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SMART BOREWELL CHILD RESCUE SYSTEM AND MONITORING

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***Abstract*— To improve the safety and effectiveness of rescue operations when individuals fall into open borewells a frequent occurrence in rural areas a robotic borewell rescue system that uses ESP 32 and sensors has been developed. The ESP32 microcontroller and Internet of Things (IoT) technologies are used in this system to monitor borewells, gather data, send it to a central platform, and offer automation, position monitoring, and real-time warnings for quicker and more efficient rescue operations. For the purpose of monitoring several borewells, it is scalable 3 and energy-efficient, improving safety and perhaps saving lives. Digging a parallel trench next to the bore well is the conventional method of rescuing the youngster. The procedure to free the imprisoned youngster is perilous, time-consuming, and complicated.**

I. INTRODUCTION

India is an agricultural country, hence the bulk of its farmers get their water from groundwater. Due to urbanization and population growth, there are less spaces accessible for 18 cultivation. Bore wells are being drilled in order to investigate groundwater. The current tragic scenario can only be attributed to the fact that bore wells often remain uncovered after producing water, providing children with the opportunity to accidentally fall into them. A horrible incident occurred recently in India when a kid fell into a hole created by a four-exposed bore well and became stuck. The process of freeing a kid who is stuck in a bore well is riskier and more difficult than in previous accidents.
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Saving a child requires more than a single day. Rescue missions are sometimes challenging, even for members of the search and rescue group. Even a little chance might reduce the chances of saving the child. there is a pause during the entire process. After being dug, bore wells are frequently left exposed in different locations. Numerous kids died in these abandoned bore wells. Generally speaking, this type of incident is generated by the careless and enjoyable behaviour of youngsters. The elevation is about 700 feet. the holes dug for the boreholes. It is more challenging and takes longer to complete in this case. The children's rescue effort from such deep bore wells.

These days, surveillance robots are becoming more and more common due to their ability to observe and collect data from a distance. With the help of the ESP32 CAM module, an integrated camera module with Bluetooth and Wi-Fi connectivity, it is now possible to construct remotely operated surveillance devices. Suitably compact for easy integration into a robotic device, the ESP32 CAM module functions as a camera module. The module, which is controlled by an ESP32 microprocessor, generates very high-quality images. The ESP32 CAM module's Wi-Fi and Bluetooth connections make it simple to connect to a computer or remote control station. Other sensors that can be monitored by the system include an ultrasonic distance sensor and a temperature sensor (the dht11 is connected to measure humidity and temperature).

II. LITERATURE SURVEY

1. Smart Borewell Child Rescue System through Wireless Monitoring”
   Authors: B. Hemalatha, Somavarapu Lokisha, Chillakuru Kamalakar Reddy, Gandu Jagadeesh, Nakkala Guruteja, M. Gunanjali
   Year: 2018
   Publication: Journal of Emerging Technologies and Innovative Research (JETIR)
   Methodology: This study implements a wireless monitoring system using sensors and a robotic arm. The system is equipped with a camera, motor drivers, and sensors to monitor and rescue the child. An ultrasonic sensor measures the distance, while temperature sensors monitor the child's condition. Real-time video is provided to operators to guide the robotic arm in securing and lifting the child safely.

2. Smart Borewell Child Rescue System
   Authors: P. Subha Sundari
   Year: 2024
   Publication: International Journal of Engineering Research and Technology (IJERT)
   Methodology: The system employs an ESP32 microcontroller to control various components like cameras, motor drivers, DC motors, and sensors. It includes a robotic arm for lifting, a teleconferencing system for communication, and a temperature sensor for monitoring the child's health. The system provides real-time monitoring and control via a mobile application.

3. Design and Development of Multi-Purpose Prosthetic Borewell System
   Authors: Rajesh Singuru, Gamini Suresh, R. Chandra Mohan
   Year: 2017
   Publication: Materials Today: Proceedings
   Methodology: This research focuses on a multi-purpose robotic arm designed for borewell rescues. The system uses various sensors and a camera for monitoring, with a robust control mechanism for the robotic arm. It emphasizes safety and precision in gripping and lifting the child from the borewell.

