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The Prototype of Field Surveillance Robot for Defence using IOT

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ABSTRACT
This paragraph describes a project that uses IoT technology to develop a spy robot that can provide continuous surveillance in hazardous environments. The robot is controlled by a smartphone and a PC and is capable of recording real-time streaming in day time and night time through a camera. The robot's movements are controlled manually at the user end. The complete system comprises various sensors like Fire sensor, ultrasonic sensor, gas sensor, metal sensor interfaced with ESP32 board. The spy robot monitors the live streaming information and it is updated in IoT. An Android application can control the navigation of the robot from anywhere. Further advancement of this project will lead to the usage of spy robots even in defences and mining areas.

1. INTRODUCTION

Robots are hardware devices that reduce human effort and perform various tasks. They are helpful in hazardous places where humans cannot go, and provide accurate results. Operating systems like Android can control robotic systems through smartphones. Robotics is the future for deploying risky and life-threatening tasks. Surveillance in hazardous environments is essential for continuous monitoring. Robots can perform programmed activities, replace human work, and provide accurate results, making them ideal for surveillance fields.

11. EXISTING SYSTEM

Current robotic systems for surveillance purposes have communication limitations due to the use of radio frequency (RF) technology, Zigbee, and Bluetooth. These wireless protocols have limited range, data transfer rates, and signal reliability, which can hinder the effectiveness of robotic surveillance systems. Some projects have attempted to address this issue by incorporating short-range wireless cameras, but these solutions are also limited in terms of resolution, field of view, and sensitivity. Additionally, many existing robots still rely on manual control with human supervision, which is not only inefficient but also prone to errors and delays in critical situations. Therefore, developing more advanced wireless communication technologies and integrating them with autonomous robotic systems is crucial for improving the efficiency and effectiveness of surveillance operations.

11I. PROPOSED SYSTEM.

Our proposed surveillance system utilizes a single camera mounted on a robot that can move in all directions to capture images from various angles, making it ideal for monitoring living objects. An ultrasonic sensor is incorporated to measure the robot's distance from objects by emitting and receiving sound waves. Additionally, if the system detects the presence of fire or gas through the respective sensors, it updates all sensor values in the IoT platform. The robot's navigation is controlled remotely using the Blynk app, and its location is tracked using GPS technology

1V. BLOCK DIAGRAM

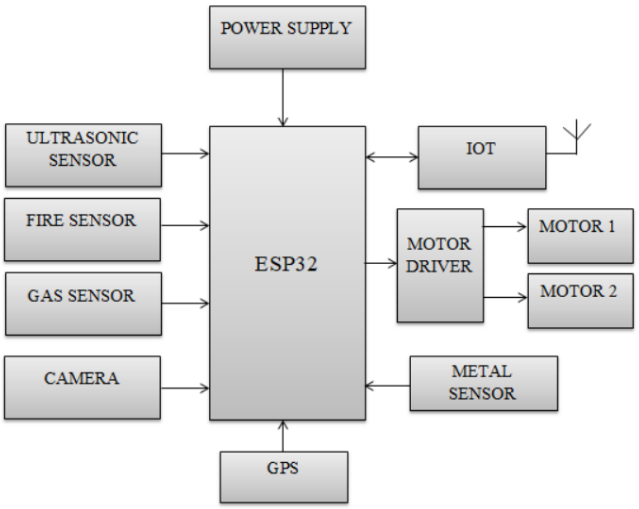

Fig 1 – Block diagram

IV. HARDWARE REQUIREMENTS

A. ESP32

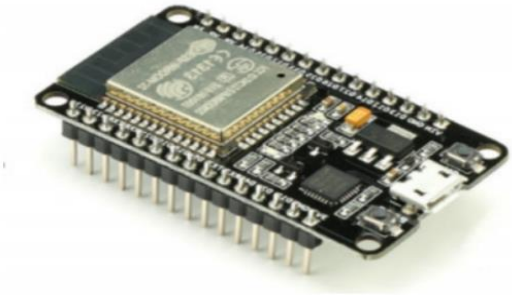

Fig 2 – ESP32

The ESP32 is a cost-effective microcontroller board with built-in Wi-Fi and Bluetooth capabilities, utilizing a dual-core processor mechanism. It consists of a powerful Xtensa LX6 processor with 512 KiB memory and a low-power ULP processor with 8 KiB memory. Other features include around 48 variable I/O pins, an array of peripheral interfaces such as temperature and capacitive touch sensors, and an 8-centimeter LCD panel that can be seen on an ESP32-WROVER board by Espressif Systems.

