# Live Feed Capture Using Arduino Controlled RC Car

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**Abstract**

Utilizing an Arduino Uno can significantly enhance a RC car's capabilities, acting as its central control unit to manage tasks such as motor control, sensor integration, and remote control interpretation. Meanwhile, incorporating an ESP32 camera module into the RC car enables live video streaming from the onboard camera, allowing remote operation and providing an engaging experience. Leveraging the ESP32-CAM's functionalities, this research study has developed a novel vehicle monitoring and control system. Although the Arduino Uno's limited processing power and GPIO pins make it unsuitable for camera-related tasks, it can still activate the ESP32 camera module whenever required. This setup enables manual motor control via a smartphone app and real-time video surveillance, offering a comprehensive situational awareness to the driver. Additionally, a dedicated smartphone app facilitates direct communication with the developed system, granting manual control over the vehicle's motor driver, enhancing flexibility, and enabling quick responses in emergency situations. The integration of modern technologies enhances accident prevention control, elevating the overall user experience and safety of the RC car.

**Keyword: Arduino UNO, ESP32 camera, RC car, IOT, Surveillance.**

# 1 Introduction

In the dynamic field of transportation and connectivity, the introduction of Internet of Things (IoT) technology has revolutionized the monitoring and control of vehicles. The initiative will introduce his comprehensive IoT-driven solution that combines an ESP32 CAM module, real-time video monitoring and smartphone-controlled motor drivers to create a smart and safe vehicle ecosystem. As modern vehicles face increasing challenges in terms of safety, traffic management, and user experience, this system not only provides remote monitoring but also allows users to manually control it via a smartphone application. By doing so, the work aims to provide comprehensive solutions. At its heart is the ESP32-CAM, a versatile IoT module with a camera that acts as the vehicle's eyes and captures important visual data from its surroundings.

The proposed work pays close attention to two central aspects: manual control and accident prevention. Users have the opportunity to remotely control the vehicle driver through a dedicated smartphone application with a dynamic and easy-to-use interface. At the same time, the system integrates state-of-the-art accident prevention mechanisms for future work and uses computer vision algorithms to analyze real-time data and take preventive measures against potential threats. Focusing more on the complexity of this intelligent vehicle monitoring and control system, the synergy of IoT, computer vision, and mobile application development opens new horizons in the transportation sector. This system not only increases the safety of vehicle operations, but also lays the foundation for future innovations in intelligent transportation systems, ushering in a connected and safe automotive future. Using the ESP32-CAM for surveillance is an important aspect as it leverages the ability to capture and send videos and images to a central server or cloud platform, allowing real-time monitoring of the vehicle's surroundings. Integration of a smartphone-controlled motor driver completes the loop, allowing remote control via a mobile app that seamlessly communicates with the ESP32-CAM.

## 2 Related Works

Adnan Bin Faiz et al [1] proposed a vehicle accident identification system that utilizes IoT. The system used accelerometers and ultrasonic sensors to detect shocks and send that information to an Arduino microcontroller. When an accident is detected, the Arduino will send a warning message to a predefined phone number and display a notification on the LCD screen.

Anil Kumar Biswal [2] proposed an intelligent warning system for intelligent vehicles that aims to automatically detect and avoid driver fatigue. As sleepiness is a natural human condition, the system uses robust algorithms for accurate detection. By analyzing the video stream based on blink patterns, eye aspect ratio (EAR), and eye distance measurements, the system detected fatigue and triggers alerts via the IoT module. This alert includes crash impact data and location information delivered through voice messages on a Raspberry Pi monitoring system, potentially saving lives and reducing accidents.

Barda Soliman [3] proposed the growing traffic accident problem in Saudi Arabia for a safe and effective IoT-based instant accident detection system. The system prioritizes data security and privacy, ensuring driver information is protected. The design utilized elliptic curve integrated encryption to enable secure data transmission, reducing response times for medical assistance and potentially saving lives. This study made a valuable contribution to road safety in Saudi Arabia and provided a flexible framework that can be adapted to various applications requiring secure data communication.

