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RESCUE ROBOT FOR BOREWELL

Prof. Vidhya [1], Nagashirisha M Srinivas [2], Nithya R [2], Noorain Fathima [2], P Navya[2]

[1]*Associate Professor ISE, The Oxford College of Engineering*

[2]*Students, ISE, The Oxford College of Engineering*

Bangalore, India

Abstract- Modern citification and development of cities has expanded since a decade, parchedness and deficient supply of water from conventional water reservoir and supply system has led to expand in number of domestic borewell installation. And price of installation and financing is easy and economical hence increasingly people are selecting for their personal bore well, rather relying of City Corporation for water supply. This has acutely enlarged the accident in the site of bore well especially toddlers are assailable and numerous incidents has transpired where toddlers smitten in open borewell and some falling into the depth. The intension of the project is to establish and design a bore well rescue robot, which can lift and rescue the kids who fall into well.

Key words- rescue robot for borewell, confined space rescue, remote-controlled robotics, live streaming surveillance, humanitarian technology, cost-effective rescue system

1.INTRODUCTION

In India, where horticulture vigorously depends on groundwater for water system, the multiplication of bore wells has become typical because of elements like development and urbanization. Notwithstanding, the rising number of bore wells has likewise achieved an unsettling issue - a considerable lot of these wells are left uncovered after use, representing a grave risk, particularly to kids who may unintentionally fall into them. The rescue of children trapped in bore wells is difficult and risky, often taking a day and requiring complicated procedures. The depth of these bore wells, which can reach up to 700 feet, further complicates matters and makes extraction efforts even more challenging. Regardless of the best endeavours of salvage groups, a few mishaps might demonstrate difficult to determine. Tragically, numerous children have died as a result of falling into uncovered bore wells, with documented cases dating back to August 2008. This inauspicious reality highlights the earnest requirement for measures to address this squeezing security concern, remembering stricter guidelines for bore well upkeep and expanded public mindfulness with respect to the perils they present, especially to kids [1]. The earnest need to save people, especially kids, caught in profound drag wells is highlighted by the specialized difficulties inborn in conventional salvage strategies. These difficulties, for example, unsteady drag well walls and dubious topographical circumstances, require the improvement of specific machine-human salvage robots [2]. India, as the world's foremost consumer of groundwater, encounters a substantial hurdle in handling bore-well incidents, marked by a notable frequency of unsuccessful rescue missions. Recent tragedies such as the

unfortunate demise of Sujith in Tamil Nadu underscores the shortcomings of traditional rescue approaches [3]. Young kids without seeing the opening tunnelled for the exhaust well slip in and get found out. Because the buried wells are so extensive that it is extremely difficult to save lives. Protecting the Children who are trapped are a popular target since a long time ago. Undertaking persevering close to thirty hours owing to their colossal profundities. Due to their huge profundities the amount of oxygen that can be accessed within the bore well decreases. quickly. In spite of the way that assuming people notice an appalling loss got inside the drag well, it takes around 20 to 40 extensive stretches of time to safeguard them in the conventional way which is equal piece safeguarding technique [4]. The robots can be used to glance through any survivors in a zone where the method can be simplified with better human robot joint effort. In the time of

headways in technology, robots are important in many important fields, with the specific goal of assisting in the rescue exercises to save a youngster from bore well. It can safeguard caught the child in a short amount of time [5]. A borewell rescue robot's main goal is to quickly and successfully free people who are stuck in tight areas or borewells. With the use of sophisticated sensors and reliable communication systems, it is designed to precisely locate and identify people who are trapped, establish contact to provide comfort and direction, and maybe provide first assistance. The robot is intended to be durable and adaptive under extreme conditions. Its goals are to speed up traditional rescue operations, minimize reaction times, and put the safety and quick recovery of people in critical situations within borewells first [8].

With the goal of saving lives and greatly enhancing conventional rescue operations, the Rescue Bore well Robot acts as a ray of efficiency and hope in dire rescue situations. Its use of cutting-edge technology highlights its essential function in accelerating rescue operations and giving priority to the security and prompt rescue of people who are stranded in tight spaces or bore wells.

