Journals Pub

International Journal of
Power Electronics Controllers and Converters

ISSN: 2456-1614
Volume 10, Issue 1, 2024
DOI (Journal): 10.37628/IJPECC

https://journalspub.com/?indexing_body=ijpecc

Research IJPECC

Fall Detection and Rescue System from Borewell

Ashish Shantaram Bhagat[1,*], Ashitosh Dayanand Swami[2], Rohit Sachin Kekan[3], S.A. Shirsat[4]

Abstract

The way the plates are arranged within the borewell prevents the youngster from entering very far, hence the offered remedy will ensure the child's survival. Unintentionally falling into a borewell can be extremely hazardous, especially for children and animals, as it could endanger their lives. In order to solve this issue, the suggested system has developed a unique robot system that can swiftly identify and handle such situations. The conventional methods of extracting persons or animals from borewells are dangerous and take a long time. In India, recent incidents have seen children and animals getting stuck in open borewells, leading to complex and risky rescue operations. The current methods take more than a day and involve complex processes, including digging a parallel hole. This paper suggests using a remote-controlled gripper to pick up and relocate trapped individuals without the need of digging a lot. This innovative approach aims to make rescues quicker and more efficient. While current rescue methods use advanced technologies like video surveillance. The gripper system aims to overcome these issues, providing a faster response and reducing the dangers associated with lengthy rescue operations.

Keywords: Raspberry Pi, OpenCV, robotic arm, image processing, internet of things (IoT)

INTRODUCTION

IoT units are becoming more difficult every day due to the expanding needs and growth within the Web of Matters automated system platform [1]. Back in India, many borewells are drilled daily to obtain various sources, such as gas, water, or oil. Because they lack the mental capacity to recognize the dangers surrounding them, many children are losing and missing their lives while they play. Since September 2009, numerous child fatalities have been recorded from the United States [2]. Establishing this security rescue program in a different borewell could help you save your own life from harm and death. The letter will be mailed to the important individuals in this location, the police, fire, and local hospital, as well as the 108 ambulances services. They will then be informed about the incidents or injuries that occurred in the borewell and will be able to take prompt action or preventative measures to save your life. Information technology also helps people become more conscious [3, 4] and ensures that no new events occur close to their borewell. Robots are built and employed for rescue missions these days [5–8]. These machines don't know how deep a child's bore is; thus, they can't ensure a child's life. If they understand the depth of the child within, these are costly and time-consuming process.

Since the child cannot go very far into the borewell due to the arrangement of the plates inside, the suggested solution will guarantee the child's survival. Accidentally falling into borewells can be very dangerous, especially for kids and animals, putting their lives at risk. To address this problem, proposed system has created a special robot system that quickly detects and responds to such

***Author for Correspondence**
Ashish Shantaram Bhagat
E-mail: ashishbhagat25022002@gmail.com

[1–3]Students, Department of Electronics and Electrical Engineering, Sinhgad College of Engineering, Pune, Maharashtra, India
[4]Professor, Department of Electronics and Electrical Engineering, Sinhgad College of Engineering, Pune, Maharashtra, India

Received Date: May 02, 2024
Accepted Date: May 15, 2024
Published Date: June 10, 2024

Citation: Ashish Shantaram Bhagat, Ashitosh Dayanand Swami, Rohit Sachin Kekan, S. A. Shirsat. Fall Detection and Rescue System from Borewell. International Journal of Power Electronics Controllers and Converters. 2024; 10(1): 7–13p.

emergencies. The usual ways of rescuing people or animals from borewells take a long time and can be risky. The existing systems are not fast enough for these urgent situations. Proposed robot system uses advanced sensors and a strong mechanical system, controlled by a Raspberry Pi 3A. This technology helps the robot retrieve things from borewells quickly and safely, preventing harm and providing quick response. This paper discusses about the problems associated with existing systems and need of proposed rescue system. This paper explains how borewell fall detection robot works, with important parts like an ESP32 camera, DHT11 sensor, and MQ6 sensor. The goal is to show how it can make borewells safer and reduce the risks involved in such incidents. Using Raspberry Pi and cameras together can help make trash management better, making the environment cleaner and more sustainable. This paper talks about the technical details of a system that sorts waste. It covers the different parts like the equipment and computer programs used, how pictures are processed, and how this technology can make waste management better.

