SUMMER INTERNSHIP REPORT

on

Surveillance Vehicle based on ESP32 CAM module

Duration: June 24, 2024 to August 2, 2024

Under Supervision Of
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E-Block, Guru Gobind Singh Indraprastha University
Sector-16C, Dwarka, New Delhi - 110078

July, 2024

Certificate

This is to certify that the internship project entitled **"Surveillance Vehicle based on ESP32 CAM module"** was successfully completed by the following students from various colleges in partial fulfillment of the requirements for the award of the degree of **Bachelor of Technology (B.Tech)** under the internship program at **AICTE IDEA Lab-Guru Gobind Singh Indraprastha University** New Delhi - 110078.

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Mentor **Mentor**

Declaration

We hereby declare that the project work presented in this internship report, entitled **"Surveillance Vehicle based on ESP32 CAM module",** is entirely our own work and has not been submitted for any degree or diploma from this or any other institute for partial fulfillment of the requirements for the award of the degree of **Bachelor of Technology (B.Tech)**

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I would want to express my gratitude to my mentor, Saurabh Anand sir, for providing me with direction, support, and constructive criticism. I would not have been able to complete this assignment without the assistance of yours.

This project has been a valuable learning experience, and I am grateful to everyone who played a role in its achievement. Thank you all

Abstract

In this project, we developed a Surveillance Vehicle utilizing the ESP32 CAM module, aimed at enhancing security and monitoring capabilities in various environments. The ESP32 CAM module, known for its compact size and powerful processing capabilities, serves as the core of our surveillance system. By integrating it with a mobile platform, we created a versatile and remotely controlled vehicle capable of capturing high- resolution images and video in real time. The system emphasizes cost-effectiveness, ease of deployment, and scalability, making it suitable for both personal and professional use

The core components employed in this project are following;

- ESP32 Cam module
- Pan Tilt Servo assembly
- Servo motor
- 4WD car kit L298N motor driver module
- 7-12 V DC Battery
- UBEC/Buck converter to step down voltage to 5 v
- Arduino Uno
- Double sided tape
- Jumper wires

The surveillance vehicle is designed to be controlled via a smartphone or web interface, allowing users to maneuver the vehicle and adjust the camera angle remotely. The system architecture incorporates essential features such as motion detection, live video feed, and image capture, ensuring comprehensive monitoring capabilities.

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1. Introduction

During the summer internship at "**AICTE IDEA LAB GGSIPU"**, I had the opportunity to work on a project focused on developing and enhancing the surveillance capabilities of the EP32 Cam, a high-performance camera designed for automotive surveillance. The primary objective of this project was to create a robust system for real-time monitoring, data analysis, and security enhancement in vehicles. This report provides a detailed account of the work carried out during the internship, encompassing the introduction, literature survey, methodology, results, conclusion, and bibliography.