B. ESP32 CAM BOARD

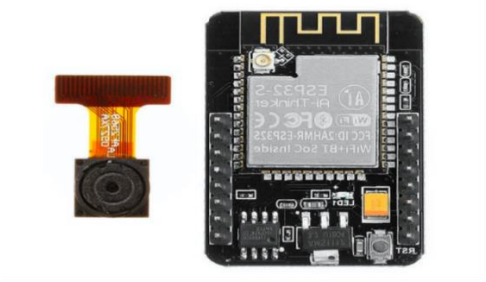

Fig 3 – ESP32 CAM BOARD

The ESP32-CAM is a compact camera module powered by ESP32, featuring an OV2640 camera and an onboard TF card slot. This module incorporates 4MB PSRAM that buffers images from the camera for video streaming and other tasks, enabling the use of higher quality images without causing the ESP32 to crash.

C. FIRE SENSOR

Fig 4 – FIRE SENSOR

A flame detector is a specialized sensor that detects and responds to the presence of flames or fires, and can also detect ordinary light sources within a range of 760nm-1100nm wavelengths. It has a detection distance of up to 100cm and can output digital or analog signals. It is commonly used as a flame alarm or in fire-fighting robots.

D. METAL SENSOR

Fig 5 – METAL SENSOR

A Metal Proximity Sensor, also known as a non-contact proximity switch, consists of a generator, shaping amplifier, and oscillator vibration that detects metal bodies by producing an alternating magnetic field when they are in proximity to the sensor. With high sensitivity, fast frequency response, and reliable stability, this inductive proximity sensor can detect metal components in distances of 0-4mm and is widely used in modern industries including machinery, metallurgy, transportation, electric power, and military applications.

E. MQ2 GAS SENSOR

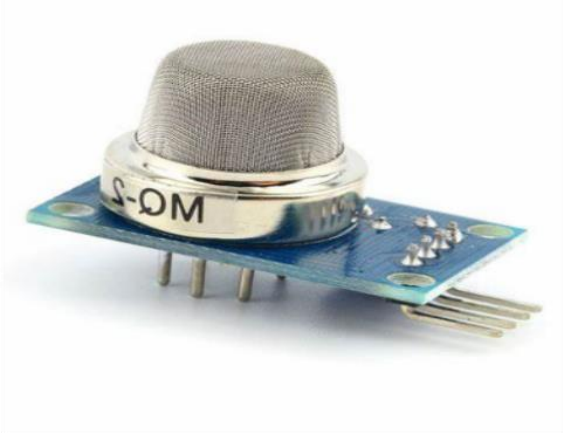

Fig 6 – MQ2 GAS SENSOR

The MQ2 gas sensor is an electronic device that detects the concentration of various gases in the air. It can detect gases such as LPG, propane, methane, hydrogen, alcohol, smoke and carbon monoxide. The sensor contains a sensing material that experiences a change in resistance when it comes in contact with gas. This change in resistance is used to detect the presence of gas in the air.

F. ULTRASONIC SENSOR

The HC-SR04 Ultrasonic ranging module accurately measures non-contact distances from 2cm to 400cm with an accuracy of 3mm. Ultrasonic sensors emit high-frequency sound pulses and use the time-of-flight of the reflected signal to determine the distance to the target. These sensors are excellent at suppressing background interference and can detect virtually all materials that reflect sound. They are suitable for target distances from 20mm to 10m and can achieve pinpoint accuracy. Ultrasonic sensors are also effective in dusty or misty environments and can detect thin wires and small objects.

G. GPS

Fig 8 - GPS

The GPS module is built around the Ublox NEO-6M technology and comes with a 25 x 25mm active GPS antenna and a UART TTL socket. A battery is also included for faster GPS lock. It is compatible with Ardupilot Mega V2.

V. FORMULA

The product features of this module include using an IO trigger for at least 10us high level signal, automatically sending eight 40 kHz signals, and detecting pulse signals that return. If a signal is detected, the high level time of the IO output is measured, which represents the time from sending the ultrasonic signal to its return. The distance is then calculated using the formula:

test distance = (high level time × velocity of sound (340m/s)) / 2.

Graphics may be full color. All colors will be retained on the CDROM. Graphics must not use stipple fill patterns because they may not be reproduced properly. Please use only SOLID FILL colors which contrast well both on screen and on a black-and-white hardcopy.

VI. CONCLUSION

The spy robot is designed to detect and transmit signals to authorized users from various environments. It uses sensors to provide information on the robot's movement direction and can sense objects and incoming obstacles. It features live video streaming and sensors that can detect gas and humans. The robot can be controlled remotely via an android device, making it useful in hazardous or inaccessible areas.

VII. REFERENCES

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