LITERATURE SURVEY

This paper proposes controller-based borewell rescuing system. The system has various temperature, gas, and atmospheric pressure sensor. This system uses passive infrared (PIR) sensor. It is used to determine whether victim is either active or unconscious. This system has lack of rescuing system features like gripper open/close. Monitoring system is not there to pre-warn the situation [1]. This paper proposes the embedded based borewell rescue system. This system uses CCD camera module for surveillance purpose. This system uses blower to provide fresh air to victim. Also, it uses a mechanical arm to grasp the victim that makes it very convenient. The mechanical arm does not come along with camera surveillance. Also, many sensors like gas detection, temperature detection is not there in the system [2]. This paper proposes the embedded system for borewell rescuing. Having manually operation using DPDT switches. Manually operating system comes with camera audio\video output surveillance. Lack of sensors. [3] This paper aims to design a robotic system for borehole rescue and child detection. This system comes with oxygen cylinder which is the best advantage of the system. Also, it comes with wireless connectivity. There is no harmful gases detection in this system. It doesn't have any pre-rescuing system. It doesn't have any temperature sensor [4]. This paper proposed system consists of a mechanical system for rescuing from borewell. It has mechanical gear system. This system has two high-resolution cameras with lights for low-light environment. Both cameras are placed at both arms of system. This system doesn't have any gas detection, temperature detection, or any pre-monitoring system [5]. This paper proposed embedded system along with IoT support for borewell rescuing. This system is very advanced and comes with many features like video surveillance. This system also uses IoT in the system. Lack of gas sensor and temperature sensor in this system [6]. This paper proposed robot to perform a task to save the victim. This system comes with all the sensors and controls which provide secure and less time-consuming operation. This system doesn't have any pre-monitoring system to take action quickly [7].

METHODOLOGY

This section describes the borewell monitoring system and rescue system Figure 1 shows borewell monitoring system. It contains temperature and humidity sensor DHT 11 and MQ6 gas sensor to detect poisonous gases in the borewell. ESP32 cam module is used to monitor victim in the borewell. Inbuild Wi-Fi node MCU checks the parameters if it is found risky it conveys to Blynk server using its inbuild Wi-Fi.

Figure 2 shows borewell rescue system for borewell. Rescue system contains Raspberry Pi as a processor and it includes gripper motor, which helps to rescue the object from borewell and the navigation part of gripper is done with the Blynk IoT server. It contains the gripper to hold the victim and a pulley motor to navigate gripper upward and downward. Gripper is connected with the Raspberry Pi. Raspberry Pi's inbuild cam module used for live streaming. Navigation of gripper is controlled with the Blynk server buttons. Blynk up button used to pull gripper upward, Blynk down button used to push gripper downward, Blynk gripper open button used to open the gripper arms, and Blynk close button used to close the gripper arms.

1. *Initialization:* Upon startup, the controller initializes the necessary hardware components, including the Raspberry Pi, motor driver, sensors, and actuators. It sets up communication interfaces and configures GPIO pins for sensor input and motor control.
2. *Sensor Data Acquisition:* The controller continuously reads data from the sensors installed on the robot. This includes capturing images from the ESP32 camera, measuring temperature and humidity using the DHT11 sensor, and detecting gas levels with the MQ6 sensor.
3. *Fall Detection Algorithm:* Once sensor data are acquired, the controller processes it to detect falls into the borewell. For example, it may analyze camera images using computer vision algorithms to identify the presence of individuals or animals.