2.LITERATURE SURVEY

For the purpose of preventing, identifying, and saving children who unintentionally fall into bore wells, the AI-Based Smart Bore Well Child Rescue Robot offers an extensive framework. The project combines hardware elements such as a Raspberry Pi, sensors, and a motor driver with AI algorithms for speech and face expression identification, utilising a portable real-time system with stages including prevention, detection, and rescue. Its uses go beyond drilling holes to include real-time monitoring, IoT and AI integration, industrial and agricultural safety, and humanitarian assistance. Preventing accidents before they happen is one of the system's benefits, since it has the capacity to detect problems early. Raising the need for thorough testing and validation in this regard is necessary since environmental constraints and the dependence on technology present problems. For example, bad network connectivity can negatively impact system accuracy and dependability [1]. The goal of Semi-Automatic Child Rescue BOT in Deep Borewell is to create a semi-automated rescue robot that can react to crises in deep bore wells. It emphasizes the need for both human expertise and cutting-edge robotic technology to handle difficult technical problems and urgent situations in borewell rescues. The suggested hybrid system combines autonomous operation with human control by making use of specialized cameras, sensors, and communication devices to transmit data in real time and provide visual feedback. A robust, water-resistant chassis with sensors for data collection, dependable communication technology for remote control, and machine learning algorithms for safe navigation and hazard detection are all part of the methodology [2]. Compact design, effective propulsion, obstacle detection sensors, and secure child extraction mechanisms are among the benefits. To improve adaptability and effectiveness, however, continued research and development are required, and careful thought must be given to the moral implications of using robots in life-or-death situations. Overall, the study shows how technology can be used to reduce risks and save lives in difficult situations [2]. A computer controls the motor on the exterior, and motors, sensors, and a camera are located inside. By means of a webpage, they manage and observe the robot. They are able to determine the well's temperature, humidity, and depth thanks to the sensors. The robot's arms are moved by motors, and a camera is used to view the scene [3]. The methodology's emphasis on accuracy and safety is one of its benefits. The technology guarantees a cautious and precise extraction of the child from the bore well, lowering the possibility of harm occurring during the rescue operation. It does this by utilizing robotic arms and sensors. The dependence on human control via a web interface is, nevertheless, a major drawback. Due to its reliance on human intervention, this dependency might hinder the rescue operation's effectiveness and speed. The process might be slowed down by the requirement for continual supervision and input from a human operator, particularly in urgent situations where prompt action is necessary [3]. Pangolin seeks to offer a dependable and adaptable rescue operation solution for dangerous environments. The system consists of a robotic hand with animatronics for efficient victim retrieval, a mechanical chain system for precise movement, and sensors and a high-definition camera for real-time health monitoring. For the purpose of guiding the robotic hands down the bore well and extracting the victim, the mechanical chain system makes use of a gear system and stepper motor that are managed by an Arduino module. A person wearing gloves with flex sensors controls the animatronic-based robotic hand, which imitates human finger movements and is controlled by an Arduino board. A high-resolution camera allows for real-time video surveillance inside the bore well, and sensors positioned along the robotic fingers monitor the victim's health.

All things considered, Pangolin presents a viable way to reduce the dangers connected to bore well mishaps and boost the effectiveness of rescue efforts [4]. An accelerometer and a DPDT switch operate a hand-gestured robotic arm and a gripping belt mechanism in the proposed system. The child's location is tracked via video surveillance, and the system is run employing a pulley system. The study highlights how crucial quick and effective rescue efforts are in protecting kids from bore well mishaps. The paper's methodology focuses on creating a child-saving robot that has two primary hardware components: a robotic arm that can be gestured with the hand and a belt

