

Rescue Automaton with Live Video Streaming from the Excavate

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Abstract: For daily use, for agriculture, and for industrial purpose water plays an important role in society so that people will dig bore wells. If the bore well doesn't provide any water after so many efforts, some bore wells will be left open by some careless people. Unfortunately, children will fall into the borewell when they are playing. In order to save the child from bore well, we have developed a Robotic system which saves the child with in less time when compared to the traditional method. In this design, it contains a Transmitter and Receiver. Where Transmitter will be sent into the bore wells and we can monitor the situation in mobile or laptop with live video streaming in the receiver section. The transmitter is a Robot that will send for 25 Feet of distance in bore well with various sensors, a Raspberry pi camera to shoot the video and a microphone to record the audio, high power LED.

Keywords: High Power LED, Microphone, Raspberry pi camera, Robotic System.

1. INTRODUCTION

In today's world bore well is the easiest way of getting the water for our daily use and all purposes, bore wells will dig by people if it's not reached their requirement then they will be left open the bore wells or not closed properly. As per Child's Psychology, they wish to all to know all objects if it seems interested. When they are playing nearby bore wells, knowingly or unknowingly they will go there and fall into bore wells. Proper action or decision must be taken within the least time if not, it causes death.

The Latest statistics of 12 Years is given here from the year of 2007 to 2019 regarding bore well accidents.

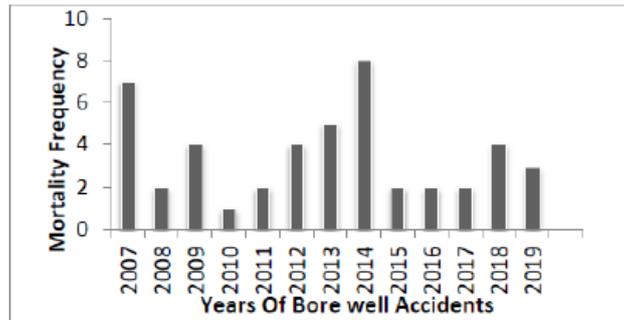


Figure 1 Histogram of Borewell Accidents

As per the Histogram which is given in Fig.1, in the year 2007, the Mortality Frequency is 7. In the years of 2008 to 2013, the Mortality Frequency is reduced. The very least of Mortality Frequency (i.e.0.5) is a recorder in the year of 2010. And In the recent year of 2019, it is recorded as 3. Hence we have developed the Robotic system which will save the child by providing the oxygen in the distance of 25 Feet in bore well. Then the risk is reduced to 50% if the child gets oxygen within less time. Voice assistance will be given from the microphone and video is recorded. When compared to the traditional method, we will save the child in less time.

The traditional method as shown in Fig.2. It may take 12 Hours to 24 Hours in our country to save the child. Even though we can't give a guarantee for children's life. Many times due to the non-availability of oxygen, a breathing problem is created, then we can't save the Child. When we are digging for child soil may fall on the child body in bore well. Then the child will get tension and cry, then the heartbeat will be increased. It may cause death.

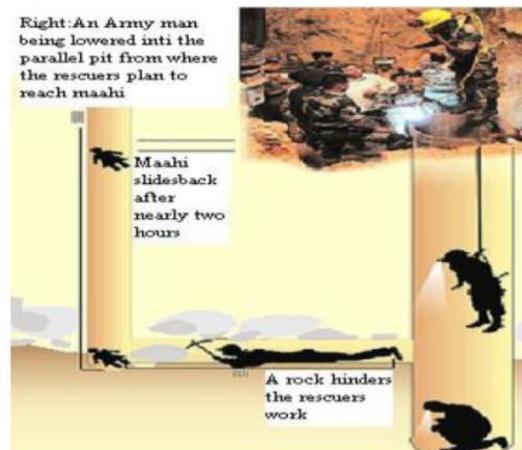


Figure 2 Traditional method

To overcome the drawbacks of the existing system, we have developed a Rescue Robotic system which will save the child with the least amount of time when compared to the conventional method. The proposed design will be explained in further sections.