Biswas [4] proposed an IoT-based vehicle and driver monitoring system as a smart and cost-effective solution to improve road safety. The system addressed the challenges of limited sensor availability in older vehicles and cost constraints faced by many drivers, especially in developing countries.

M. Karthik [5] addressed the ongoing problem of increased car accidents and high mortality rates due to delayed emergency response. The author uses MEMS sensors to detect collisions between vehicles and this data is processed by Arduino. An alert message containing the exact location is then sent to the police control center or rescue team via the GSM module. Once the police receive the information, they can use the GPS module to quickly determine the location and take immediate action. The system ensured timely notification to emergency services and families, enabling a faster response to incidents and potentially reducing the severity of the consequences.

Navid Ali Khan [6] proposed a 5G and IoT-based reporting and incident detection (RAD) system to address the increasing number of road accidents and improve response time. The system must be compatible with any vehicle and cost-effective.

Rajev Gupta [7] cited WHO data showing that 1.4 million people die and 50 million people are injured worldwide but as the number of vehicles increases, the issue of traffic accidents also increases. This paper proposed a AI-powered accident detection and warning system that utilizes IoT and deep learning, highlighting the need to reduce response times and save lives. Capitalizing on the rise of smart cities, the system integrated IoT and AI to mimic human cognitive functions. The IoT kits are then used to detect incidents and transfer relevant data to the cloud. A deep learning model verified the information and activated the rescue module to notify emergency services. In this paper, through comparative analysis he demonstrates the superiority of his InceptionResnetV2 over ResNet, and with validation performed under real-world conditions on a toy car, he achieved an impressive 98% in training, validation, and testing.

Saif Ul Islam [8] proposed a new Internet of Things (IoT)-based accident detection and reporting system for smart cities. The system provides a cost-effective and accessible solution to leverage the advanced features of smartphones to improve road safety, especially for older vehicles that do not have advanced sensors.

Saif Almilad [9] proposed IoT-based systems for accident detection and classification in smart cities. Recognizing that timely response plays a critical role in saving lives, the system aims to improve response and efficiency.

S. K. Singh et al [10] proposed Internet-controlled cars could be a great way to help reduce emissions, improve traffic flow, and promote shared mobility. But they come with some challenges, like their environmental impact and security. If they're hacked, it could lead to traffic accidents and other disruptions, so it's important to make sure they're secure before they're widely adopted.

Sumit Chandra (2021) [11] presented an innovative accident detection and warning system that uses Arduino to address the critical problem of unattended accidents. Combining Arduino, GPS receiver, and GSM module technology, the system uses vibration sensors to detect critical accidents and rollovers. The microcontroller sends this information to the GSM module, which sends an SMS containing the victim's exact location to the assigned contacts via Google Maps. This specialized solution provides a timely response to people involved in accidents, especially in developing countries such as Nepal, India and Bangladesh, where the number of vehicles is rapidly increasing. The system's ability to prevent uncertain deaths by instantly notifying registered contacts makes it a valuable investment in improving driver and passenger safety.

Sunil Paliwal [12] acknowledged that speeding is a significant cause of accidents on the country's roads and highlights the importance of studying speed limits in specific areas. The authors emphasize that identifying barriers to ensuring the safety of children and older people is a key concern. While previous research has focused on automatically stopping the vehicle when it detects an obstacle, this paper leverages the Internet of Things (IoT) to stop the vehicle in a specific zone. The author proposes a new approach to reduce speed. The aim is to develop a hardware prototype for safely monitoring and controlling vehicles in specific areas, offering a promising solution for improving road safety.

Swetha Bergonda [13] proposed an IoT-based system to detect accidents and track vehicles using Raspberry Pi, vibration sensors, and GPS technology. The system used vibration sensors to detect accidents and transmits the vehicle's location via GPS, supporting emergency response and improving road safety.

T. A. M. Van der Zant [14] described the development and testing of an internet-controlled car. The car uses a wireless module to communicate with a host computer over the internet. The user can control the car from the host computer using a joystick or keyboard. The paper also discusses the challenges of controlling a car over the internet, such as latency and packet loss.

