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IOT Based Child Rescue System in Open Borewell

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ABSTRACT: Water is a very essential component for every living being. It is also an important component for agricultural purposes. With the increasing population, the demand for ground water is increasing. Deeper borewells are being dug to extract water. When a borewell dries up, it's not used anymore as it is unfit for any kind of usage. These borewells are left abandoned and are mostly not closed which turns out to be very dangerous, especially for small children, where they might fall into the borewell, the hole which is uncovered and getting trapped in. They seem to be becoming death pits for children. There is no proper rescue system for the fallen victim. In normal cases, rescue operation is carried out using big machines and large man power involvement. A small delay in rescuing the victim may cause death or health issues to them. The currently available systems to save the child are less effective and costly too. It takes more than a day to save the child. Here, the child who is stuck inside the hole is to be saved by the clipper which pick and place the child with the help of remote controller. The clipper is left inside manually by the rope tied up at its hands. In this alternative scenario there will not be any requirements of digging hole parallel to the bore well. It also consists of camera which is affixed to the clipper which is used for monitoring the child. By this camera we get the visuals of the child and their condition.

KEY WORDS: ESP32 Microcontroller, Motor Driver circuit, Pulley, IoT, Rescue Robot

I.INTRODUCTION

Water is a very essential component for every living being. It is also an important component for agricultural purposes. India being an agricultural country, farmers depend primarily on ground water. With the increasing population, the demand for ground water is increasing. Deeper borewells are being dug to extract water. India has approximately 27 million borewells, which is the biggest source of groundwater in the world. When a borewell dries up, it's not used anymore as it is unfit for any kind of usage. These borewells are left abandoned and are mostly not closed which turns out to be very dangerous, especially for small children, where they might fall into the borewell, the hole which is uncovered and getting trapped in. They seem to be becoming death pits for children.

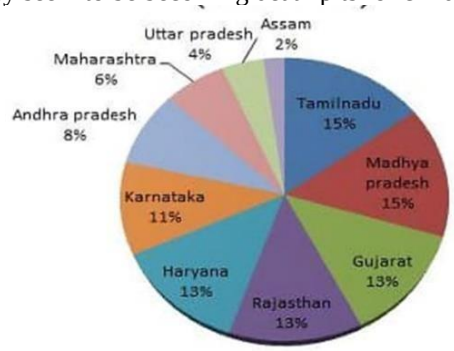

Fig. 1 Number of Borewell accidents in India

Reports say that since 2009, more than 40 children fell into the borewell. On an average 70% of the conventional child rescue operation fails. According to the figures available, from 2006 till early 2019, more than 33 people have died after slipping into the borewell and 92% of those victims were below 10 and according to the NCRB report of 2011 there are 5 average deaths per day in the licensed bore wells.

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There is no proper rescue system for the fallen victims. The currently available systems to save the child are less effective and costly too. It takes more than a day to save the child. Below table represents of the stats of the incident, victim and if they were successful in saving them or not.

Generally, in conventional method a hole parallel to the bore-well is dug up, then a horizontal path is created to reach to the subject's body. But it takes too much time to save the life of the sufferer. Moreover, it involves a lot of energy and expensive resources which are not easily available everywhere. The possibilities of damaging the body of sufferer during the rescue operation loom large.

In some cases, makeshift arrangements are made to pull out the body of sufferer. In such methods certain kind of hooks are used and sufferers body organs get caught hold of. This may cause wounds on the affected body. The occurrence of latest technique provides pragmatic opportunity for new robot power and awareness of new methods of control theory. The present robot control system can be used for different enlightened robotic applications. Robots have been very successful at manipulation in simulation and controlled environments.

A two-year-old boy fell into a defunct borewell in Indi taluk, Vijayapura, Karnataka. Rescuers monitored the situation using a camera and lowered oxygen pipes. A parallel well was dug up to 10 feet deep. Satvik Satish Mujagond fell while playing on his grandparents' farm. Rescue efforts were ongoing, with the boy in critical condition. The boy, trapped at a depth of 15-20 feet, was seen able to breathe. A camera was dropped in the borewell to capture the situation. Subsequently, the oxygen pipes were also lowered.

Fig 2 Child Trapped inside the Open Borewell

Satvik Satish Mujagond was playing on his grandparents' farm on the outskirts of Lachyana village when he tumbled into the borewell. SDRF, health, fire and emergency officials have started the rescue operation, said police. Mujagond family dug a new borewell on Tuesday. "Upon finding water, they removed the casing pipe from the defunct borewell and installed it in the new one. But the old borewell remained open leading to the tragedy," said villager Basavaraj Kumbar. Sugarcane and lime crops grown on the four-acre farmland had begun to wither due to severe drought, prompting the family to dig the new borewell.