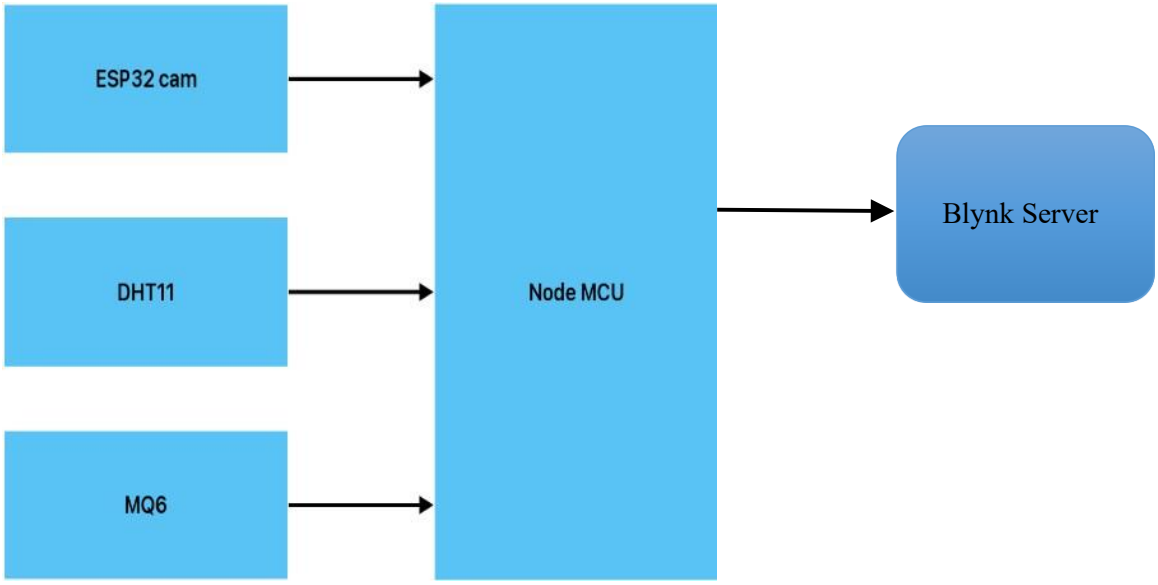

Figure 1. Borewell monitoring system.

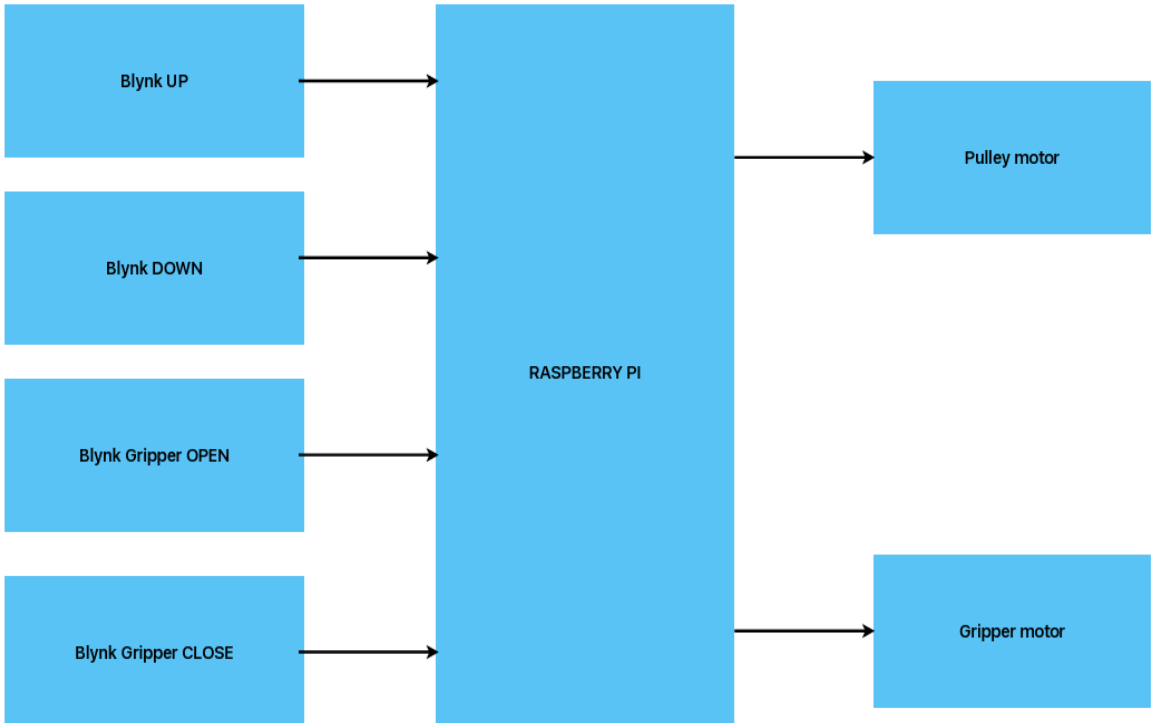

Figure 2. Borewell rescue system.