J. Vetter et al [15] discussed about the different types of ageing that can occur in a lithium-ion battery. The most common way is repeated cycling, which results in unstable compounds on the battery electrodes. The second type of ageing was through mechanical stress, which resulted in the degradation of battery and structural integrity. The third type of ageing was due to chemical reactions within the battery, resulting in degradation of the battery's active materials. The paper ends with methods that can help slow down ageing in a battery, such as operating the battery within the specified temperature range, limiting the current consumed, and avoiding deep discharges.

# 3 Methodology

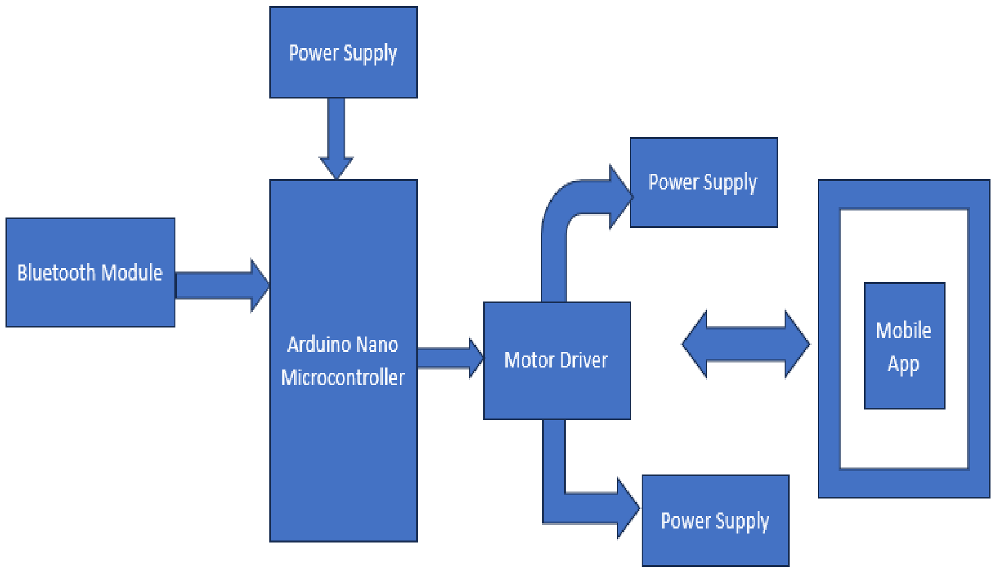


**Figure 1:** System Architecture of the Live feed capture using Arduino controlled RC car

As shown in figure 1, the proposed system aims to enhance vehicle safety and monitoring by integrating hardware components like sensors and communication modules with software algorithms and interfaces for user interaction. A feasibility study assesses technical, economic, and operational viability, exploring existing IoT technologies and regulations. A high-level system architecture outlines components, interactions, and data flow, while appropriate IoT communication protocols and cloud platforms are selected. Algorithms are developed for collision prediction, driver behavior analysis, and accident prevention. Modules include data acquisition, telematics, data transmission, algorithmic analysis, a mobile application, and monitoring/reporting. Fleet managers monitor the entire fleet through a centralized dashboard, generating reports on vehicle performance and incidents. The system's continuous improvement is driven by regular updates, feedback loops, and ongoing monitoring.

# 4 Results and Performance

**Figure 2:** Operating the RC car

Figure 2 shows the functioning of the Arduino controlled RC car using the mobile application installed.