When a child falls into open bore-wells and rescue operations was almost a failure, to counter such incidents we are developing a robot machine that can take out the trapped body in a systematic way. It will be a light weight machine that will be setup easily into bore well and hold the trapped body systematically. In this technology, there will be no requirement of digging any hole parallel to the borewell.

With this machine, we can save the child in less amount of time compared to conventional method and this system named as "IoT based Child Rescue System in Open Bore-Well". 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. This machine assembly will be supported by a cable wire and this will be controlled and supported by a gear assembly.

In this proposed work, there will be no requirement of digging any hole parallel to the borewell. 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 borewell is not only difficult but also risky. To lift the child out the narrow confines of the bore wells is also not very easy. This project offers a solution to these kinds of situations. To construct this project, we have used inbuilt microcontroller with Wi-Fi module, board IR Sensor etc. At present there is no proper solution for this problem; in this paper the model of a robot arm which can be used for rescue operation is briefly explained.

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II. METHODOLOGY

A) BLOCK DIAGRAM

The bore wells, which successfully hit the water does not pose any threat because those are completely sealed with casing after installing the motors. Borewells which do not successfully hit the water at maximum depths, are left uncovered and abounded. Such bore wells are called dry or dead borewell, these uncapped borewells become a threat to the children. The figure 3 shows the block diagram of child rescue system in open borewell. In this proposed methodology the micro controller will control all the peripheral devices through Blynk in which the microcontroller is connected with the internet and robot control is done through android blynk application. Once the system has reached proximity of child, it is stopped immediately and is given the commands by the controlling device to perform the closing of the systemic arms. The live video streaming is available on any web page from ESP32 camera which is connected to the internet. MQ125 Sensor is used to detect the presence of harmful gases. Oxygen supply unit is kept stationed, which supplies oxygen as and when the requirement arises.

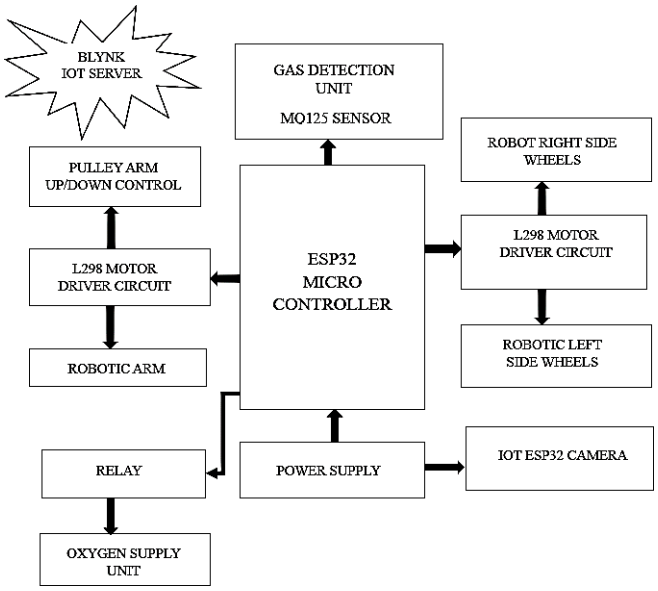

Fig. 3: Block Diagram

B) WORKING

The borewell rescue robot is equipped with a robotic arm capable of reaching down the borewell. An ESP8266 Node MCU board is used as the main controller for the robot. It communicates with other components and connects to the internet for remote control. An ESP32 camera module is used for live video streaming from the borewell. This allows rescuers to monitor the situation in real-time.

i. Blynk Application

Blynk is an IoT platform that allows you to control hardware remotely through a smartphone application. A Blynk application is created to control the robot and monitor the live video stream. Users can send commands to the robot through the app interface.

ii. Control Logic:

The ESP8266 Node MCU board runs firmware that listens for commands from the Blynk application. When a command is received, the NodeMCU board processes it and controls the robotic arm accordingly. For example, it might lower the arm into the borewell to rescue the child. The Node MCU also handles communication with the ESP32 camera module to stream live video feed to the Blynk application.

iii. Rescue Operation:

Upon receiving a rescue command from the Blynk application, the robotic arm is lowered into the borewell. The arm carefully picks up the child and lifts them out of the borewell. Once the child is safely retrieved, the arm is raised to the surface and the child is released

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iv. Feedback and Monitoring

The Blynk application provides feedback to the user, indicating the status of the rescue operation. Users can monitor the live video stream to assess the situation and ensure the rescue is conducted safely.

v. Safety Features

The system might include various safety features, such as emergency stop buttons or sensors to detect obstructions in the bore well. These features help ensure the safety of both the rescuers and the child during the operation.