In Figure 3, the flowchart for monitoring system is given. For the first, all the sensors will turn on as power turns on then the video surveillance camera and continuous temperature and harmful gases detection will inform all the information on online server.

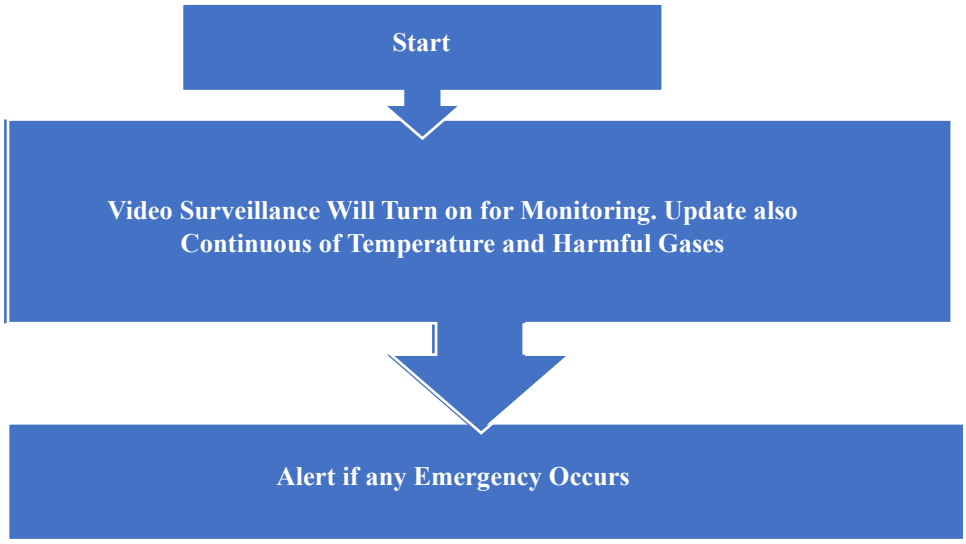

Figure 3. Flow chart of borewell monitoring system.

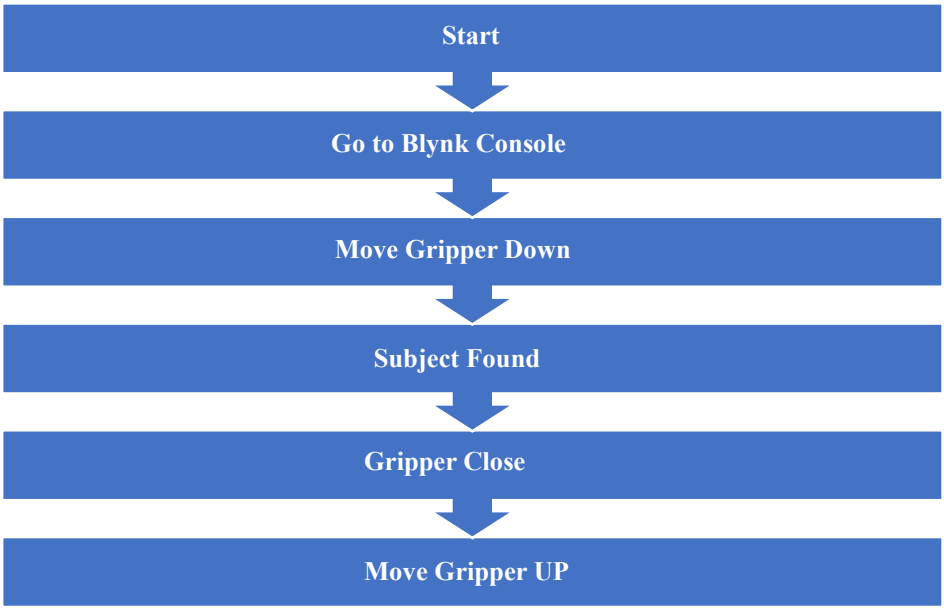

Figure 4. Borewell rescue system.