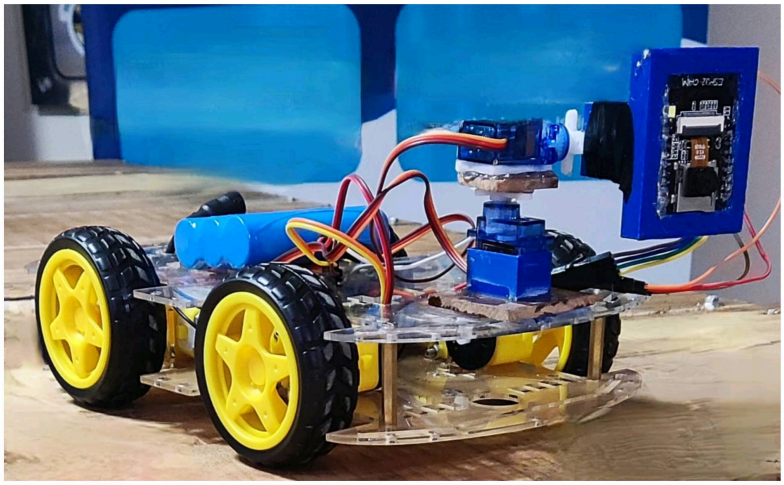


Figure 1.1: Picture of Project

1.1 CIRCUIT DIAGRAM

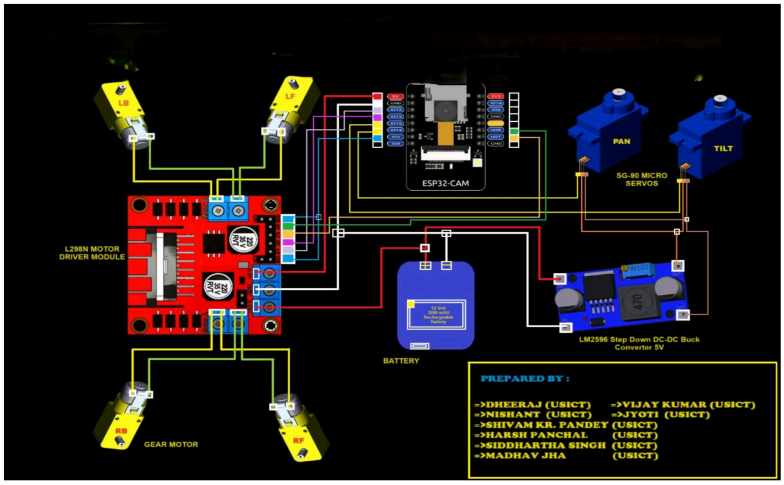


Figure 1.2: Circuit Diagram

2. Components Used

2.1 ESP-32 CAM

The ESP32 CAM is a compact development board based on the ESP32 microcontroller and the OV2640 camera module. It integrates Wi-Fi and Bluetooth connectivity along with a camera, making it ideal for projects involving IoT (Internet of Things) and image recognition. The ESP32 CAM board supports deep sleep modes for low-power operation and can be programmed using the Arduino IDE. Its widely used in applications such as surveillance cameras, smart home devices, and remote monitoring systems due to its small size, versatility, and affordable cost.

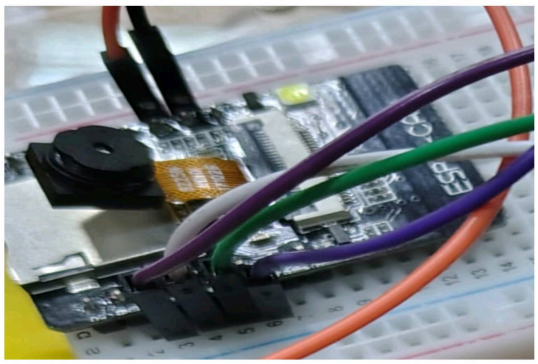


Figure 2.1: ESP-32 CAM

2.2 BUCK CONVERTER

A buck converter is a type of DC-DC power converter that steps down (or reduces) the input voltage to a lower output voltage. It operates on the principle of switching and uses an inductor and a semiconductor switch (often a transistor) to efficiently regulate the output voltage. By switching the transistor on and off at a high frequency, the buck converter controls the energy flow from the input to the output, achieving voltage reduction while minimizing power loss. Buck converters are widely used in various electronic devices and power supplies where efficient voltage conversion and regulation are essential, such as in battery-operated devices, voltage regulators, and power adapters.