2. LITERATURE SURVEY

S. Arthika et-al [1] describes the robotic system which has several sensors to detect the parameters such as the LPG gas, Temperature inside the bore well, and IR Transmitter and

Receiver to detect the child inside the bore well. They have used 4 Robotic arms for different operations such as Rope, Arm, and Size movement.

Kavianand G et-al [2] describes the robotic system which uses a Passive Infrared sensor to detect the child inside the bore well. The important thing is they have developed a system that has an alert and GSM Module that sends messages to the nearest police and rescue team when a bore accident occurs. This can be done within a short period of time.

Sidharth Singh et-al [3] describes the system which has a transmitter and receiver. The transmitter will be sent into the bore well and we can monitor the parameters of Temperature and Gas in the LCD Display in the Receiver section. This operation can be done through Zigbee Transceiver.

Sumith Pandey et-al [4] describes the system which has IR Sensor to detect the object or person, and this system works for 5feet of distance in the underground. Metal plates are used inside the bore well. A wireless camera has been used to capture the situation inside the bore well.

S. Gopinath et-al [5] describes the rescue system which uses a vacuum cup to drag the child from the bore well to the outside. Here various sensors have been used to detect the parameters such as temperature and Gas values. The camera is interfaced with the system that can be sent into the bore well and captures the video that can be sent to a personal computer through the Zig-bee Transceiver.

3. PROPOSED DESIGN

The Proposed design consists of the Transmitter and Receiver section. Where Transmitter will be sent into the bore well and the Receiver will give the video streaming on Personal Computer through Zig-bee and in Mobile through Wi-Fi. The Block diagram of the proposed design is as shown in Fig. 3.

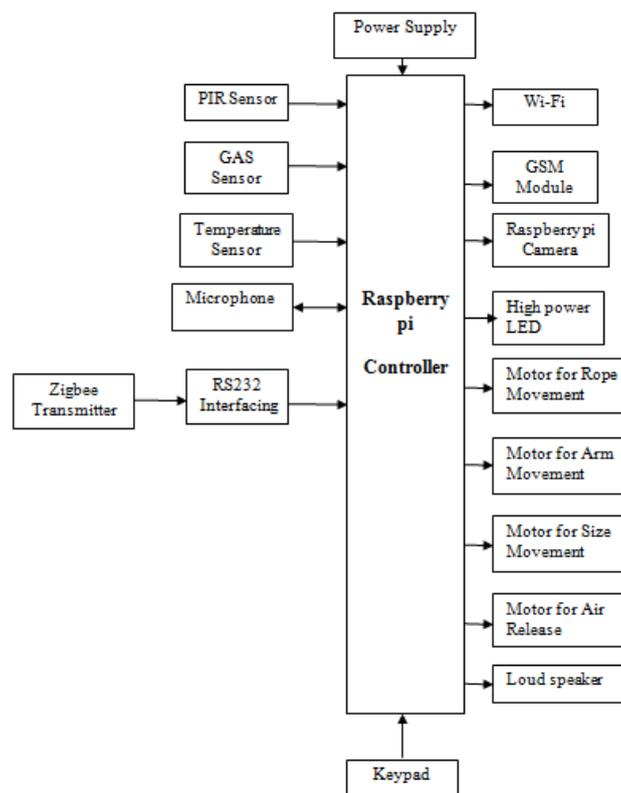


Figure 3 Block diagram of Transmitter Section

3.1 Hardware Description

Transmitter Section

It has a Raspberry pi controller to which various sensors such as PIR Sensor, Gas Sensor, and Temperature Sensor, and GSM Module, Microphone, Robotic Arms, a Raspberry pi camera, High power LED, Loudspeaker, Zig-bee Transmitter, Keypad is connected as shown in Fig.3.

Raspberry pi controller

It's the main controller for the Transmitter section which can be activated by providing a Power supply of 5V. It consists of In-built Wi-Fi so that we have selected this controller and no need to connect any external Wi-Fi Module for getting updates from the transmitter to the Receiver section as the Receiver consists of a Mobile App, which will be accessed through Wi-Fi.