In Figure 4, the rescue system is provided to rescue the victim. As the power turn on, all the sensors will turn on and the all control will be displays on online blynk server. Move left, right, up, down like controls are there to rescue the victim.

RESULT

Simulation Results

This section gives simulation and hardware results of borewell monitoring and rescue system. This system is simulated using Proteus 8.16. Figure 5 shows simulation of borewell monitoring system. It has temperature sensor DHT11 and gas sensor MQ6 with monitoring system using ESP32 cam module. Simulation result shows the temperature and gas present in the borewell system on LCD.

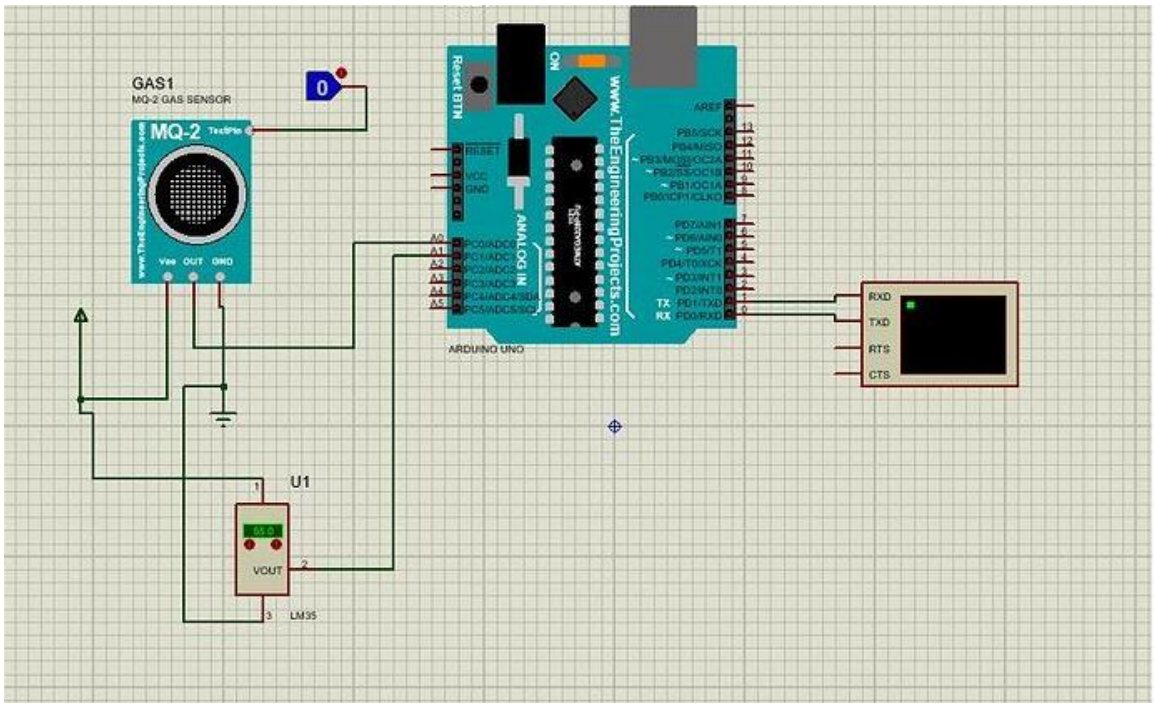

Figure 5. Simulation of borewell monitoring system.

Figure 6 shows simulation of borewell rescue system which has two motor drivers. One motor driver is used for the navigation of pulley up and down. Another motor is helps to open and close the gripper arms. This simulation shows the rotation of pulley and movement of gripper.

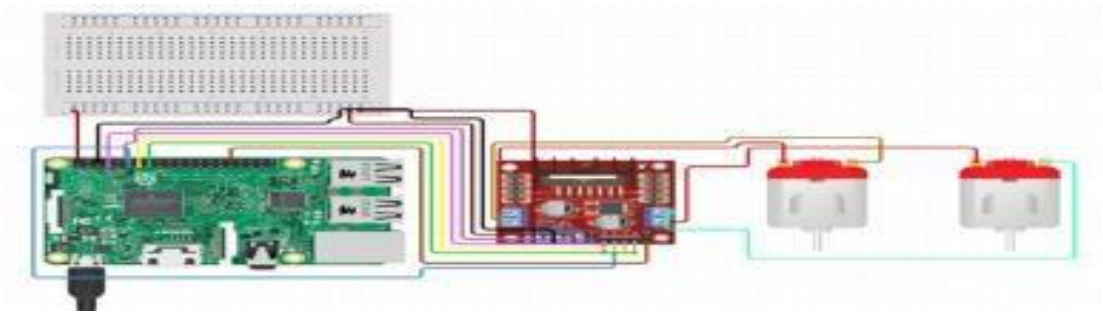

Figure 6. Simulation of borewell rescue system.

