ENGINEERING IN ADVANCED RESEARCHSCIENCE AND TECHNOLOGY

ISSN 2352-8648
Vol.03, Issue.01
June-2022
Pages: -365-375

SMART PHONE CONTROLLED SURVEILLANCE ROBOT

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Abstract

The human cannot record video safely in critical conditions and environments. These conditions and environments may be buildings where the fire breaks out, Areas with poisonous gases or harmful radiation and the places where there is an exchange of fire such as battlefield. This paper introduces design and implementation a surveillance tanked robot based on Wi-Fi protocol and windows operating system. The movement directions of the robotic tank are controlled by a GUI designed using visual studio development environment. The robot can transmit real-time video to the intended recipient. The robot can identify and track the object.

Keywords: Intelligence, Robot, Camera, Servo motor.

Introduction

Robots are defined as mechanical devices that can perform physical tasks using either man control or artificial intelligence. The considerable development in fabrication of the processors and sensors makes the robots to be more intelligent. One of the important applications of the robots is surveillance. The surveillance is the operation of monitoring humans, locations, and areas. This commonly occurs in a military application where monitoring enemy's location and the borderlines are important to a country's safety. The process of deploying human near sensitive regions is called human surveillance. This type of surveillance is limited, because the human cannot deploy in risky and inaccessible locations. These locations threaten the life of a human or make him vulnerable to capture by the enemies. The great prosperity in networks and robot technology provides the feature of monitoring the critical areas remotely using robots instead of persons. The aerial and terrestrial robots can collect details that are not clear to the humans. The collecting data about a specific region remotely can be achieved by equipping the robots with precise sensors and cameras. The advance in wireless communication facilitates the communication with the robots and getting a real-time video seamlessly . Thus, in recent days, surveillance technology attracts many researchers to employ it in their researches.

This project presents a speed and direction control of cost-effective robot which can be used for surveillance in places where human beings are unable to enter. Always the customer expects single device usage for various applications; this requirement makes the designer to incorporate all the features in a device that leads to increased cost

and reduction in speed. The proposed method incorporates many features and increases the speed of operation by doing parallel operation with different sensors and can detect the objects in its range. The robot is capable of following the selected object by maintaining the object tracking protocol.

The objectives of this project are as follows.

• To create Surveillance RC Robot with ESP32-CAM and Arduino Uno module.

• Which can be controlled from anywhere by web browser on any smartphone.

• To create an IOT environment in which we can see live streaming with camera & control the car withcontrol panel through internet.

Proposed System

This web controlled surveillance car can be easily built using the ESP32-CAM module. Apart from the ESP32-Camera module, here we will use two DC motor with Robot chassis and L298N motor driver module to build this Robotic car. ESP32 is one of the most popular boards to build IoT based projects. The AI-Thinker ESP32-CAM module comes with an ESP32-S chip, a very small size OV2640 camera and a microSD card slot. MicroSD card slot can be used to store images taken from the camera. Here HTTPcommunication protocol will be used to receive video streaming from the OV2640 camera over the web browser. The web page will also have buttons to move the car in Left, Right, Forward and reverse directions as shown in the image above. ESP32-CAM doesn't have a USB connector, so you need an FTDI board to upload the code into ESP32-CAM. VCC and GND pin of ESP32 is connected with the VCC and GND pin of the FTDI board. Tx of andRx of ESP32 is connected with Rx and Tx of the FTDI board. Two DC motors are connected to ESP32 through the L298N module. Module pins are connected to IO4, IO2, IO14, and IO15 pins of ESP32.

Hardware

The hardware designing of the robot consist of 2 sections. The first one is the electronic section and another one is the body section. The electronic section is consist of some well-designed circuitries that contains some electronic components and modules which has been listed below with their pictures in thefig.3. The hardware section consist of robotic kits and gear motor wheels.