mechanism that grips. An accelerometer regulates the hand gesture mechanism, enabling the robot to firmly attach the belt to the child's hand [5]. The gripping belt mechanism uses a pulley system and DC motors that are managed by a DPDT switch to lift the child out of the bore well. With a web camera, video surveillance is used. to keep an eye on the child's placement within the bore well [5]. A humanoid robot to rescue kids from bore wells, tackling the difficulties and dangers involved in such operations. The robot's design incorporates a human-like hand that can be operated by gestures, wireless technology, an oxygen supply for the child, LED lighting, and a wireless camera for monitoring. When handling the child, safety is the top priority, and the robot's greater Degree of Freedom (DOF) increases its adaptability. The robot is controlled by the operator while it descends into the bore well; images captured by the video camera are viewed on a PC. It also allows for voice feedback. Based on gestures, the robot uses its arms to grasp the target, retrieve it safely, and pull it out of the bore well [6]. The suggested system's implementation may be hampered by financial concerns, particularly in areas with limited resources, as well as by the inaccessibility of sophisticated technological components [4]. The hand gesture robotic arm and gripping belt mechanism may not be able to function as well in certain bore well environments, such as cramped quarters or uneven surfaces. Regular maintenance and servicing may be necessary to ensure the robustness and durability of the robotic system, particularly in harsh or unpredictable environments [5]. Robots that use hand gestures run the risk of making accidental gestures or misinterpreting them, which could result in incorrect command execution and decreased dependability in some situations. The sensitivity of inverse kinematics in robotics to unknowns like joint friction calibration errors can result in inaccurate end effector positioning [6]. Data collection from animal shelters can present difficulties because due to a shortage of personnel and supplies as well as the requirement for more thorough data gathering. Combining different sensors and technologies, like ZigBee may encounter difficulties with seamless communication and compatibility between the system's various parts [7].

3.PROPOSED SYSTEM

3.1 Materials Used:

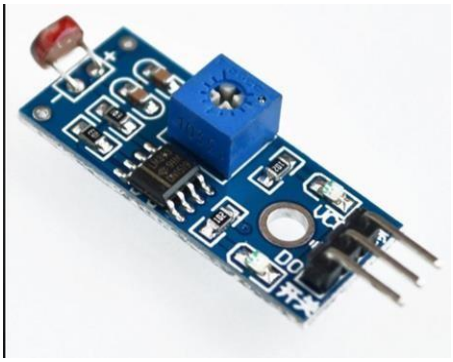
1. Hardware components

i . Esp32 cam development board

The tiny, low-cost ESP32-CAM development board has an integrated camera. For DIY projects, prototype builds, and Internet of Things applications, it is the perfect answer. The board combines two powerful 32-bit LX6 CPUs with WIFI, conventional Bluetooth, and low power BLE. It uses an on-chip sensor, Hall sensor, temperature sensor, and a seven-stage pipeline architecture. Its primary frequency adjustment ranges are 80MHz to 240MHz. It can be used as a slave to other host MCUs to add networking functionality to existing devices, or as a master mode to build an independent network controller. It is fully compliant with Wi-Fi and Bluetooth 4.2 standards. ESP32-CAM has a broad range of applications in the Internet of Things. It is appropriate for Internet of Things applications such as wireless positioning system signals, industrial wireless control, wireless monitoring, QR wireless identification, and smart home gadgets. For IoT applications, it is the perfect answer.

Fig-3.1.1: ESP 32-cam development board

ii. Arduino Uno Board



The Arduino UNO is a standard board of Arduino. Here UNO means 'one' in Italian. It was named as UNO to label the first release of Arduino Software. It was also the first USB board released by Arduino. It is considered as the powerful board used in various projects. Arduino.cc developed the Arduino UNO board. Arduino UNO is based on an ATmega328P microcontroller. It is easy to use compared to other boards, such as the Arduino Mega board, etc. The board consists of digital and analog Input/Output pins (I/O), shields, and other circuits. The Arduino UNO includes 6 analog pin inputs, 14 digital pins, a USB connector, a power jack, and an ICSP (In-Circuit Serial Programming) header. It is programmed based on IDE, which stands for Integrated Development Environment. It can run on both online and offline platforms.

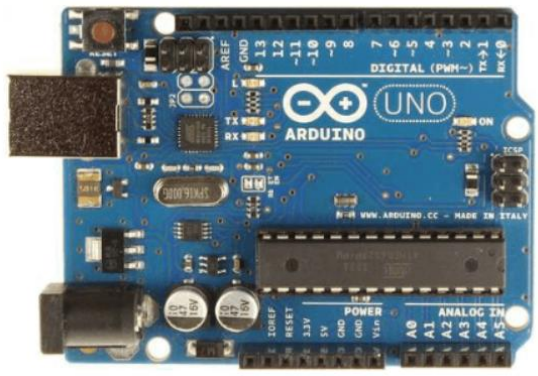


Fig-3.1.2: Arduino Uno Board

iii. LDR Sensor

An LDR, also known as a photo resistor or photocell, is a type of resistor whose resistance changes based on the amount of light it receives. It works on the principle of photoconductivity, where incident light decreases the material's conductivity, causing electrons to move from the valence band to the conduction band. LDRs are commonly used in circuits to detect light presence and can be employed to control lighting based on ambient light levels. They have a resistance of around one Ohm in darkness, which increases significantly in the presence of light.