C) FLOW CHART

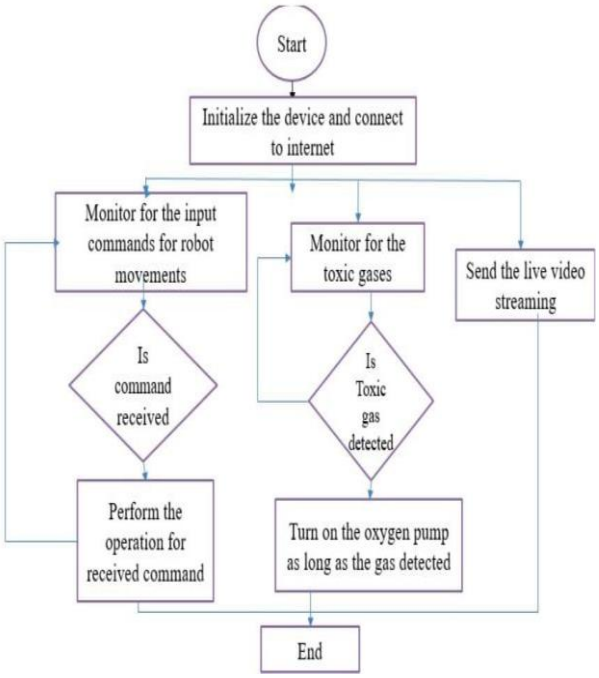

Fig 4 Flowchart

V. EXPERIMENTAL RESULTS

In the proposed system microcontroller is connected to the internet from WiFi or from mobile hotspot and then robot movements are controlled from the Blynk application

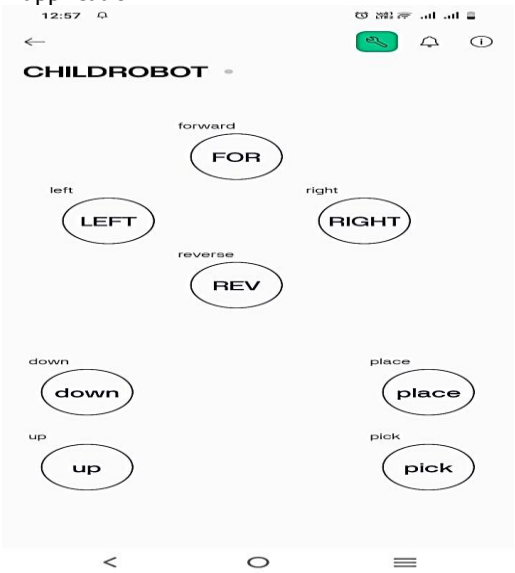

Fig 5 Commands

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The commands are given from mobile application and commands are received on the IoT controller and the robot acts as per the commands.

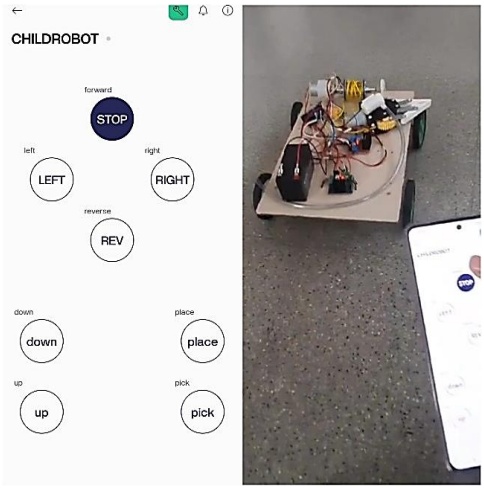

Fig 6 Forward Movement of Robot

L298N motor driver circuit will drive the robot in the given direction. Here commands are giving for the robotic wheels to move forward and as per the command it moves forward direction and same applies for reverse, left and right.

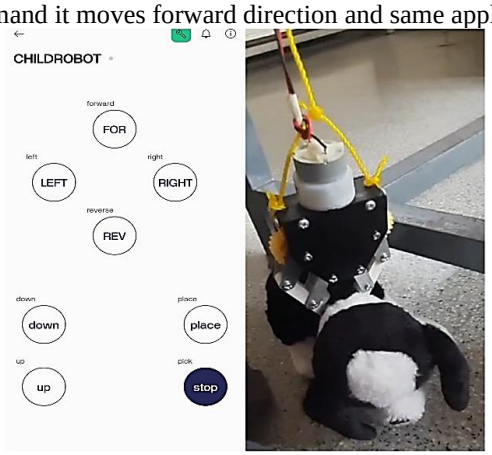

Fig 7 Pinch in

Robotic arm to pinch in and pinch off the victim, a command is giving as pinch in to the robotic arm as per the command the arm pinches in and will give a command to lift up so that the arm pinches in and lifts up the victim. This will be repeated for the pinch off command also.