The proposed system consists of following components:

- L298N MOTOR DRIVER
- ESP-32S CAMERA
- BLUETOOTH MODULE HC-05
- LED
- ROBOT CHASIS
- DC MOTORS
- LITHIUM ION BATTERY
- WEB SERVER
- ARDUINO IDE

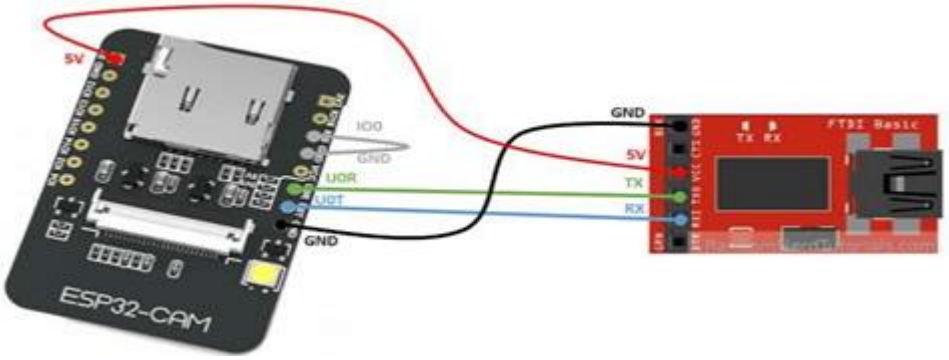


Fig 1: Connection Between ESP32-CAM and FTDI

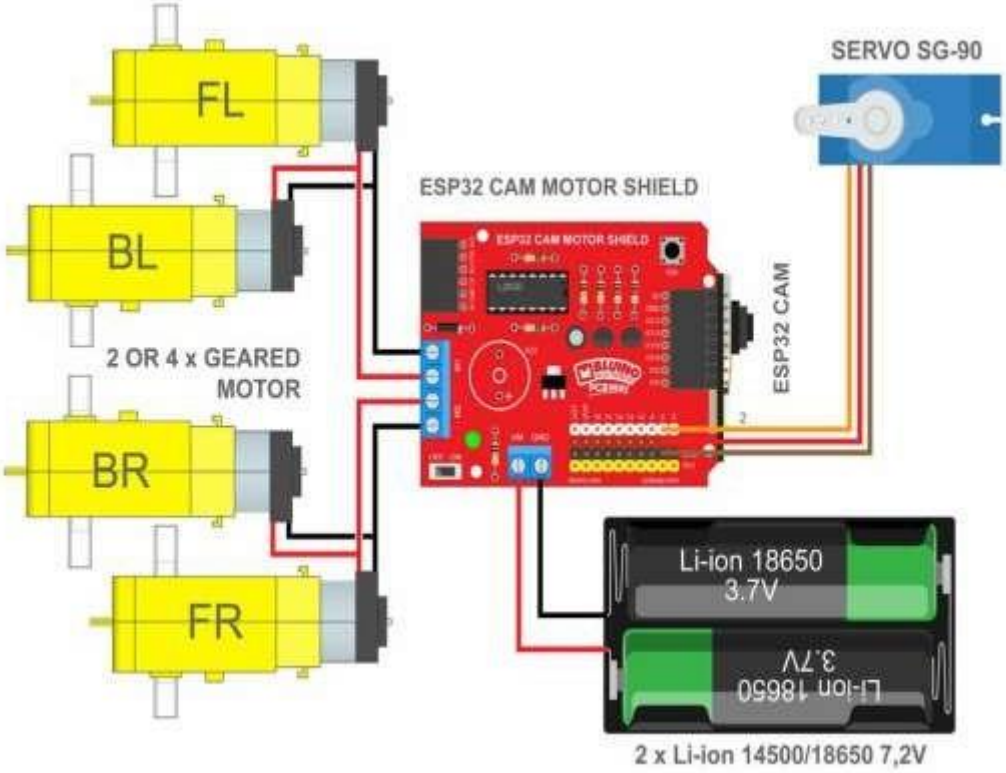


Fig 2: Circuit Diagram

The hardware section the robot has been described below:

- ROBOT: The robot consists an ESP32 that has the embedded code dumped into it.
- CONTROLLER: The controller is an Android cell-phone. The cell phone is connected to the Bluetooth in the robot. This Bluetooth establishes a communication channel between the controllerand the robot. The RC Controller .apk file i.e. the target file is stored into the cell-phone. When it runs then the GUI i.e. the screen on the cell phone occurs and the user gives gestures. These gesturesare converted into analogue signals and transmits to the robot. Here, they converted into digital signals and the microcontroller code starts executing and the robot moves according to the gestures.
- ESP: ESP32 is a series of low-cost, low-power system on a chip microcontrollers with integrated Wi-Fi and

dual-mode Bluetooth. The ESP32 series employs either a Tensilica Xtensa LX6 microprocessor in both dual-core and single-core variations, Xtensa LX7 dual-core microprocessoror a single-core RISC-V microprocessor and includes built-in antenna switches, RF balun, power amplifier, low-noise receive amplifier, filters, and power-management modules. ESP32 is created and developed by Espressif Systems, a Shanghai-based Chinese company, and is manufactured by TSMC using their 40 nm process. It is a successor to the ESP8266 microcontroller.

