



Surveillance Robot with ESP32 Camera by using Web Application

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Abstract : In recent times, we used surveillance cameras for monitoring and recording moments, but manual surveillance and real-time monitoring is one of the most important and challenging branches of computer vision, which has been widely applied in peoples life, such as monitoring security. The presence of surveillance cameras and a warning sign indicating that the area is under monitoring can serve as a significant deterrent to criminals and thieves, as the recorded footage can be used to identify people and trace their activities. It can be more advanced and which supports low transmit power along with low cost. ESP32 Camera reduces high network traffic and computing load. This system facilitates the user to receive notifications whenever the intrusion is detected with the help of sensors connected with the surveillance robotic car cameras.

IndexTerms - Surveillance, Security, ESP-32 Camera Module, Wi-Fi Module, Web Application, Servo Motor

I. INTRODUCTION

In the Modern world. There are many people who are investing in Wi-Fi technology. Wi-Fi technology used in such as airport, home, office, and other public areas. Wi-Fi technologies supported by the computer, laptop, game consoles, and smartphones. Wi-Fi technology helps people to work and communicate without network cabling. This is very helpful for many users. Nowadays, Wi-Fi technology is not for internet use. Wi-Fi technology can control any kind of equipment like Air condition, Television, Alarm, and many other appliances that support Wi-Fi technology. Hence it is possible to control the robot with Wi-Fi technology. This project is to design a robotic vehicle that can be utilized for surveillance. Robot is an unoccupied robot that is connected by a series of cables. These cables transmit command and control signals between the operator and the Robot. Many robots have been built for manufacturing purposes and can be found in factories around the world. This robot is controlled by smartphone and hardware. The remote camera is on a vehicle for capture the circumstance around the robot. This kind of robot is helpful in any spying reason field like the police investigation further it can be used for security of assets. Another benefit of this robot of this size can ignore people. It has endless applications and can be utilized as a part of various situations and environments. The use of this robot that can command is sent to a robot for controlling the operation of the robot to moves left, right, forward, or in reverse. The receiving command from application to the Wi-Fi module is connected with the Arduino ide to receiving control and motor with a motor driver where they can help for movement of the vehicle and to esp32 camera module to capture the footage. The power of the DC source is taken from batteries attached to a robot for camera, and motor driver.

The security paradigm has shifted from "investigation of occurrences" to "prevention of potentially catastrophic incidents" as a result of recent global events. Existing digital video surveillance simply provide the technology for capturing, storing, and distributing video, leaving danger detection to human operators alone. surveillance video monitoring by humans is a time-consuming task. For that, we use video surveillance without human i.e., CCTV is also known as video surveillance it sends video signals to a limited number of monitors and it is typically installed and used for limited coverage area so for coverage more area we use car, camera is installed in the car, it can cover the area where ever car moves. The system will use all the latest technology to ensure you get the best service when you connect to us. We are using ESP32 – CAMERA module to record the footage covered. The data of ESP-32camera module is transferred to the web application and to get the vehicle position move through the web server.

II. PROPOSED WORK

In this project work, ESP-32 camera module used to surveillance the area has to be covered and it consists of wi-fi module in built so it can operate through the wi-fi without having extra component has to be connected. Servo motors are used to rotate the camera direction. Motor drivers are used to move the vehicle. These are the three important and main components of the surveillance robot. We are using the web application to operate, control speed of the vehicle and esp32 camera rotation. The data that has captured through esp32 camera is transferred to web application. To show the live streaming of surveillance. The footage can be stored in the external storage holder which has been in-built in the esp32 camera module. Servo motors are used to rotate the camera direction. servo motors main purpose to lift the weight. So to camera rotation we are using servo motor.