These papers highlight the advancements in technology used for borewell child rescue systems, demonstrating the integration of robotics, sensors, and real-time monitoring to improve rescue operations.

III. METHODOLOGY

A. Methodology

An inexpensive microcontroller with integrated Wi-Fi and camera functionality is called the ESP32-CAM. The purpose of this project is to control the robot's movement and record and upload photos and video to a remote location using the ESP32-CAM. The robot can move in many directions since it has a set of motors attached to it. Building a surveillance robot with an ESP32-CAM may be broken down into many phases in the technique.temperature sensor and ultrasonic sensor are connected with Arduino uno and Bluetooth module in order to monitor the temperature and distance through system.

B. Hardware Setup

Assembling the hardware needed for the project is the first stage. The ESP32-CAM module, motor drivers, wheels, chassis, batteries, and sensor are all included in this. Jumper wires are used to link the ESP32-CAM module to the sensor and motor drivers. The wheels are fastened to the motors, and the motors are connected to the motor drivers. To power the robot, the motor drivers and ESP32-CAM module are linked to the battery. Assembling the hardware needed for the project is the first stage. The ESP32-CAM module, motor drivers, wheels, chassis, batteries, and infrared sensor are all included in this. The wheels are fastened to the motors, and the motors are connected to the motor drivers. To power the robot, the motor drivers and ESP32-CAM module are linked to the battery.

C. Programming

The ESP32-CAM module and Arduino uno needs to be programmed in order to operate the robot movement and capture images and videos. The ESP32-CAM library and the Arduino IDE are used for programming. The code has features for managing the motors, taking pictures and videos, and sending them via Wi-Fi to a distant server.

D. Remote access

Turning on the robot's remote access is the last step. To accomplish this, a server capable of receiving the pictures and video the robot takes must be set up. Users can view the surveillance footage in real-time by connecting to the server using a computer or smartphone.

E. Proposed Style

The system that uses the ESP32-CAM board along with a robot chassis to build a mobile surveillance device is called a borewell rescue robot utilizing ESP32-CAM. Integrated with a tiny camera module and Wi-Fi connection, the ESP32-CAM is an affordable development board. Its ability to travel and record video in various areas is facilitated by the robot chassis. Via a web interface located on the ESP32-CAM board, users may configure the system. Usersmay see live video broadcasts, take screenshots of the video feed, control the robot's movement,and move its arms using the web interface.

IV. BLOCK DIAGRAM

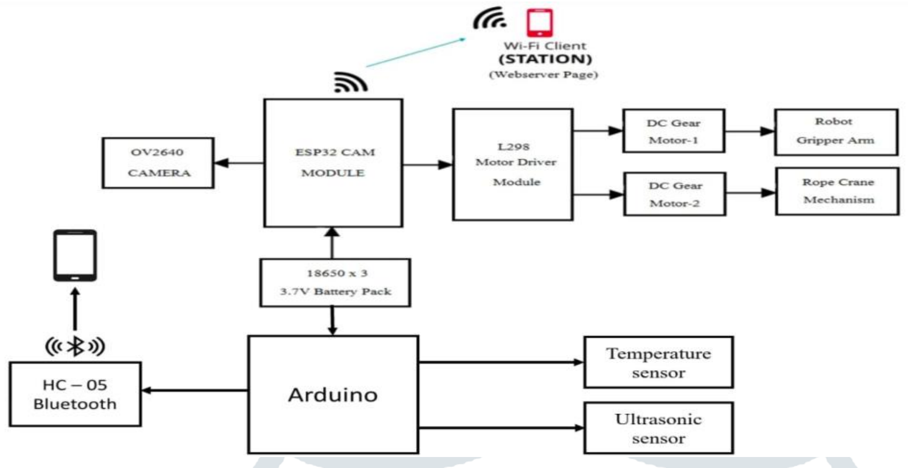

Figure 4.1

A. HARDWARE COMPONENTS

ESP32cam

Figure 4.2

sBased on the OV2640 sensor and ESP 32 microprocessor, the ESP32-CAM, a compact cameramodule, is depicted in Figure 1.1.1. It can transmit video, take pictures, and analyse photos inseveral ways. The ESP32CAM module is perfect for 10T and surveillance applications becauseit has Bluetooth and Wi-Fi connection as well low power consumption and easy to program.