- ESP32-CAM is a development board module with a size of 27×40mm. It can be integrated into acamera system with an ESP32 module and camera. ESP32-CAM can be widely used in various IoT applications. It is suitable for home smart devices, industrial wireless control, wireless monitoring, QR wireless identification, wireless positioning system signals and other IoT applications. It is an ideal solution for IoT applications.
- **Future Technology Devices International Limited**, commonly known by its acronym FTDI, isa Scottish privately held semiconductor device company, specializing in Universal Serial Bus (USB) technology. FTDI. The FTDI cable is a USB to Serial (TTL level) converter which allowsfor a simple way to connect TTL interface devices to USB. The I/O pins of this FTDI cable are configured to operate at 5V. The FTDI cable is designed around an FT232RQ, which is housed in a USB A connector.
- All Electronic and mechanical component will be mounted on the skateboard. To provide mechanical strength to the board for bearing extra weight an elastic property using aluminum covering over the joinedwith resin is provided. This will increase the physical strength of the skateboard.

Software Simulation Circuit

After completing the system design and hardware selection schematic circuit is drawn in Proteussimulation software. In Proteus simulation, circuit works properly.

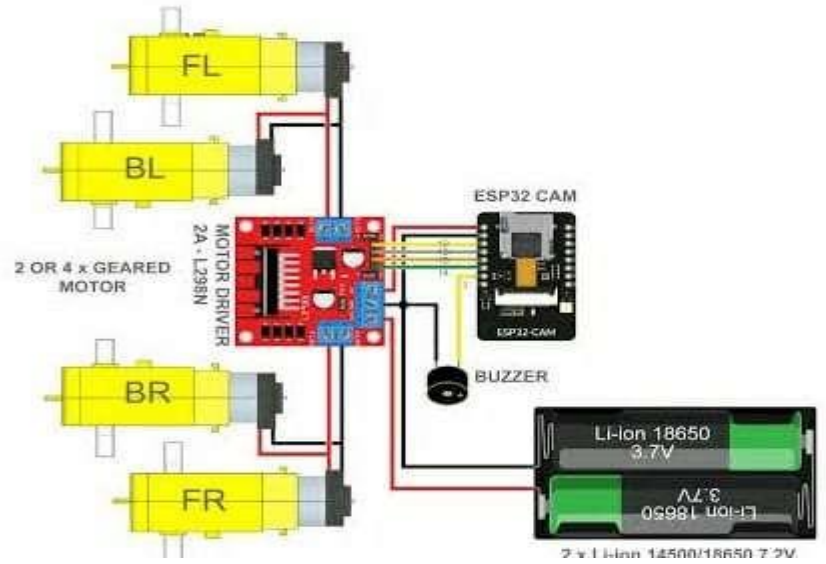
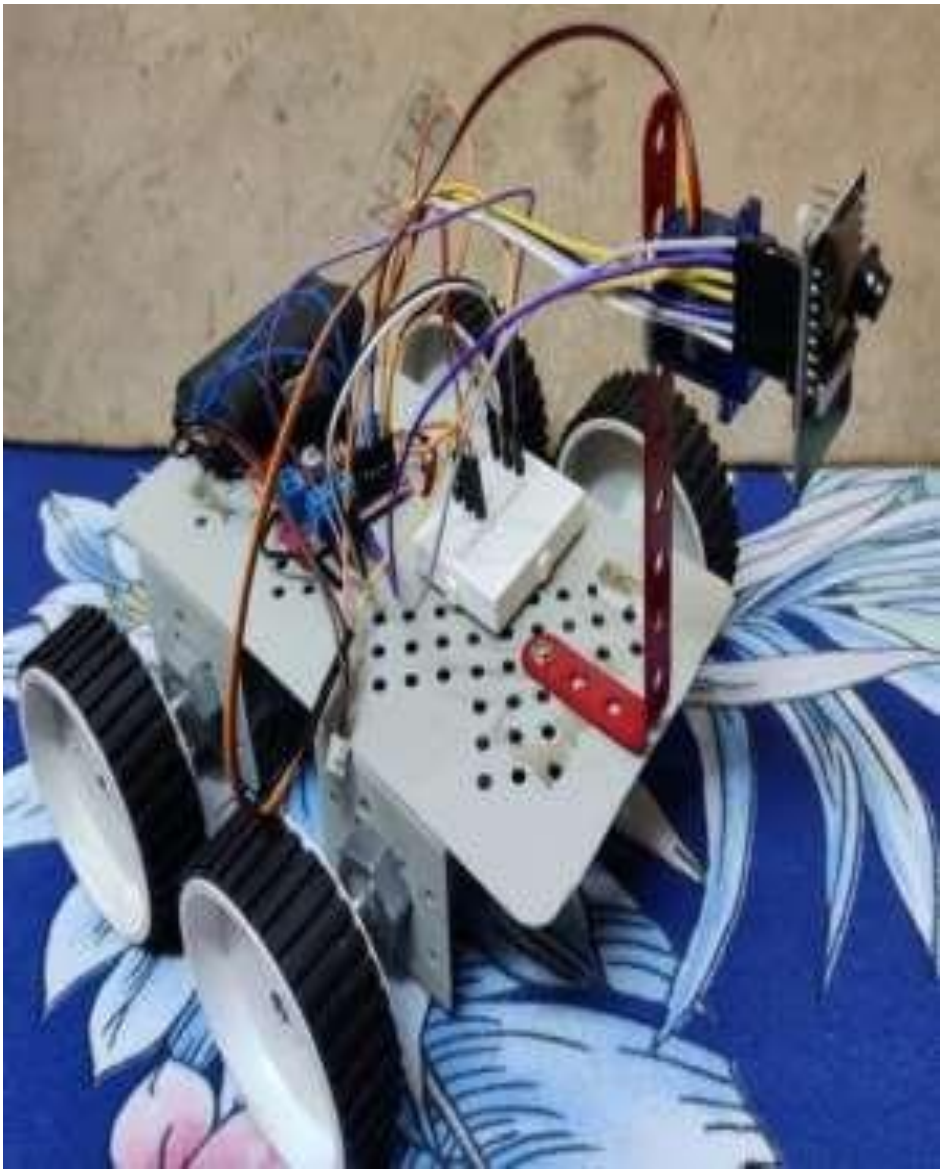