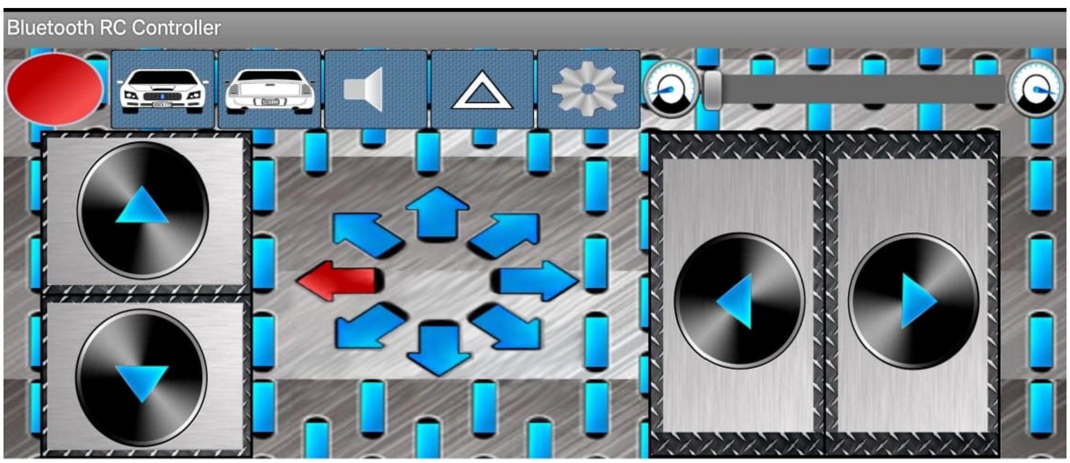


**Figure 3:** Application used to control the RC car

Figure 3 represents the application used to control the Arduino controlled RC car. The arrows enable the RC car to move in a certain direction, the control is given by the user.

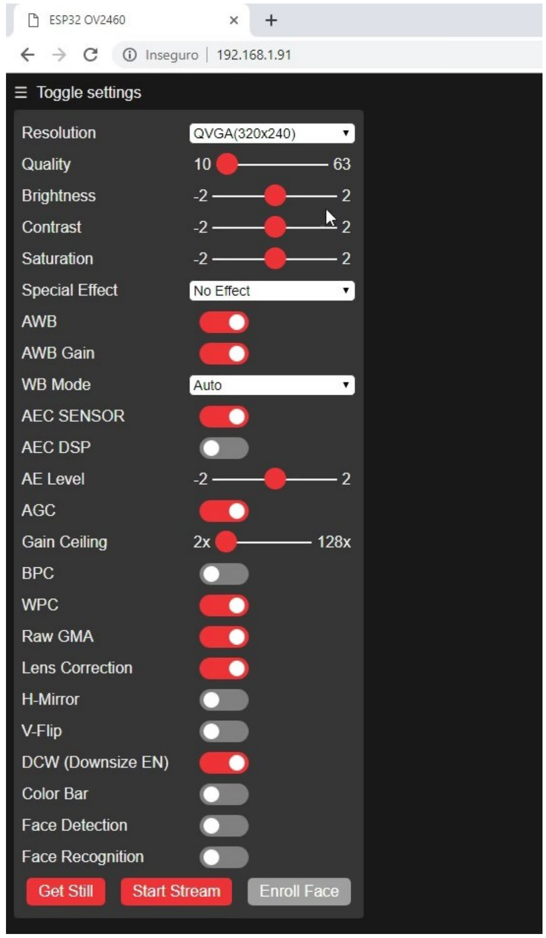


**Figure 4:** Live feed capture using ESP32 camera

Figure 4 represents the video feed obtained by the ESP32 camera which can be accessed by entering a certain URL specially for the ESP32 camera module on the browser.

# 5 Conclusion and Future work

Therefore, the suggested intelligent vehicle monitoring, and control system is a significant advancement in terms of user friendliness, efficiency, and safety in transportation. Real-time video surveillance, smartphone-controlled driving mechanisms, and the integration of the ESP32-CAM-IoT module create a holistic framework that might completely change how vehicles interact and are managed. By assessing the system's advantages and disadvantages during the project and determined that it might raise traffic safety, enhance user satisfaction, and support a connected and transportation vision. Real-time monitoring from the ESP32-CAM offers a strong basis for both human control. In order to adjust to changing traffic conditions, future development prospects are found in machine learning algorithms, sophisticated sensors, and V2X communications. Long-term success requires an emphasis on user-centric features, energy efficiency, and compliance with changing standards. Technological advancements alone won't guarantee success; user education, acceptance, cooperation with regulators, and smart city initiatives will all be critical. It is critical that these systems strike a balance between innovation, security, and user privacy as they become a crucial component of transportation in the future. In conclusion, the suggested system establishes the groundwork for an ecosystem of connected, safer, and smarter vehicles that will be able to influence mobility in the future as society's perceptions of intelligent transportation and technology progress. This can be accomplished through real-time monitoring using the ESP32 camera module.

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