PIR Sensor

Generally, Passive Infrared Sensor will detect Objects and Human beings. In our proposed design, it will identify the child in the bore well in the distance of 25 Feet at the bottom of the earth.

Gas Sensor

In the underground, Dangerous gases will be released which are very dangerous to health. Hence, we are using the Gas sensor in order to detect dangerous gases and LPG Gas.

Temperature Sensor

As we are going deeply into underground heat will be increased more. So that in order to measure the temperature inside the bore well, we are using a temperature sensor.

Robotic Arms

Robotic arms will use to pick the child from the bore well and to place the child outside of the bore well. DC Motor will be used for this Arm movement.

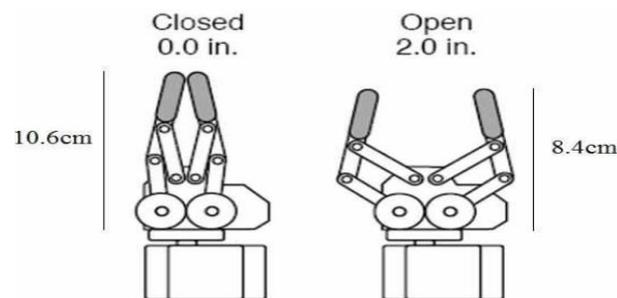


Figure 4 Robotic Arm Architecture

Raspberry pi camera

In order to capture the situation of the child inside the bore well, we are using the Raspberry pi camera which is having a better megapixel lens when compared to other cameras.

GSM Module

When the Child falls into a bore well or when the child is found in bore well, The GSM Modem, which is connected with the Transmitter will send the alert message to the nearest

rescue teams and to the police station. So that they will also help the existing rescue system. GSM Modem will send the message regarding Temperature values, Gas percentage, and the presence of the child.

Microphone

In order to provide voice assistance from the outside of bore well to the child, this microphone will be used.

High power LED

As inside the region of bore well is dark. A High power LED is connected to the Transmitter which provides Light with high performance so that we can capture the situation with the Raspberry pi camera.

Loudspeaker

The loudspeaker will announce the words to the child inside the bore well. As it will take the input from the microphone.

Keypad

When a child is detected inside the bore well, the robot has to pick the child and place, the child at the outside of the bore well with its arms. For that person, the keypad is used which is having push buttons. By pressing the buttons pick and place operation can be performed.

Zig-bee Transmitter

The Zigbee Transmitter is interfaced with the Transmitter section through RS232 cable. It's a wired transmission. It will send the captured video to the ZigBee Receiver.

Motors

Here 4 Motors can be used for various purposes. For the Rope movement, size movement, air release, and arm movement, these motors are used. According to the situation each motor will be activated as shown in Fig. 5.

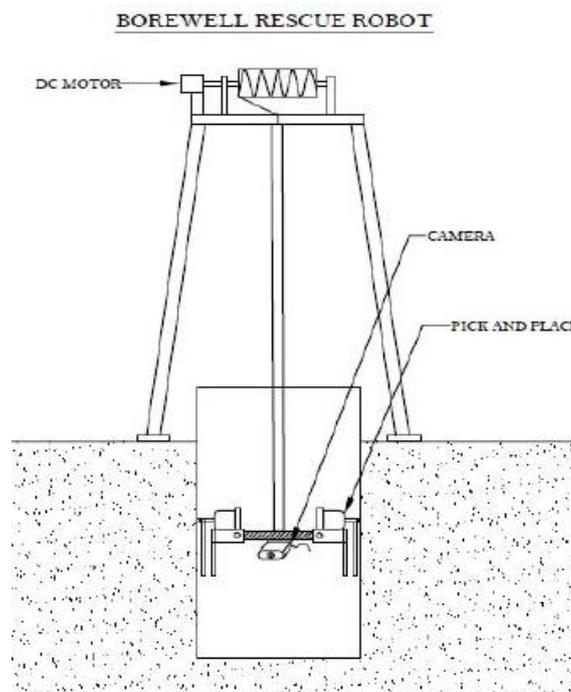


Figure 5 Connection of DC Motor

Receiver Section

It consists of Zig-bee Receiver, which is connected to Personal Computer or Laptop through RS232 Interface and Mobile which is connected through Wi-Fi as shown in Fig.6.