Fig-3.1.3: LDR Sensor

iv. Motor Drivers

Motor drivers are vital components in robotics and automation projects, providing the necessary energy to operate motors and other system parts. They handle voltage, current, directionality, and protection, ensuring efficient operation of robotic components. Motor drivers serve as the interface between control circuits and motors, converting low-current control signals into higher-current signals required to power motors. This conversion enables seamless integration of low-current control circuits with high-current

motor operations.

Fig-3.1.4: Motor Driver

v. DC Motor

A DC motor is defined as the class of electrical motors that convert direct current electrical energy into mechanical energy. A DC motor is any electric motor powered by direct current (DC). In the upcoming sections, we'll delve into the construction of DC motors and explore how they transform supplied DC electrical energy into mechanical energy.

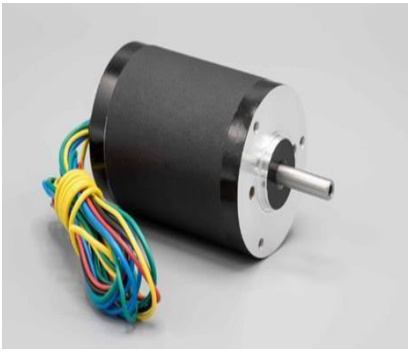


Fig-3.1.5: DC motor

vi. Servo motor

A servomotor, also known as a servo motor, is a precision actuator used for controlling angular or linear position, velocity, and acceleration in mechanical systems. It consists of a motor paired with a position-feedback sensor and requires a specialized controller for operation. While often associated with closed-loop control systems, servomotors encompass various motor types adapted for precise control applications. Widely utilized in automated manufacturing, robotics, and CNC machines, servomotors play a critical role in achieving accurate motion control for various industrial and mechanical tasks.

Fig-3.1.6: Servo Motor

vii. Robotic Arm Gripper

A robotic arm gripper serves as a crucial end effector for robots, facilitating the grasping, holding, and movement of objects. Positioned at the end of a robot arm, grippers typically feature fingers or jaws to securely grip the workpiece. They mimic the dexterity and strength of a human hand, enabling repetitive tasks and object transportation in various industries, particularly manufacturing. While offering benefits like increased efficiency, productivity, and customization for different objects, grippers also present challenges such as high costs, maintenance needs, and limitations in flexibility. Vacuum grippers are cost-effective but suitable only for smooth, flat surfaces, while magnetic grippers work well with magnetic materials but may not be compatible with others. Mechanical and electric grippers offer reliability and precision but come with their own drawbacks, emphasizing the importance of selecting the right gripper based on specific task requirements and environmental factors.

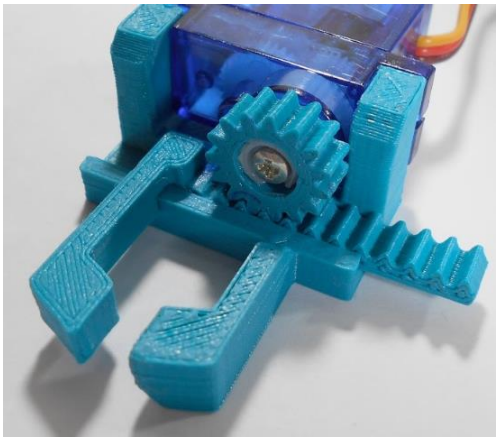


Fig-3.1.7: Robotic arm gripper

viii. Temperature and humidity Sensor

The DHT11 Temperature and Humidity Sensor stands out for its advanced temperature and humidity sensing technologies, coupled with a calibrated digital signal output, ensuring excellent reliability and efficiency. This sensor, connected to a high-performance 8-bit microcontroller, offers outstanding stability, quick response, and anti-interference ability. With its resistive-type humidity measurement component and NTC temperature measuring component, the DHT11 provides great quality and cost-effectiveness for various applications.