Hardware Result

The proposed system can provide a hypothetical scenario for rescuing children from boreholes, making it suitable for government use. This notion enables the creation of large scale of this system to save children's lives. This tool provides an insight of abnormal situation by monitoring system. The system design as shown in Figure 7, was tested on a pipe measuring 8–10 inches wide and 2–3 feet tall. The robot system modified based on these dimensions. Small objects weighing 200–300 grams were placed into the pipe. The system gets inside the vertical pipe and was controlled using Blynk cloud. The target was seen on a PC. The device safely removed the thing using a gripper, following instructions. This technique is applicable to borewell monitoring and borehole rescue operations, potentially saving many lives with minimal risk.

APPLICATIONS

- *Borewell Safety Monitoring:* Deploying the robot for continuous monitoring of borewells in rural and urban areas helps identify potential hazards, such as uncovered or poorly secured borewells, allowing for timely intervention to prevent accidents [9].

- *Emergency Response:* In the event of a fall into a borewell, the robot can quickly detect the incident, assess the situation, and initiate rescue operations, reducing response times and increasing the chances of successful outcomes [10].
- *Search and Rescue Operations:* Beyond borewells, the robot can be used for search and rescue operations in various environments, including disaster zones, collapsed structures, or hazardous terrains, where conventional methods may be impractical or risky.
- *Industrial Safety:* In industrial settings such as mines, construction sites, or oil and gas facilities, the robot can enhance safety by monitoring confined spaces, detecting hazardous gases, and assisting in emergency response and evacuation procedures [11].