The ESP32-CAM has the following important features:

- ESP32 microcontroller, first
- 2 Megapixel camera sensor (OV2640)
- Bluetooth and Wi-Fi access
- GPIO pins for securing connections to other devices
- MicroSD card slot for storing information
- A DC power source of 5 V

ROPE CRANE

The entire robotic mechanism is suspended through the rope crane mechanism. It uses a pulleyattached to the shaft of robot motor which winds and unwinds the rope. By rotation of the pulley the rope can move the robot arm upward or downward.

MOTOR DRIVER

Figure 4.3

To operating DC and stepper motors, this L298N motor driver module offers high power. Thecomponents of this module are a 78M05 5V regulator and an L298 motor driver IC. Two DC motors with speed and direction control, or up to four DC motors, can be operated by the L298N Module.

FDTI programmer

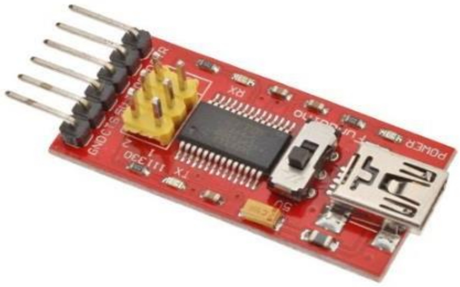

Figure 4.4

Future Technology Devices International, or FTDI, is the organization that creates the FTDI programmer, which is a tool for programming and interacting with electronics that employ FTDI chips for USB connection. Typically, an FTDI programmer in Fig 3.3.1 comprises anFTDI USB-to-serial converter chip and a connection for the target device interface. Data and programming instructions may be sent between a computer and a device thanks to theprogrammer, which offers a dependable and easy-to-use interface for communication.

ROBOTIC GRIPPER ARM

Figure 4.5

The Gripper module is a cutting-edge robotic arm that Roboart created in-house. It may be applied to several types of "pick and place" robots. The DC motor (9 to 12V DC) powers it. Jaw Open & Close Action is produced by a change in the DC Motor's rotational direction. With the aid of a DPDT switch (manual mode) or any microcontroller working in tandem with the L293D Motor Driver module, it is simple to control the DC motor. Your robots will have more capability if you equip them with a fully working robot.

ARDUINO UNO

Figure 4.6

Based on the Microchip ATmega328P microprocessor (MCU), the Arduino Uno is an open-source microcontroller board that was first made available in 2010 by Arduino. Its sets of digital and analog input/output (I/O) pins allow it to be interfaced with various expansion boards (shields) and other circuits. The Arduino Uno can be powered by a rectangular 9-volt battery or a barrel connection that takes voltages ranging from 7 to 20 volts. It shares the same headers as the Leonardo board and the same microprocessor as the Arduino Nano board.

BLUETOOTH

Figure 4.7

Electronics and communication are rapidly moving away from wired connections and toward wireless ones. created to take the role of cable connections The electronics and the HC-05 communicate via serial transmission. Its typical purpose is for exchanging data via a short-range wireless connection between tiny devices, such as cell phones. The frequency band it operates in is 2.45GHz. The data can travel 10 meters at a maximum transmission rate of 1Mbps. Within a 4–6 V power source, the HC-05 module can function. 19200, 38400, 57600,and other baud rates are supported. Primarily, it can function in Master-Slave mode, meaning it won't send or receive any data from outside sources.

TEMPERATURE SENSOR

Figure 4.8

The DHT11 sensor is made up of a thermistor for temperature detection and a capacitive humidity sensor. The humidity detecting capacitor consists of two electrodes separated by a substrate that may retain moisture as a dielectric. Changes in humidity levels cause changes inthe capacitance value. The resistance values are measured, processed, and converted into digitalform by the IC.