Figure 2.2: Buck Converter

2.3 ARDUINO UNO

Arduino Uno is a popular microcontroller board based on the ATmega328P processor. It features a straightforward design with digital and analog input/output pins, making it versatile for a wide range of projects. The Uno is known for its ease of use, affordability, and strong community support, which includes extensive documentation and a vast array of libraries and examples. Its widely used by beginners and experienced developers alike for prototyping and creating interactive electronic devices, from simple LED blinkers to complex robotics and IoT applications. The Uno USB interface allows for easy programming and communication with computers, making it a go-to choice for anyone looking to delve into the world of embedded electronics and programming

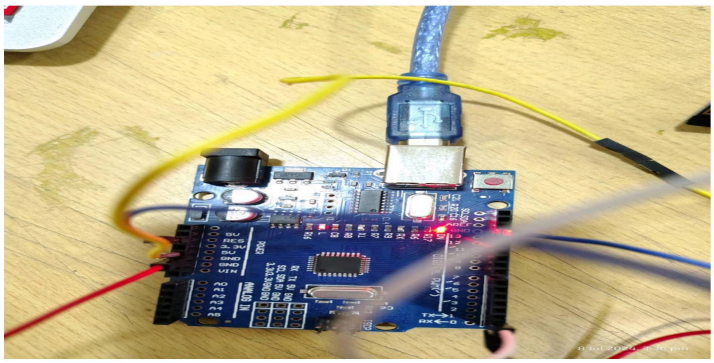


Figure 2.3: Ardino UNO

2.4 L298N-driver-module

The L298N driver module is a versatile and widely-used dual H-bridge motor driver capable of controlling the speed and direction of two DC motors or a single stepper motor. It operates with a voltage range of 5V to 35V and can handle up to 2A per channel, making it suitable for various robotics and automation projects. The module features onboard logic level shifters, thermal shutdown protection, and a convenient design with screw terminals for easy motor and power connections. Its robust performance and ease of use make the L298N a popular choice for hobbyists and engineers alike

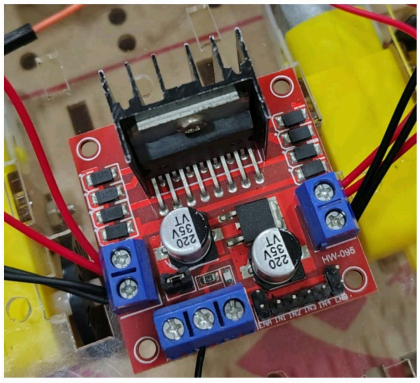


Figure 2.4: L298N DRIVER MOTOR

2.5 TT GEAR MOTOR

The TT gear motor is a compact and affordable DC motor commonly used in educational and hobbyist robotics projects. Featuring a built-in gearbox, it provides increased torque and reduced speed, making it ideal for applications requiring precise and controlled movements. These motors typically operate at 3-12V and offer various gear ratios to suit different needs. Their lightweight and durable construction, along with standardized mounting holes, make TT gear motors easy to integrate into small robots, wheeled platforms, and other mechanical systems

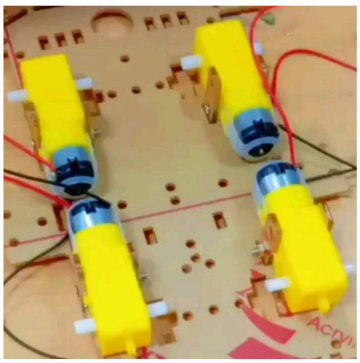
h 

Figure 2.5: TT GEAR MOTOR

2.6 servomotor

A servomotor is a precise and efficient motor designed for applications requiring accurate control of angular position, speed, and acceleration. It consists of a motor coupled with a sensor for position feedback, typically a potentiometer or encoder, and is controlled by a dedicated servo controller. Servomotors are commonly used in robotics, CNC machinery, and automation systems due to their ability to provide high torque at low speeds and maintain precise positioning. They come in various sizes and torque ratings, making them suitable for tasks ranging from small hobbyist projects to industrial applications.

