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Rover Based Monitoring System Using AR Application

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ABSTRACT: The main purpose of this project is to monitor the sectors based on IOT where there is minimal to no human intervention. It encompasses the basic concepts of maintenance and monitoring. It suits to the extreme conditions of mining locations, manholes, and mineral quarries. It aids in examining the presence of minerals in extreme locations like deep undergrounds using ESP32 CAM surveillance placed on the rover. The rover is operated using ESP8266, primarily connected to Wi-fi for connectivity. The rover control is duly based on AR Application. Additionally, this could be further controlled by VR. The rover also measures pH, temperature, moisture in the examining area.

KEYWORDS: IOT, Rover, ESP32 CAM, ESP8266, AR Application.

I. INTRODUCTION

Rover-based surveillance systems have become increasingly popular in recent years because they can collect data from remote or hard-to-reach locations. These systems typically use rovers, vehicles equipped with various sensors and cameras, to collect data and send it back to a central location for analysis. Augmented Reality (AR) can be integrated into the rover to improve the control and monitoring capabilities of these systems. AR technology allows users to overlay virtual objects and information on the real world, providing an enhanced and immersive experience. The system uses an ESP8266 microcontroller to enable wireless communication between the rover and the control centre. The ESP8266 is a low-cost Wi-Fi module that can be easily integrated into various projects and is popular for IoT and remote monitoring applications. In summary, the combination of rover-based surveillance system, AR technology and ESP8266 microcontroller provides a powerful and flexible solution for remote data collection and analysis. The system allows users to monitor and control the rover in real time from anywhere with an internet connection, enabling a wide range of applications in fields such as agriculture, environmental monitoring, and exploration. The objective of a rover-based monitoring system using augmented reality (AR) is to provide a comprehensive and interactive solution for remote monitoring of a designated area. Some specific objectives of such a system include:

Remote Monitoring: The system aims to enable remote monitoring of locations that are difficult to access or too dangerous for human presence. The rover can be controlled from a safe distance, and the user can receive real-time video feeds and data from the rover's sensors.

Efficient Data Collection: The system aims to provide efficient data collection and analysis by equipping the rover with various sensors and cameras. The collected data can be used to analyse environmental conditions, monitor wildlife, or detect potential hazards, among other things.

Improved User Experience: By using AR technology, the system aims to provide an immersive and interactive experience for the user. The user can overlay additional information onto the live video feed, such as environmental data or 3D models, providing a more detailed and engaging monitoring experience.

Cost-Effective: The system aims to provide a cost-effective solution for remote monitoring. By reducing the need for physical presence and providing efficient data collection and analysis, the system can reduce costs associated with monitoring remote locations.

Overall, the objective of a rover-based monitoring system using AR is to provide a comprehensive, efficient, and cost-effective solution for remote monitoring, while also providing an engaging and interactive experience for the user.

II. RELATED WORK

[1] Surveillance Car Bot Future of Surveillance Car Bot

The design for a wireless espionage robot that may be operated with a phone is presented in the article. The AI Thinker ESP32-CAM module, which has an OV2640 camera and a microSD card slot, is used by the robot's camera, motor drivers, batteries, and two wheels to take and save pictures. The web browser, which has buttons for directing the robot's motions, streams live footage from the camera via the HTTP connection protocol. A Robot chassis, two DC motors, and an L293D motor driver module are used to construct the robot. To direct the robot's motions, the cell phone delivers signals, and Wi-Fi is used to send the live video feed.

[2] Unmanned Ground Vehicle for Surveillance

The paper discusses the potential benefits of using remote-controlled spy robots for investigation and surveillance purposes, especially in battlefields. The use of advanced technologies like Bluetooth can enhance their abilities and expand their reach. The paper proposes the creation of an automated vehicle equipped with a camera that can continuously send video for spying on enemies during battles. The simplicity and problem-solving capabilities of robots make them a valuable tool in the automation industry and the robotic world.

[3] Smart Buggy: An IoT Based Smart Surveillance Robotic Car Using Raspberry Pi

The Smart Buggy is a surveillance robot car that can be controlled from anywhere in the world using a Raspberry Pi. It is equipped with a camera that captures live video, which is streamed over a micro web framework and can be viewed from different locations. The camera uses a motion detection algorithm called Background Subtraction Model to detect movements, and can be panned and tilted using servo motors. The Smart Buggy is powered by DC motors and can move forward, backward, left, and right. All operations are performed over the internet using the Internet of Things (IoT) concept. The device can be port forwarded to enable control from any location, and is primarily used for surveillance purposes.

[4] An Android Application Controlled Video Surveillance Vehicle

This paper describes the development of a surveillance vehicle that can monitor inaccessible or hazardous areas. The vehicle is controlled and monitored using a custom Android application, which allows the user to give directional inputs and view live video streaming from the vehicle's camera. The system is built using an Arduino Uno, Crowtail Wi-Fi module, and a Motor Base shield. The Wi-Fi module is used to establish a connection between the mobile application and the vehicle, transmitting directional inputs to the Arduino and streaming video to the Android device..

III. METHODOLOGY

The Rover Based Monitoring System based on ESP8266 controller and ESP32 cam controlled over AR application is set up in a step-by-step process that includes setting up the hardware, configuring the software, developing the AR application, integrating the components, testing, and debugging the system, and deploying it for use. Connecting the ESP8266 controller and ESP32 camera to the required sensors and motors is part of the hardware setup. Setting up the Wi-Fi connection, configuring the sensors and motors, and installing the required libraries are all part of the software configuration. An AR development platform is used to create the AR application, and hardware and software components are integrated to work together. The system is tested to ensure that it is operationally sound, and any problems or bugs are identified and resolved.