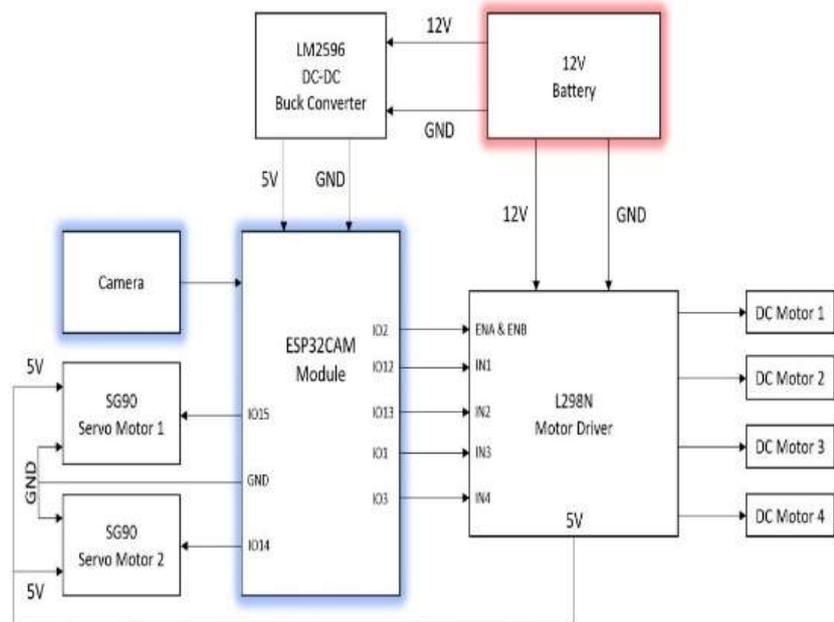


Figure 2.1: Block diagram of the proposed work

2.1 ESP camera module

The ESP32-CAM is a small size, low power consumption camera module based on ESP32. It comes with an OV2640 camera and provides onboard TF card slot.



Figure 2.2: ESP32 camera pinout

2.2 ESP camera module

In this project we have used cp2102(6-pin) usb 2.0 to ttl uart serial converter module. this is a great little tool for embedded systems that require a serial connection to a computer. the board can simply attach to a usb bus and will appear as a standard com port.



Figure 2.3: USB to TTL converter CP2102

2.3 LM2596 DC to DC bulk converter

DC-DC Buck Converter Step Down Module LM2596 Power Supply is a step-down(buck) switching regulator, capable of driving a 3-A load with excellent line and load regulation. These devices are available in fixed output voltages of 3.3 V, 5 V, 12 V, and an adjustable output version.



Figure 2.4: LM2596 DC to DC bulk converter

2.4 L298N Motor driver

In this project we have used **L298N Motor Driver Module** is a high power motor driver module for driving DC and Stepper Motors. This module consists of an L298 motor driver IC and a 78M05 5V regulator. **L298N Module** can control up to 4 DC motors, or 2 DC motors with directional and speed control. The L298N Motor Driver module consists of an L298 Motor Driver IC, 78M05 Voltage Regulator, resistors, capacitor, Power LED, 5V jumper in an integrated circuit

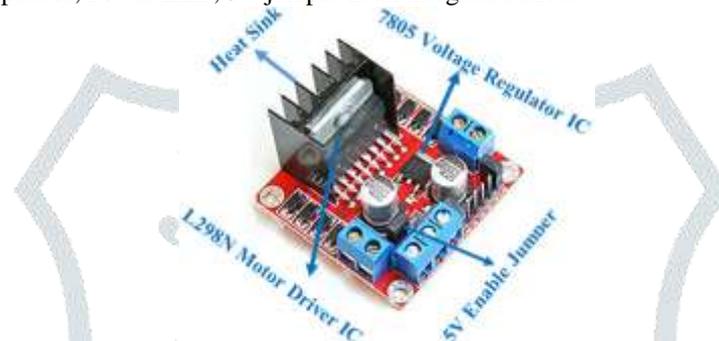


Figure 2.5: L298N Motor driver

2.5 SG90 Micro servo motor

Micro Servo Motor SG90 is a tiny and lightweight server motor with high output power. Servo can rotate approximately 180 degrees (90 in each direction), and works just like the standard kinds but smaller. it can be use any servo code, hardware or library to control these servos. It comes with a 3 horns(arms) and hardware.

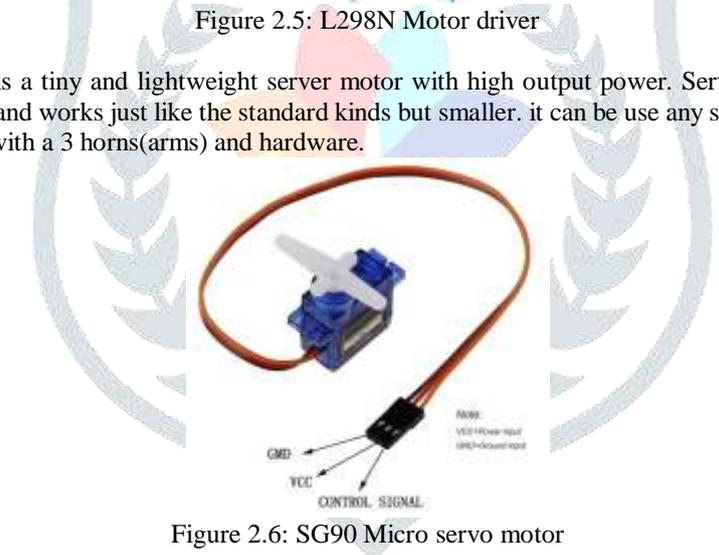


Figure 2.6: SG90 Micro servo motor

The SG90 Micro Servo Motor is a small, high-performance servo motor commonly used in robotics, model making, and other hobbyist projects. It has a compact form factor and is relatively low-cost, making it an attractive choice for many applications. The SG90 has a 9-gram weight and a size of 22.8 x 11.8 x 22.7 mm, making it small enough to be used in compact and lightweight robotic designs. It has a torque rating of 1.8 kg/cm, which is sufficient for most hobbyist applications and small robotic projects. The servo motor also features a dead-band width of only 1 μ s, which provides precise control and positioning of the servo's output shaft.