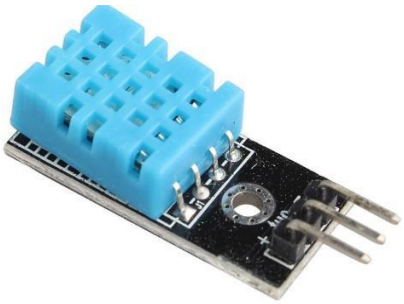


Fig-3.1.8: Sensor

2.Software Components

i. ARDUINO IDE

The open-source electronics platform Arduino is constructed upon user-friendly hardware and software. Arduino boards have the ability to read inputs, such as a light from a sensor, a finger pressing a button, or a message from Twitter, and convert them into outputs, such as starting a motor, turning on an LED, or posting content to the internet.

By sending a set of instructions to the microcontroller on the board, you can instruct your board on what to do. You use the Arduino Software (IDE), which is based on processing, and the Arduino programming language, which is based on wiring, to accomplish this. The IDE is user-friendly for novices and has sufficient flexibility for more experienced users. It functions on Linux, Windows, and Mac. It's applied by educators and students to construct inexpensive scientific apparatuses, demonstrate chemistry and physics concepts, and begin learning robotics and programming.

Interactive prototypes are created by architects and designers, and artists and musicians use them for installations and to test out new musical instruments. Naturally, makers use it to construct a large number of the projects on display at events like the Maker Faire. An essential tool for learning is Arduino.

ii. C++ Language

C++ is a versatile and powerful high-level programming language developed by Bjarne Stroustrup in 1983, building upon the foundation of C. It encompasses a wide range of programming styles, including procedural, object-oriented, functional, and generic paradigms. Known for its high performance and direct access to hardware, C++ is often favored for creating large-scale applications. As a superset of C, it inherits all of C's features while introducing new ones. With its emphasis on control over system resources and memory, C++ is a preferred choice for developers seeking efficiency and portability. It is cross-platform and can be compiled to run on various operating systems. Regular updates, such as C++11, C++14, C++17, and C++20, ensure that C++ remains relevant and adaptable to evolving programming needs. While its syntax may be more complex than other languages, prior experience in languages like C or Python can facilitate the learning process for mastering C++.

3.2 PROPOSED METHOD

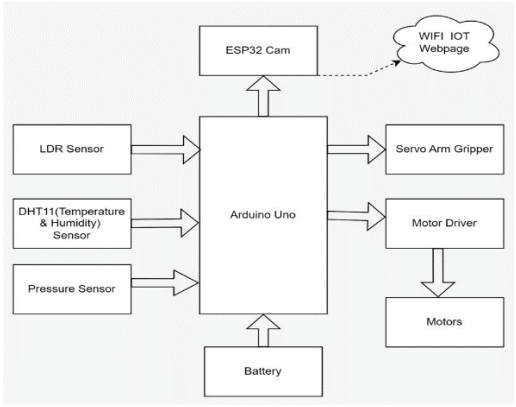


Fig-3.2.1: Block diagram

i.ESP32: The ESP32 is a robust microcontroller featuring dual-core processing for high performance. It includes Wi-Fi and Bluetooth for wireless connectivity, while its GPIO pins support interfacing with sensors and actuators. With ample memory and processing power, it efficiently handles complex algorithms and real-time data processing.

ii. Power Supply: The 7.4V lithium-ion battery offers reliable, portable power with high energy density. Its rechargeable nature suits mobile applications, providing stable operation and convenient recharging for uninterrupted use and long-term cost-effectiveness.

iii. Motor Driver (L293D): The L293D motor driver is a dual H-bridge IC used for controlling DC motor speed and direction. It provides built-in protection features like thermal shutdown and current limiting for enhanced safety and reliability. Its bidirectional control capability allows for forward, reverse, and braking actions. Compatible with various microcontrollers, it's a popular choice for motor control applications.

iv. DC Motor: DC motors are popular in robotics and automation for their simplicity, high torque, and controllability. In this system, they enable vertical movement within a bore well using a rope mechanism. Their torque makes them ideal for lifting and lowering operations, allowing precise control. By adjusting voltage and polarity via the motor driver, speed and direction can be effectively controlled.

v. LDR Sensor: LDRs are passive components whose resistance varies with light intensity. In this system, they're used to measure ambient light levels in the bore well. They offer a simple, cost-effective way to monitor light conditions, providing data for assessing environmental parameters or detecting anomalies.