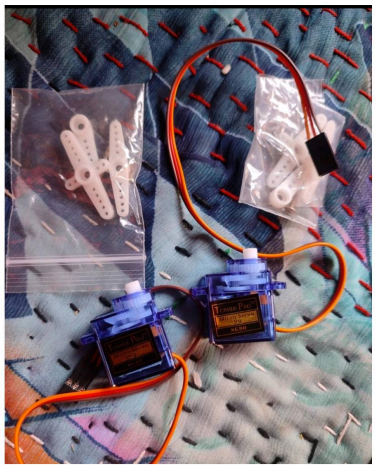


Figure 2.6: SERVO MOTOR

2.7 jumper-wires

wires are essential components used for making temporary electrical connections in prototyping and testing circuits. Available in male-to-male, male-to-female, and female-to-female configurations, they facilitate easy connections between breadboards, microcontroller boards, and other electronic components without soldering. Jumper wires come in various lengths and colors, aiding in the organization and identification of connections. Their flexible and reusable nature makes them a staple in educational settings, hobbyist projects, and professional electronics development, allowing for quick and efficient circuit modifications and troubleshooting

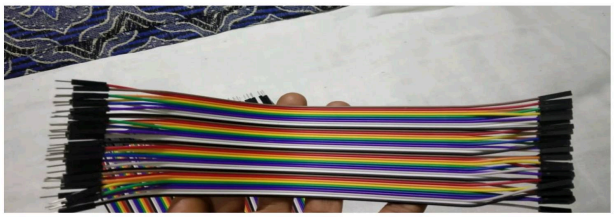


Figure 2.7: JUMPER WIRES

2.8 12v-battery

12V battery is a common power source used in a wide range of applications, from automotive and marine uses to renewable energy systems and backup power supplies. These batteries are available in various types, including lead-acid, lithium-ion, and nickel-metal hydride, each offering different advantages in terms of capacity, lifespan, and performance. A 12V battery typically consists of six cells, each producing around 2V, connected in series. Known for their reliability and robustness, 12V batteries are crucial in providing stable and consistent power for starting engines, powering electrical systems, and supporting off-grid power solutions.

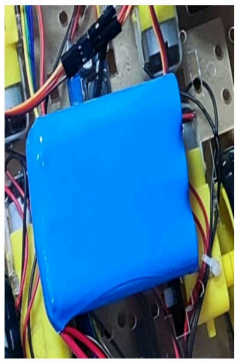


Figure 2.8: 12V BATTERY

3. Video Presentation

Description: In this video, we provide a comprehensive overview of our project, "Surveillance Vehicle Based on ESP32 CAM Module." The video demonstrates the key features and functionalities of the surveillance vehicle, highlighting the integration of the ESP32 CAM module for surveillance and control.

Video link: https://youtu.be/TrrsYN1DB1U?si=AozrQtksKIb_4vVU.

Key Points Covered in the Video:

1. Introduction to the Project:
    - Brief overview of the project's objectives.
    - Explanation of the problem being addressed.
2. Hardware Overview:
    - Description of the ESP32 CAM module and other key components used.
    - Visuals of the hardware setup and connections.
3. Software and programming;
    - Insights into the software architecture and programming logic.
    - Demonstration of the code and its role in controlling the vehicle.
4. Vehicle operation:
    - Live demonstration of the vehicle in action.
    - Explanation of how these challenge were overcome.
5. Future work and improvements:
    - Suggestion for potential improvements future enhancement

Conclusion: The video showcases our project execution and the practical use of the ESP32 CAM module in a service vehicle, offering deeper insights into our work

4. Literature Survey

- The literature survey involved a comprehensive review of existing technologies, methodologies, and innovations related to automotive surveillance systems. The key areas of focus included: Automotive Surveillance Systems: Investigating the current state of surveillance systems in vehicles, including components, functionalities, and limitations. Various research papers, articles, and patents were reviewed to understand the latest advancements in this field.

- Camera Technology: Examining the different types of cameras used in surveillance systems, with a specific focus on the EP32 Cam. This included an in-depth study of technical specifications, image processing capabilities, and integration with other vehicle systems. Real-time Monitoring: Exploring techniques for real-time video processing and analysis.

- This involved reviewing algorithms for object detection, tracking, and event recognition to ensure efficient monitoring and quick response to incidents. Data Analysis and Security: Analyzing methods for storing, processing, and securing the data captured by surveillance cameras.