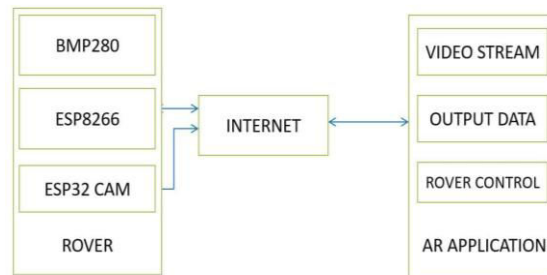


Fig.1. Block diagram of Rover Module

The rover, which is equipped with an ESP32-CAM module, moves around, and captures images of its surroundings. The ESP32-CAM module processes the images and sends them to the ESP8266 microcontroller. The ESP8266 microcontroller then uses Wi-Fi to transmit the images to a cloud server or a local network. An AR application installed on a user's device, such as a smartphone or tablet, accesses the images from the cloud server or local network. The AR application uses the device's camera to superimpose the images captured by the rover onto the user's real-world view, providing an augmented reality experience.

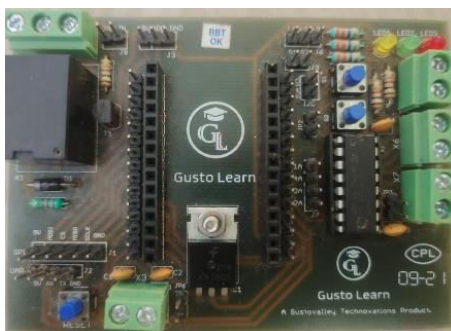


Fig.2. ESP8266 Trainer Kit

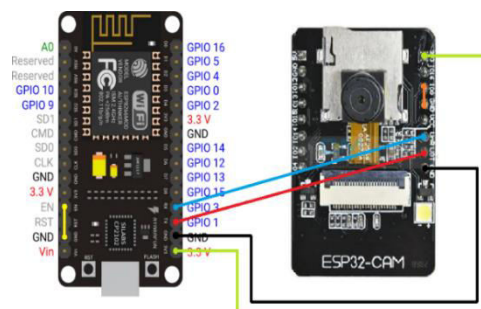


Fig.3. ESP32 Camera Module

An ESP8266 Fig.2 development kit with relay connectors and motor driver is a board designed for building IoT projects that require control of high-power devices, such as motors, pumps, and lights. The board includes an ESP8266 microcontroller, which provides Wi-Fi connectivity and processing power, as well as several relay connectors and a motor driver to control external devices. The motor driver on the board provides an easy and efficient way to control DC motors up to 1A, such as those used in robotics, drones, and electric vehicles. The motor driver can handle voltages from 3V to 12V, and it can be controlled using PWM signals from the ESP8266. The motor driver also includes protection circuits, such as over-current and over-temperature protection, to ensure safe operation.

The ESP32 CAM Fig.3 is connected to the ESP8266 microcontroller to provide a powerful and versatile platform for remote sensing, video streaming, and robotic control.

IV. EXPERIMENTAL RESULTS

The rover is equipped with an ESP32 CAM module, which is a low-cost camera module with built-in Wi-Fi connectivity. The ESP32 CAM module captures live video and streams it wirelessly to an ESP8266 microcontroller, which controls the movement of the rover. The ESP8266 microcontroller can also receive commands from an external device, such as a smartphone or tablet, using Wi-Fi or Bluetooth connectivity. The external device can be used to control the rover and view the live video stream using an AR application developed in Unity. The AR application overlays the live video stream with virtual objects or information, allowing the user to interact with the rover and its surroundings in a virtual environment.

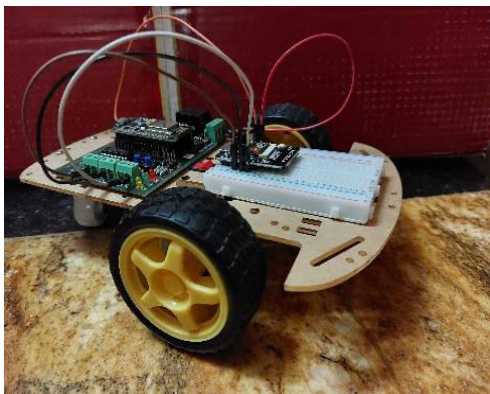


Fig.4.Rover Module

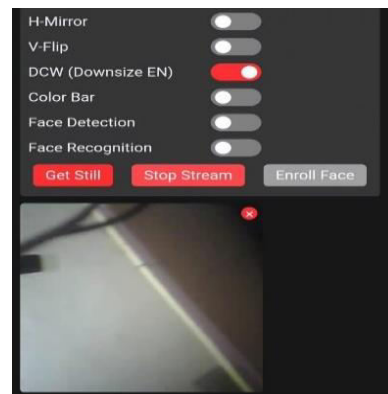


Fig.5.Video Streaming AR App

V. CONCLUSION AND FUTURE WORK

In conclusion, a rover-based monitoring system using AR application offers significant benefits in various areas such as surveillance, disaster management, and environmental monitoring. The system enables remote and real-time monitoring of a designated area, providing valuable insights and data that can aid in decision-making processes. The use of AR technology enhances the system's functionality by allowing users to visualize data in a more intuitive and interactive manner. The AR application can overlay virtual objects and data onto the live video feed from the rover's camera, allowing users to have a better understanding of the environment and the data being collected. Overall, a rover-based monitoring system using AR application is a promising technology that has the potential to revolutionize monitoring and surveillance in various industries. As technology continues to advance, we can expect to see further improvements in the system's capabilities, making it an even more valuable tool for decision-makers.

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