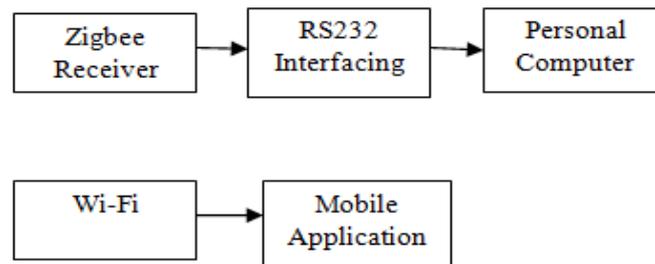


Figure 6 Receiver Section

Zig-bee Receiver

From the bore well, the captured video can be sent to the ZigBee receiver in the receiver section through the ZigBee transmitter. Its wired communication.

Wi-Fi

Raspberry pi has inbuilt Wi-Fi. No need to connect any Wi-Fi modem again. The recorded video can be sent to mobile through Wi-Fi.

Mobile Application

“Wi-Fi bot control” Application must be installed on our smart android phone. By connecting to the Wi-Fi, we can monitor the live video streaming from bore well.

3.2 Working

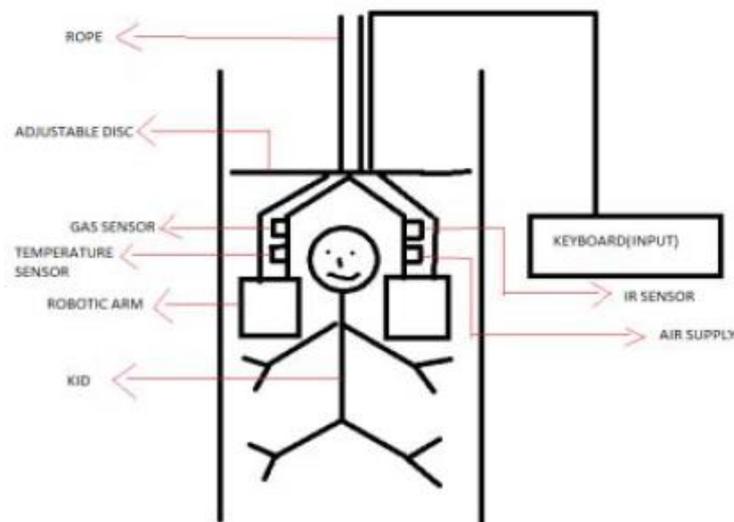


Figure 7 Working of Rescue Robot

At the initial stage of the rescue process, make the arrangement of DC Motors as shown in Fig.5. The motor for the Rope arrangement is to be fixed properly as it plays an important role. Rescue Robot diameter should be adjusted to the diameter of the bore well while manufacturing. So that it will go smoothly into the bore well. The devices which are connected to the Robot are properly checked and activated. Tie the top of the Robot with

Rope which will be controlled and operated by DC Motor by pressing the push button 1. Slowly release the rope when the robot goes into the bore well. High Power LED will be activated automatically in order to detect the path. Raspberry pi camera will capture the situation inside the bore well. We have to monitor the situation in Mobile Application by connecting to the Wi-Fi from our phone. Temperature values and the Gas percentage will be sent to the registered mobile number. And motor for air release will be kept on working to provide oxygen. If a child is found by PIR Sensor then the message can be sent if a child is found by PIR Sensor then the message will be sent. By pressing the push button 2, robot arms will pick the child. DC Motor for rope movement will start dragging the robot outside of the bore well. By pressing the push button3, robot arms will place the child in a safe place. In this way, this rescue system will save the child within the least amount of time as shown in Fig.7.