2.6 Robot Car chasis

This is 4WD Four Wheel Drive Kit - A Smart Robot Car with Chassis and this comes with four pairs of Geared Motors and Wheels. All the products included in this car kit are quality products. The chassis used in this kit is transparent to create dynamic handling of the components mounted on your robot car.

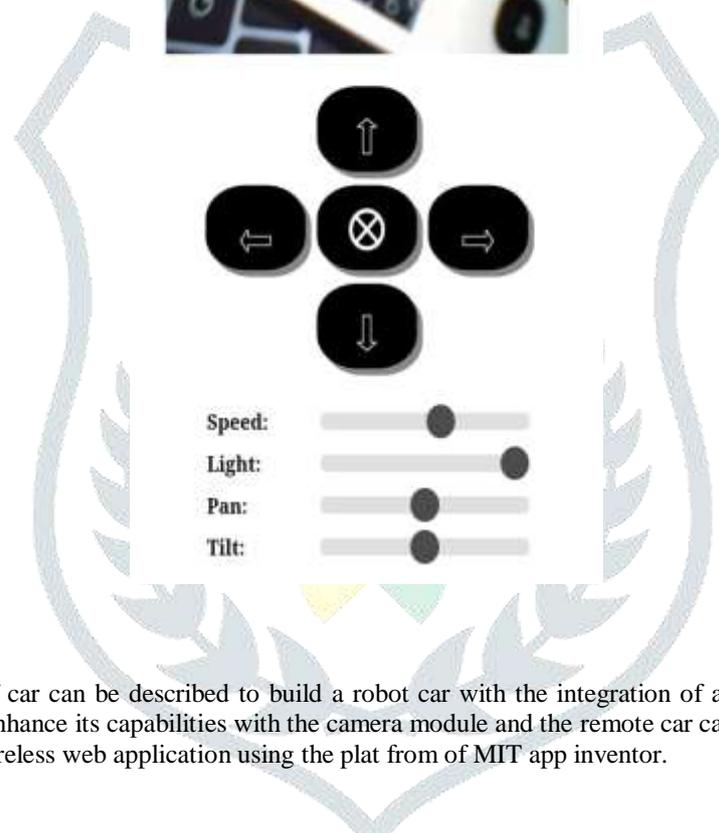
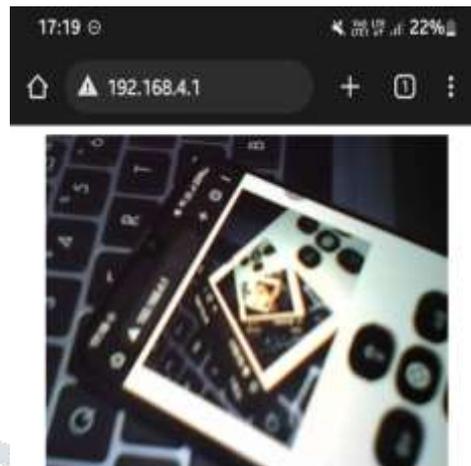
2.7 Web Application

The Arduino IDE is an open-source software, which is used to write and upload code to the Arduino board. In this project, we have used MIT app inventor, The MIT App Inventor user interface includes two main editors: the design editor and the blocks editor. The design editor, or designer, is a drag and drop interface to lay out the elements of the application's user interface (UI). The blocks editor is an environment in which app inventors can visually lay out the logic of their apps using color-coded blocks that snap together like puzzle pieces to describe the program. To aid in development and testing, App Inventor provides a mobile app called the App

Inventor Companion (or just “the Companion”) that developers can use to test and adjust the behavior of their apps in real time. In this way, anyone can quickly build a mobile app and immediately begin to iterate and test.

III. RESULTS

In this project we can operate the vehicle wireless and it has movable surveillance area to capture the footage. The final output of project is shown below:



IV. CONCLUSION

In this paper, the model of car can be described to build a robot car with the integration of an ESP 32 CAM run by android application and it can greatly enhance its capabilities with the camera module and the remote car can capture images and videos and it can be operated through a wireless web application using the plat from of MIT app inventor.

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