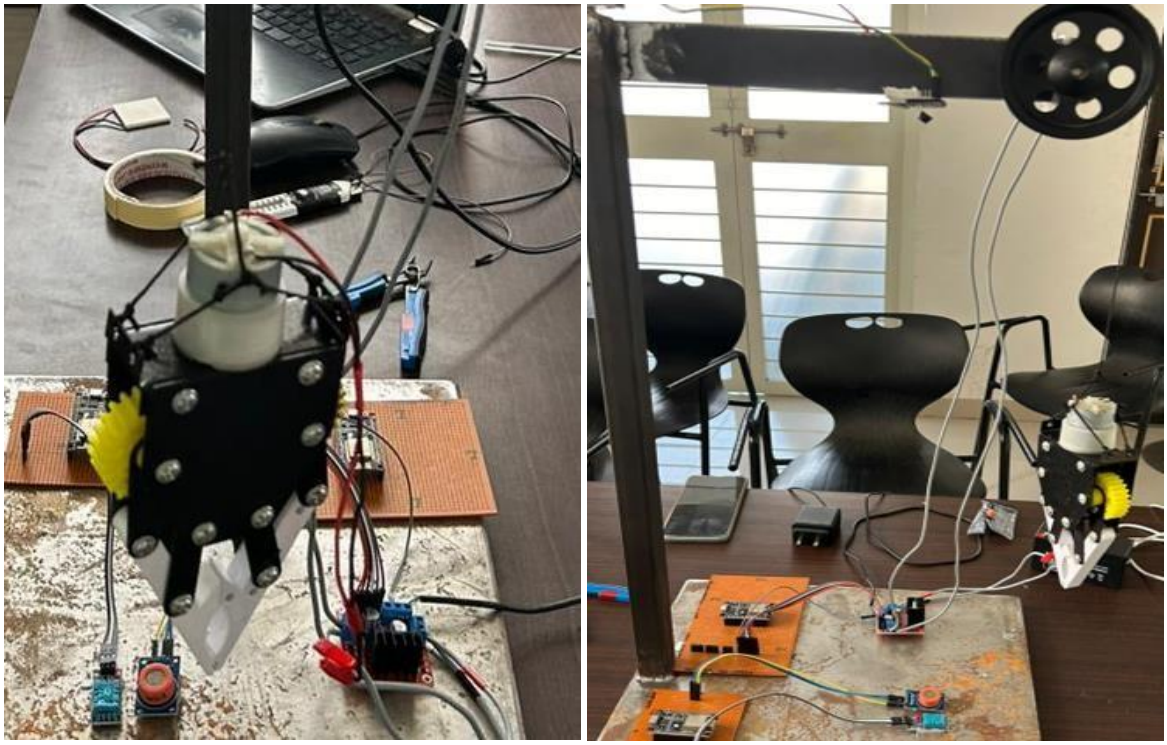

Figure 7. Borewell rescue system.

CONCLUSION

In conclusion, the development and deployment of a borewell fall detection robot represent a significant advancement in safety technology with the potential to save lives and mitigate risks in environments where borewells pose a danger. By leveraging sensor technology, robotics, and artificial intelligence, the robot offers proactive monitoring, rapid response, and effective rescue capabilities in emergency situations. Through continuous monitoring of borewell environments, timely detection of falls, and autonomous or remote-controlled rescue operations, the robot addresses critical challenges associated with borewell accidents, such as delayed response times and limited access to remote locations. Its versatility extends beyond borewells to encompass.

Acknowledgement

I wish to express my sincere thanks and deep sense of gratitude to respected mentor and guide Dr S. A. Shirsat, Assistant Professor in Department of Electronics and Telecommunication Engineering of Sinhgad college of Engineering, Vadgaon (BK), for the technical advice, encouragement and constructive criticism that motivated to strive harder for excellence. We would also like to express our sincere thanks to Dr M. B. Mali, Head, Department of E&TC for his cooperation and useful suggestions. We would also like to thank Dr S. D. Lokhande, Principal, Sinhgad College of Engineering. He always remains a source of inspiration for us to work hard and dedicatedly.

REFERENCES

1. Pahl M. -O., Aubet F. -X., Liebald S. Graph-based IoT microservice security. NOMS 2018 - 2018 IEEE/IFIP Network Operations and Management Symposium. Taipei, Taiwan. 2018. pp. 1–3. doi: 10.1109/NOMS.2018.8406118.
2. Kaur P., Kaur R., Singh G. Pipeline inspection and borewell rescue robot. International journal of research in engineering and technology. 2014; 3(4): 726-729p.
3. Cuff D., Hansen M., Kang J. Urban sensing: Out of the woods. Commun. ACM. 2008; 51(3): 24–33p.
4. Mulligan C. E. A., Olsson M. Architectural implications of smart city business models: An evolutionary perspective. IEEE Commun. Mag. 2013; 51(6): 80–85p.
5. Gnanaprakasam D., Sanjay S., Jegan S., Tharanidharan S. Implementation of a Child Rescue System from Borewell Using Wi-fi for Long Range Applications. International Journal of Scientific Research and Engineering Development. 2022; 5(3): 1337–1341p.
6. Palaniswamy S. Life Saving Machine. Special Issue of the International Journal of the Computer, the Internet and Management. 2011; 19(1):
7. Manoj E., Monish S., Rahulreevan P. J., Veerasamy B. Child Rescue System from Open Borewell. International Research Journal of Engineering and Technology (IRJET). 2020; 07(03): 2560–2563p.
8. Vishnu Vardhan Y., Srinivasa Rao P., Manoj Babu N., Mahesh Babu G. Borewell Rescue Robot. Pramana Research Journal. 2019; 9(4): 60–63p.
9. Agarwal N., Singhal H., Yadav S., Tyagi S., Pathak V. Child Rescue System from Open Borewells. International Journal of Trend in Scientific Research and Development (IJTSRD). 2019; 3(4): 639–642p.
10. Madhukara S., Vidyashree M. Child Rescue System. International Research Journal of Modernization in Engineering Technology and Science. 2022; 04(07): 49–52p.
11. Kaur P., Kaur R., Singh G. Pipeline Inspection and Borewell Rescue Robot. IJRET: International Journal of Research in Engineering and Technology. 2014; 03(04): 726–729p.