4. RESULTS AND DISCUSSION

The proposed design will give a 95% Result when compared to previous models in various aspects such as algorithm, aspect, efficiency, distance up to which robot can save the child as shown in Table. 1.

Table 1: The Comparison of results with previous models

Authors	Algorithm	Aspect	Efficiency	Distance up to which robot can travel to save a child	Success rate	Remarks
S. Arthika [1]	Various sensors connected to PIC microcontroller	Based on IR and four dc motors well-run operation	85%	5 feet	85%	There is no high power LED & camera to capture the child condition
Kavianand G [2]	Raspberry Pi controlled system	Based on the PIR sensor and motor drivers	87%	5 feet	87%	no sensors and no camera is connected
Siddharth Singh [3]	Arduino based system	Zigbee technology is employed	89%	10 feet	89%	LCD displays value not video. there is no pc connection
Sumit Pandey [4]	Arduino based system	IR sensor with metal plates employed	90%	5 feet	90%	gas and temperature sensors needed
S. Gopinath [5]	ARM8 processor based system	vacuum cup is employed	91%	10 feet	91%	there are no arms to pick the child. only vacuum cup will drag the child
Our New Derived System	raspberry pi based system	mobile app and HD camera is employed	95%	25 feet	95%	with modern technology, the robot can travel to longer distances to save the child

By pressing push button1 as shown in Fig.8, Rope will be released from DC Motor into the borewell, so that the Rescue robot will move into the borewell.



Figure 8 Pressing the push button 1 for release of Rope

By Pressing the Push button 2 as shown in Fig. 9, Robot Arm will pick the child in bore well if he found.



Figure 9 Pressing the push button 2 to pick the child

By pressing button 3 as shown in Fig.10, Robotic arms will place the child in the safest place, which is at the outside of the bore well.



Figure 10 Pressing the push button 3 to place the child in a safe place

Rescue Robot which will save the child from bore well accidents is as shown in Fig.11.



Figure 11 The prototype of the Rescue Robot

By login to the Mobile App, we can monitor the live streaming video as shown in Fig.12.

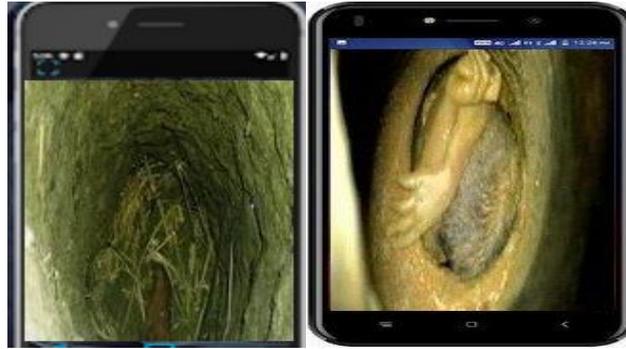


Figure 12 Live streaming the video in Mobile Application

This is the live video streaming can be captured by the Raspberry pi camera which is inside the Borewell in Transmitter section Rescue Robot.

5. CONCLUSION

This Robotic system will save the child in a short time and maximum resources are provided to save him/her from risk. Compared to other Proposed design, this Robotic design will provide the live video streaming in Mobile Application. If Wi-Fi is not getting connected due to technical issues. We have provided a wired connection of Zigbee Transmitter, which will send the captured video to the Zigbee Receiver in the Receiver section. So that we can get the live video on our Personal Computer or Laptop. Other than that 4 DC Motors are used for different purposes. This Rescue robot will work effectively up to the distance of 25 Feet in the underground. No other proposed systems won't work in this distance.

6. ACKNOWLEDGMENTS

Our special thanks to the Management of St. Martin's Engineering College, Hyderabad for providing the required facilities for our research work and for providing funds towards research work and thanks to colleagues and friends for providing the publication support. And sincere thanks to friends and family members without their support it can't be possible.

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