and to ensure the safe handling of victim. Though there are various systems adopted for such rescue operations, we propose a model which is unique in architecture especially in the gripper design.

In the proposed model the existing difficulties were overcome by introducing a special gripping mechanism which has the ability to rotate at 360 angles by controlling the forward and the reverse movement of the rotating disc, such robotic arm is equipped with two pairs of gripping arm each one can be controlled individually. The entire system is operated through a pulley mechanism which provides upward or downward motion of the robotic system and other key components inside the bore hole. To view the bore-well the robotic system is equipped with two cameras one is fixed and the other one is movable, the camera angle plays a key part as it provides precise view of child, which enables the rescuer to control the gripping system accurately.

A novel fail-safe mechanism was introduced by placing an air bag at the bottom of the tunnel which saves the child in case of any gripper failure and also it serves as an additional safety hands to hold the child from the bottom. Apart from these features an easy to use control system software was developed which is very helpful for the rescuers where they can control the entire mechanism with the help of graphical user interface (GUI), the GUI also displays two different camera angles which covers the entire bore-well, the current temperature, the level of toxic gases, the distance between robotic arm and the victim inside the bore-well. Moreover the GUI controls the robotic gripping system and the pulley assembly based on user commands.

III. SYSTEM OVERVIEW

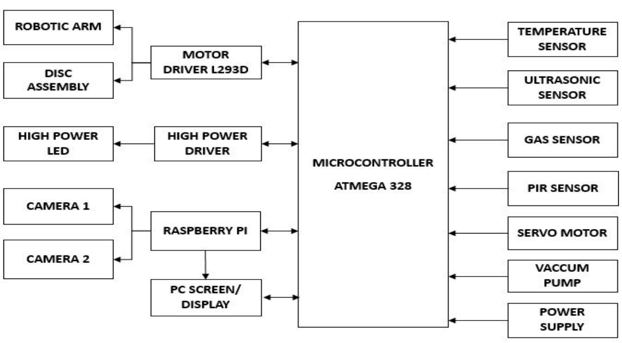

Figure.1 Overview of the System

The entire overview of the system is shown in Figure.1. The major components are classified as lifting unit, control unit, sensing unit, gripper system, fail-safe system and graphical unit. The lifting unit comprises of a rope, pulley and a pole. The upward and descending movements of the mechanical framework are controlled by utilizing the pulley assembly and the motor. The whole mechanical assembly is controlled from the portable workstation through the serial commands. The Arduino At mega 328 controller is the heart of the framework that controls the operation of sensors, furthermore, the DC motors are driven using an L293D motor driver. The raspberry pi is used to get the video from the 2 camera modules. Temperature sensor is utilized for detecting the temperature inside the well, gas sensor is utilized to gauge the level of harmful gasses, and ultrasonic sensor is utilized to quantify the correct separation between the robotic arm and the casualty, PIR sensor detects the movement of human by sensing if the human has moved in or out of the sensors. A fail-safe system comprises of air bag which is to be placed on the bottom of the pit, the air bag is blown using a vacuum pump. A GUI is developed using Visual Basic (VB) which consists of two camera angles, grip controller, pulley system controller, base rotation control and various sensors value.

IV. SYSTEM SPECIFICATIONS

Atmega 328/p Microcontroller

Atmega 328/p is a single-chip low-power 8-bit microcontroller. It operates in the voltage range of 1.8 to 5.5V [6]. It provides 32Kbytes of In-System programmable flash with read-while-write capabilities.

Raspberry pi 2

Raspberry Pi2 is a single-board computer, which is equipped with a Broadcom BCM2835 SoC (System on Chip), which integrates a 700-MHz ARM117JZF-S core CPU (Central Processing Unit), 512 MB of RAM (Random Access Memory) and a Broadcom video core IV GPU (Graphical Processing Unit) [7]. The raspberry pi runs on Raspbian Jessie Operating System (OS) and the system runs on 16 GB (Giga Bytes) SD memory card.