vi. Temperature Sensor (DHT11): The DHT11 is an affordable digital sensor that measures temperature and humidity. Its calibrated digital output makes it simple to connect with microcontrollers like the ESP32. Temperature monitoring is crucial for bore well safety. The DHT11's accuracy and reliability make it ideal for various applications, including HVAC, weather stations, and industrial monitoring.

vii. Pressure Sensor: Pressure sensors convert pressure changes into electrical signals. In this system, they gauge bore well pressure, offering insights into water levels or obstructions. Various types like piezoresistive or capacitive sensors may be employed based on needs. Precise pressure measurement is vital for assessing bore well condition and equipment performance.

viii. Robotic Arm (Gripper): The robotic arm with gripper mechanism enables versatile object manipulation. In this system, it's used for rescue operations, safely retrieving individuals from the bore well. Its precision and dexterity facilitate efficient grasping and lifting, reducing injury risks. Gripper mechanisms, including pneumatic, hydraulic, or electrically actuated types, offer flexibility for handling diverse payloads.

ix. High-Power LED: High-power LEDs are used in bore well systems for improved visibility during surveillance and rescue. Their efficiency and long lifespan make them perfect for battery-powered setups. LED brightness and colour temperature can be adjusted for optimal lighting conditions, aiding video capture and inspection.

x. Camera: The camera in the bore well system provides real-time video streaming for remote monitoring via smartphones or laptops. Its high resolution, low-light sensitivity, and wide-angle lens ensure clear footage. Integration with wireless communication enables seamless data transmission, aiding in timely decision-making during rescue operations.

3.3 Methodology

The borewell rescue robot, which is used to extract the kid from the borewell, is first fastened to the surface hub and then gradually lowered into the borewell. The web application is used for the robot's entire operation can be utilized with a mobile phone or a laptop. TCP/IP is used for communication between the webapp and the esp32, the robot's central processor unit. By using commands from the web application, the motors are turned on when the power supply is turned on. To prevent any unintentional movement, the commands to move forward or backward for entering and exiting the borewell must be followed by a stop command. The live streaming camera records the entire process. There is a high power led that can be turned on or off based on our needs to help illuminate the borewell hole. The robot's numerous sensors installed within give the

operator access to the internal environment's current values, such as the CO gas levels, light intensity, pressure, and temperature. The Arduino Uno gathers these sensor values and transforms the real-time data into values that the operator can understand. In addition to serving as an extender for the esp32, the Arduino Uno lowers operational overhead that would otherwise be placed on the esp32, increasing overall efficiency. The entire working code is written in C++, which is subsequently integrated into web programming languages to enable web applications for the entire operation. The robot is gradually lowered after the operator locates the victim, and it must manoeuvre to find a suitable spot to seize a victim. With the aid of grippers that are command-driven by the servo motor and can move left or right, the victim is grasped. The victim is then pulled to the surface when the motors are turned on. Compared to the convectional process, which can take several hours, the entire process should only take about 20 minutes.

4.OUTCOMES

The envisioned outcome for the borewell rescue robot is the development of an innovative and cost-effective solution that can be widely deployed in critical areas such as remote villages. Designed to be user-friendly and operable by non-technical individuals, this system ensures accessibility even in areas with limited technical expertise. By securely attaching the robot to a surface hub via a rope, operators can remotely control it using everyday devices like computers or mobile phones, facilitating efficient rescue operations. The robot's features, including controlled crawling, real-time monitoring via a live streaming camera, and an efficient victim extraction mechanism, are aimed at expediting rescue efforts while ensuring a secure and gentle extraction process for trapped individuals. The emphasis on affordability makes the system suitable for deployment in diverse settings, ensuring that even resource-constrained villages can benefit from its life-saving capabilities. This approach not only enhances rescue efficiency but also reflects a commitment to minimizing discomfort for victims during extraction.

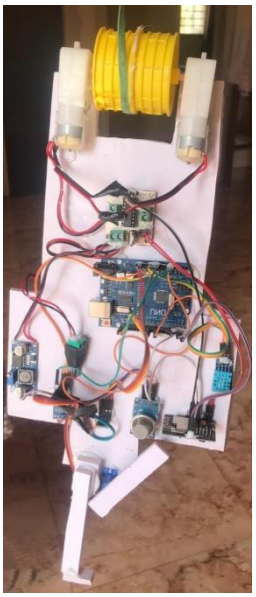


Fig-4.1: Rescue robot for borewell prototype

5.CONCLUSION

The borewell rescue robot represents a remarkable technological advancement with the potential to transform and greatly enhance the efficiency of rescue operations in challenging environments. Engineered with a user-friendly interface and capable of remote operation by non-technical personnel, it addresses the urgent need for swift and effective borewell rescues. By incorporating advanced components like DC motors, servo motors, and specially designed robotic grippers, the system demonstrates a commitment not only to technological sophistication but also to ensuring the safety and comfort of victims. Moreover, its cost-effectiveness allows for widespread deployment in rural areas, enabling prompt response to emergency situations and potentially saving lives.