- This included studying encryption techniques, data compression methods, and cloud based storage solutions to ensure data integrity and reliability

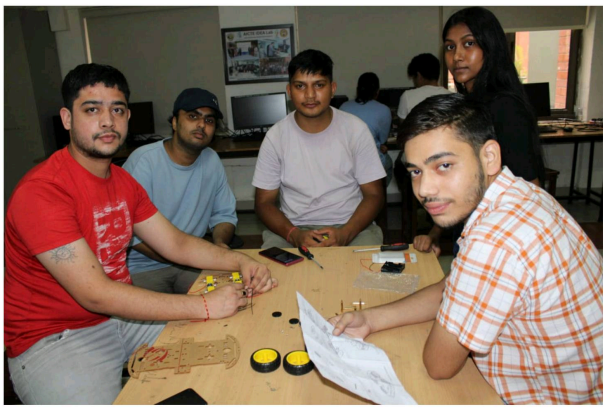


Figure 4.1: show the team member of the project.

5. Methodology

The methodology for the project was structured into several phases to ensure systematic development and implementation:
Requirement Analysis: Understanding the specific requirements for the surveillance system, including desired features, performance metrics, and integration with existing vehicle systems. System Design: Designing the architecture of the surveillance system,
including hardware and software components. This involved selecting appropriate sensors, processing units, and communication interfaces.
Camera Integration: Integrating the EP32 Cam with the vehicle systems. This included configuring camera settings, establishing communication protocols, and ensuring seamless data transfer between the camera and the central processing unit.

Figure 5.1: show the team member of the project.

Figure 5.2: Team work

6. Result

- The project yielded significant results in enhancing the surveillance capabilities of the EP32 Cam. Key outcomes included
- Enhanced Image Quality: The integration of the EP32 Cam resulted in improved image quality, with higher resolution and better low- light performance, enabling clearer and more detailed surveillance footage.
- Real-time Monitoring: The developed system demonstrated efficient real-time monitoring capabilities, with accurate object detection and tracking. The response time for detecting and alerting about incidents was significantly reduced.
- Data Security: The implementation of advanced encryption techniques ensured the security and integrity of the captured data. The use of cloud based storage provided scalable and reliable data management solutions.
- System Integration: The surveillance system was successfully integrated with the vehicle existing systems, allowing seamless operation and data sharing. The user interface developed for monitoring and control was intuitive and user-friendly.
- Performance Metrics: The system met the desired performance metrics, including frame rate, processing speed, and accuracy of detection. The field tests demonstrated the system robustness and reliability under various environmental conditions

7. Conclusion

he summer internship project on the Surveillance Car EP32 Cam was a valuable learning experience, providing practical insights into automotive surveillance systems. The successful development and implementation of the surveillance system demonstrated the potential for enhancing vehicle security and monitoring capabilities. The project laid the foundation for future research and development in this field, with opportunities for further improvements and innovationshe summer internship project on the Surveillance Car EP32 Cam was a valuable learning experience, providing practical insights into automotive surveillance systems. The successful development and implementation of the surveillance system demonstrated the potential for enhancing vehicle security and monitoring capabilities. The project laid the foundation for future research and development in this field, with opportunities for further improvements and innovations

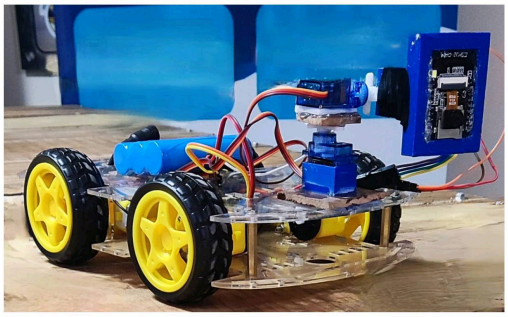


Figure 7.1: PITURE OF MODEL

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