LM35 Temperature sensor

LM35 is a temperature sensor with its output proportional to that of the temperature. The operating temperature range is from -55°C to 150°C. For every oC rise/fall in ambient temperature the output voltage varies around 10mV.

L293D Motor driver

L293D is a typical Motor driver which allows DC motor to drive on both directions. Two DC motors can be simultaneously controlled in both directions using the L293D which is a 16-pin IC. Its working concept is based on H-bridge. H-bridge is a circuit that allows the voltage to be flown in both the direction.

Arduino IDE

The Arduino Integrated Development Environment or Arduino Software (IDE) is a tool used to connect with the Atmega 328/p microcontroller by uploading the user programs into it. It also provides with additional features such as serial monitor, serial plotter, etc. It makes the programmer feel at ease because there is no complexity in code because it is based on simplified version of C++.

Python IDE

Python IDE is another environment used to execute python programs written by the user. The python program has the ability to manipulate user commands which is very similar to that of shell scripts. Python scripts are used along with the raspberry pi to control the cameras.

V. IMPLEMENTATION

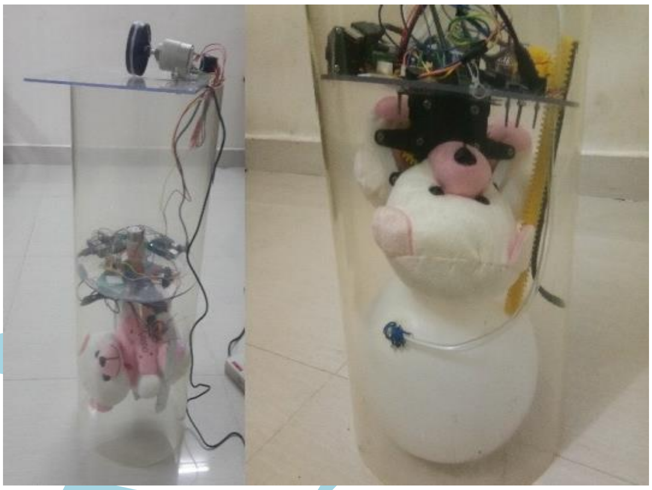

Figure.2 Implementation as prototype

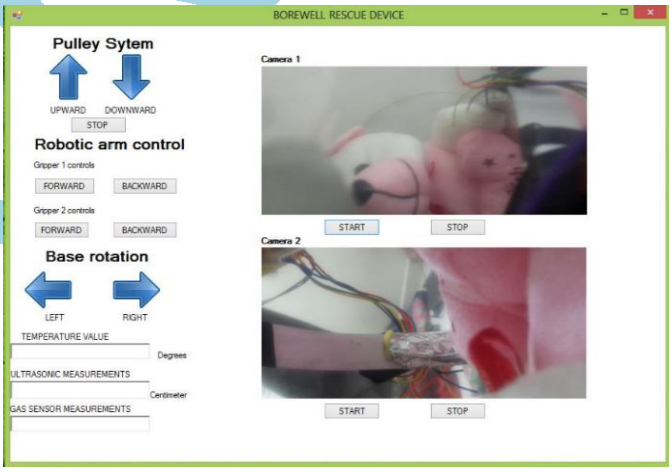

Figure.3 Graphical Interface of the control panel

VI. CONCLUSION

With the increase in the bore-well accidents more number of children dies every year, usage of robotic system to help in rescue of the child is shown in this paper. At first various incidents involving the bore-well accidents were briefly discussed and then the various work to overcome the accidents were shown. Some of the challenges faced by the previous works were overcome by the proposed model. A novel gripping system was introduced which does not cause any harm to the child and can be controlled independently from the rescuer through the camera. A fail-safe system was also proposed which acts in case of failure in the gripping system. Apart from this a special GUI was designed for monitoring and controlling the entire operation from the workstation of the rescuer. In the future more precise gripping system should be developed by employing pressure and tactile sensors in order to ensure better results in handling of the victim.

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