<u>ULTRASONIC SENSOR</u>

Figure 4.8

Ultrasonic wave transmission and reception are essential to the functioning of ultrasonic sensors. The sensor functions as a transmitter and a receiver in essence. It sends ultrasonic waves in the direction of an item and then waits for the waves to return, effectively echoing from the surface of the target. The amount of time that passes between transmission and reception provides important information regarding the target's distance.

V. RESULT AND CONCLUSION

A. Webserver Page and Robot Controls

There are five controls on the web server: UP, DOWN, OPEN, CLOSE, and STOP. As long as we keep hitting the buttons, the robot moves is shown in fig 5.1. The robot stops when you release any of the buttons. Another web page shoes temperature, humidity, and distance in centimetres in fig 5.2. We have added a Stop button, though, just in case the ESP32 doesn't get the stop command when you release a button

Figure 5.1

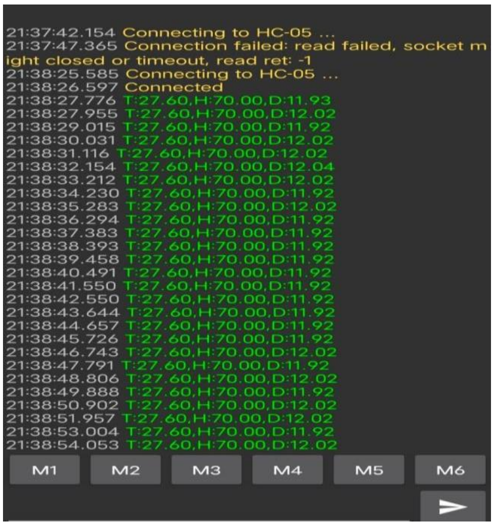

Figure 5.2

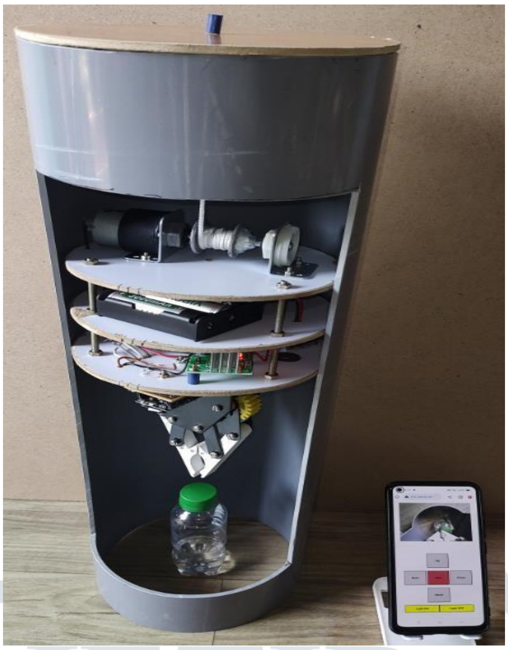

Figure 5.3

CONCLUSION

Human life is precious. Our strategy for saving the lives of kids involved in borewell mishaps is rather extensive. All possible scenarios that may emerge during a rescue operationare now accommodated in the kid-saving equipment for bore wells. Saving the lives of many children who fall into bore wells is the initiative's main objective. In the past 10 years, severallives have been lost as a result of falls into bore wells since it is a very difficult and time-consuming process to excavate a pit adjacent to one. Using bigger motors, arms, and state-of-the-art technology, this task can be accomplished efficiently. It follows that the proposed approach has the potential to save countless lives.

To conclude, there is great potential to improve difficult rescue operations through the creationand implementation of a dual-arm mobile robot that resembles a person with sensors for both temperature and ultrasonic data. Its ability to explore and function in difficult conditions is made possible by the integration of various sensors. To protect the safety of the robot and any potential human casualties, the temperature sensor offers vital information about the thermal conditions. This information helps identify hot areas or potential fire threats. The robotis able to navigate through garbage and tight places more precisely, avoiding obstructions and recognizing safety. passageways, thanks to the ultrasonic sensor's simultaneous ability to detect distance precisely.

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