Fig 8 Gas Detector

Gas detector is used to detect the harmful gas present inside the borewell so that necessary oxygen to the victim is supplied. When the gas is detected automatically the sound beeps and the oxygen will be supplied to the victim.

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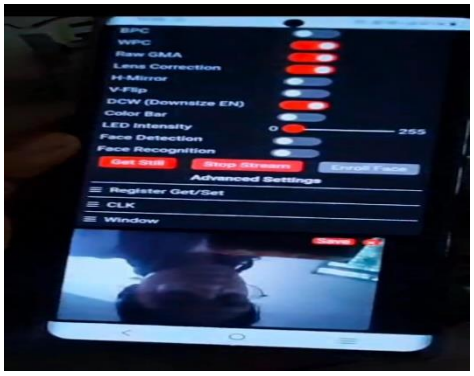

Fig 9 Live streaming Photo

The ESP 32 camera will provide the live video streaming for viewing the child inside the borewell to operate easily. This helps to locate the position and condition of the victim and then the victim is rescued safely & effectively.

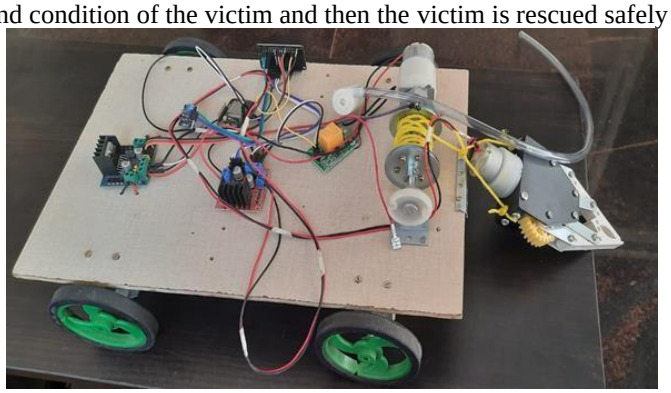

Fig 10 Complete Working Model

Table 5.1: Comparison between Conventional and Current Rescue System

Agenda	Conventional Rescue Operation System	IOT based rescue operation system
Detection Method	Often rely on manual inspection, visual assessment, and physical intervention by rescue personnel to locate and extract thechild trapped in the borewell.	They utilize sensors, cameras, and other IoT devices to detect and locate the child trapped in the borewell. These devices provide real-time data and feedback to aid in the rescue process.
Communication	Communication between rescue teams, ground personnel, and equipment operators is typically conducted via verbal instructions, hand signals, or two-way radios.	Enable real-time communication and coordination between rescue teams, ground control centers, and the robotic devices deployed in the rescue operation. This allows for more efficient collaboration and decision- making.
Navigation and Mobility	Rely on manual labor and traditional equipment such as ropes, pulleys, and excavators to access and extract the childfrom the borewell.	Robots are equipped with advanced navigation systems and mobility features that enable them to navigate narrow and confined spaces, as well as uneven terrain, in a more controlled andprecise manner.
Data Collection and Analysis	May lack the ability to collect and analyze real-time data about the condition of the child, the borewell, and the surrounding environment.	Systems collect and analyze data fromsensors and cameras installed on the robotic devices to assess the situation, monitor the child's condition, and identify potential hazards or obstaclesin the rescue operation.
Speed and Efficiency	May be slower and less efficient due to thereliance on manual labor and	Have the potential to be faster and moreefficient, as robotic devices can perform tasks autonomously, with greater

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	traditional equipment.	precision and speed, under the guidanceof rescue personnel.
Resource Utilization	May require a larger number of personnel and resources to execute the rescue operation, including heavy machinery and specialized equipment.	May require fewer personnel and resources, as robotic devices can perform many tasks autonomously, reducing the need for manual labor andincreasing operational efficiency.
Risk to Personnel	Pose greater risks to personnel due to the reliance on manual labor and exposure tohazardous conditions	Can help minimize the risk to personnelby reducing the need for human intervention in high-risk areas and hazardous environments.

VI. CONCLUSION AND FUTURE WORK

The IoT-based borewell rescue robot represents a valuable tool for improving the efficiency, safety, and effectiveness of borewell rescue operations. Continued research and development in this area, coupled with collaboration between technology developers, rescue agencies, and regulatory authorities, will further enhance the capabilities and deployment of such robots, ultimately saving lives and mitigating risks associated with borewell accidents.
In future this structure could be made strong enough to sustain all possible loads and can be made flexible at the same time to adjust to any environment or diameter of the bore. The potentiometer is get placed by hand gesture mechanism to increase the rescuing time from the borewell. Implementation of real-time monitoring systems can continuously track the status of borewells, providing instant alerts and enabling timely intervention to prevent accidents.

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