REFERENCES

1. S. Bharathi, D. Ravi, SK. Shukur, A. V. Kiranmai “AI-Based smart bore well child rescue robot.” Journal of Engineering Sciences in year 03,2023.

2. R. Nithya Prakash, S. Shankar, R. Naveenkumar, S. Praveen Kumar, R. Seenivasa, S. Naveen Prasath "Semi-Automatic Child Rescuing BOT in Deep Borewell." E3S Web of Conferences453, 01056 (2023) year.

3. Akash B, Kanisha K, Sumya Ranjan, M Jaya Kumar "Design and Development of Robot for Rescue Operations for Bore-Well Victims." IEEE Journal in the year June 05,2021.

4. Sen K Varghese, Tom Joseph, Sandra Ann Varughese, Lakshmi Anil, Reneesh C Zacharia "Pangolin"-Animatronic Based Robotic Hand System for Human Rescue in Deep Mine Hole and Bore Well Accidents." IEEE Journal in the year June 03,2021.

5. M. Jayasudha, Dr. M. Saravanan "Efficient Child Saving Robot from Open Bore Well using Hand Gesture based Robotic Arm and Gripping Belt Mechanism." May 20,2021 IEEE journal.

6. R. Gayathiri, M. Nalini, R. Archana, M. Varsha Nambiar, S. Kishore "Hand gesture base bore well rescue robot." Elsevier Journal in the year Feb 21,2021.

7. Associate Prof Dr. Sheryl Radley, Assistant Prof. N. Mohana Priya, Assistant Prof B. Vennilapriya, Dinesh Kumar R, Pawan Eshwar A, Supratha Devi S.R, Iswariya R "Novel Crawler for Recovery of Things from Unmanned Pit Using Micro Electro Mechanical System." International Journal of Scientific Research & Engineering Trends in sept 2020.

8. S.Arthika, S.Chidammbara Eswari, R.Prathipa and D.Devasena(2018),"Borewell Child Fall Safeguarding Robot", International Conference on Communication and Signal Processing(IEER), pp 825-829.

9. P.Sumathy, A.Monika and R. Dhanashree (2018), "Smart and safe child rescue system", International Journal of Pure and Applied Mathematics, Vol.119, No. 15 , pp 861-865.

10. Sumalatha A ,M Pradeepika, M Srinivasa Rao and M Ramya (2018) , "Arduino Based Child Rescue System from Borewells", International Journal of Engineering Research & Technology (IJERT) ,Vol. 7 , No.2, pp 4-6

11. Rahul Gowtham Poola, A.Anilet Bala,Rajesh Peddikuppa and Mahanth Reddy(2018), "Gesture Regulated Animatronic Robotic Hand", International Journal of Pure and Applied Mathematics,Vol.120,No.6,pp 1335-1346.

12. Lawrence Danieal R, Vinolee R, Ruhan Bevi A (2017), "Design Of Robotic System To Rescue A Child Under Constrained Environment", International Journal of Pure and Applied Mathematics,Vol.116,No.5,pp 31-36.

13. Shreenivas Jog, Abhisek Dwivedi, Sarang Ashtankar, Govind Gautam (2016), "Animatronic Hand Using Wireless Module", International Research Journal of Engineering and Technology (IRJET), Vol.3,No.5, pp 1529-1531.

14. Kavianand G,Gowri Ganesh, Karthikeyan P(2016),"Smart Child Rescue System from Borewell", International Conference on Emerging Trends in Engineering, Technology and Science.

15. Manish Raj, Arpit BansaI, A.Makhal, P.Chakrabort and G.C.Nandi (2014),"An Approach Towards Rescue Robotics In Bore Well Environment" IEEE International Conference on Communication and Signal Processing, pp 1097-1100.