Fig 3 : Simulation Circuit

The IN pins of the L298N motor driver are connected to IO pins of the ESP 32 Camera module i.e., IN1 is connected to IO12, IN2 is connected to IO13, IN3 is connected to IO15 and similarly IN4 is connected to IO14. Pins are connected as mentioned above. The servo motor has 3 pins and PWM pin is connected to IO2 and the remaining 2 pins are connected to 12v supply and ground respectively. The 12v pin of L298N driver is connected to the Battery and the GND is connected respectively. The 4 DCmotors are connected in a manner that the direction of the wheels is selected properly. The ENA pins of themotor driver are connected to the left side motors and the ENB pins of the driver are+ connected to the rightside of the motors.



Result and Discussion The implemented system is shown in Fig.4. In this system instructions are given to the ESP32 with thehelp of a smartphone through webserver interfacing. Within 100 meters the instructions from the smartphone reach to the NodeMCU very accurately. This system can move towards any direction properly.The wireless camera to transmit video has worked as the instruction given to it. The video transmission and all the sensors in this system are performing accurately. The transmitting signal's quality is good. While developing this system some problems have been faced to control servo motor and interfacing Bluetooth. All those problems have been solved by modifying the circuit and the programming code. Therefore, at present it works properly. We have measured the current consumption as well the battery backup. Here, the gear motors consume around 300mAh currents individually. Therefore, it consumes around 1200 mAh currents altogether as there are four motors in the system. TheServo motors consumes 500 mAh (metal gear) and 250 mAh (SG90) currents individually. The NodeMCU, Bluetooth module and other circuits consumes around 300mAh currents altogether. Considering some losses around 2600mAh currents is been consumed by the system. Here, we have installed batteries with the current rating of 3000 mAh and 5 volts. Therefore, it can run about 1 hour or slightly more depending on the use with one charge.

Conclusion

The proposed system shows how the Android smartphone can be used as remote controller for robot and various embedded technologies with the help of the Bluetooth technology. It could be improved by adding Wi- Fi module for large area coverage. The proposed system also shows that how a robot can be used for spy & rescuing purpose. The operating system of the smartphone is Android, and we can develop effective remote controller program and by using Wi-Fi wireless network, which makes it simple and convenient to control the robot. If the motor wheel is changed and replaced by a chain wheel than it can move anywhere at any rough condition.

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