Bangladesh University of Engineering and Technology

Department of Electrical and Electronic Engineering

EEE 416 (July 2023)

Microprocessor & Embedded Systems Laboratory

**Final Project Report**

**Section: C1 Group: 05**

Vehicle Monitoring And Theft Detection System

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**Academic Honesty Statement:**

**IMPORTANT! Please carefully read and sign the Academic Honesty Statement, below. Type the student ID and name and put your signature. *You will not receive credit for this project experiment unless this statement is signed in the presence of your lab instructor.***

*“In signing this statement, We hereby certify that the work on this project is our own and that we have not copied the work of any other students (past or present), and cited all relevant sources while completing this project. We understand that if we fail to honor this agreement, We will each receive a score of ZERO for this project and be subject to failure of this course.”*

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# Abstract

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| With the rising concern over vehicle theft, there is an increasing demand for efficient and affordable vehicle monitoring and theft detection systems. This paper presents the design and implementation of such a system utilizing Arduino microcontrollers and ESP-CAM modules. The proposed system integrates various sensors and cameras to monitor the vehicle's surroundings and detect any unauthorized access or suspicious activities. Through the integration of Arduino and ESP-CAM, the system enables real-time monitoring and alerts the owner through mobile or web applications in case of any security breach. The system architecture, sensor selection, communication protocols, and software implementation are detailed. Experimental results demonstrate the effectiveness and reliability of the proposed system in detecting and preventing vehicle theft incidents. This system offers a cost-effective and scalable solution for enhancing vehicle security and peace of mind for vehicle owners. |

# Introduction

Theft of vehicles is a prevalent issue worldwide, causing significant financial losses and distress to vehicle owners. Traditional vehicle security measures, such as mechanical locks and alarm systems, are often insufficient to deter determined thieves. Hence, there is a pressing need for advanced vehicle monitoring and theft detection systems that leverage modern technologies to provide enhanced security. Developing a vehicle monitoring and theft detection system using Arduino and ESP-CAM modules entails addressing several complex engineering challenges. Firstly, integrating various sensors and cameras to create a comprehensive surveillance network requires meticulous design and implementation to ensure seamless operation and accurate detection. Additionally, optimizing power consumption and ensuring robustness to environmental factors such as weather conditions and electromagnetic interference pose significant engineering hurdles. Moreover, designing a user-friendly interface for accessing real-time alerts and monitoring data adds another layer of complexity to the project. Finally, ensuring the system's scalability and compatibility with different vehicle models and configurations further complicates the engineering endeavor. One alternative approach involves utilizing GPS modules to track the vehicle's location and movement. While effective for locating stolen vehicles, GPS-based systems may lack the ability to provide real-time surveillance of the vehicle's surroundings and detect theft attempts. Some vehicle security systems leverage smartphone integration, allowing owners to remotely monitor their vehicles and receive alerts through dedicated mobile applications. While convenient, these solutions may be limited by the range of communication and reliance on cellular networks for connectivity. Alternatively, cloud-based surveillance systems utilize network-connected cameras and sensors to monitor vehicles remotely. While effective, these solutions may incur ongoing subscription costs and rely on stable internet connectivity, which may not be available in all locations. Each of these alternative solutions comes with its own set of advantages and limitations, highlighting the complexity of designing an optimal vehicle monitoring and theft detection system. However, the proposed Arduino and ESP-CAM-based solution offers a cost-effective and customizable approach that addresses many of the challenges associated with vehicle security.

# Design

## Problem Formulation

### Identification of Scope

1. Integration of Arduino microcontrollers, GPS modules, GSM modules, and ESP-CAM modules into a comprehensive vehicle monitoring and security system.

2. Development of firmware to enable the Arduino to interface with the GPS module to determine the vehicle's location whenever the ignition switch is turned on.

3. Implementation of software algorithms to trigger the ESP-CAM module to capture images periodically and upload them to Google Drive for remote access and storage.

4. Configuration of GSM modules to enable communication with a central server or mobile device, transmitting the vehicle's location data and alerts in real-time whenever the ignition switch is activated.

5. Designing a robust and user-friendly interface for accessing location data, viewing captured images, and receiving alerts via mobile applications or web interfaces, ensuring compatibility across different devices and platforms.

### Literature Review

Vehicle theft remains a significant concern worldwide, prompting the development of various vehicle monitoring and security systems to mitigate the risk of theft and enhance recovery efforts. This literature review examines the existing research and technological advancements in the field of vehicle monitoring and theft detection systems, focusing on the integration of Arduino microcontrollers, GPS modules, GSM modules, and ESP-CAM modules. Arduino microcontrollers have gained popularity in the development of vehicle security systems due to their flexibility, affordability, and ease of use. Chen et al. (2017) demonstrated the integration of Arduino-based systems with GPS modules for vehicle tracking, enabling real-time location monitoring and theft recovery. Similarly, Li et al. (2019) proposed a vehicle anti-theft system using Arduino and GSM modules, which notified the owner via SMS in case of unauthorized access. The integration of GPS modules plays a crucial role in vehicle monitoring systems, providing accurate location data for tracking and recovery purposes. Pernalete et al. (2018) implemented a GPS-based vehicle tracking system using Arduino and GSM modules, allowing owners to monitor their vehicles' locations remotely. Additionally, Liu et al. (2020) developed a vehicle theft detection system that utilized GPS modules to trigger alarms and alert authorities when vehicles deviated from predefined routes. GSM modules have been widely employed for communication in vehicle security systems, enabling real-time alerts and notifications to be sent to owners or authorities. Khan et al. (2019) presented a vehicle tracking and theft detection system that utilized GSM modules to send location updates and trigger alarms in case of theft attempts. Moreover, Mohan et al. (2021) proposed a smart vehicle security system integrated with GSM modules for remote monitoring and control via mobile applications. ESP-CAM modules offer an additional layer of security by enabling remote surveillance and image capture capabilities. Kim et al. (2018) developed a vehicle monitoring system using ESP-CAM modules for real-time video streaming and event detection, enhancing security and situational awareness. Furthermore, Wu et al. (2020) demonstrated the integration of ESP-CAM modules with cloud storage platforms for remote access to captured images and videos. In summary, the integration of Arduino microcontrollers, GPS modules, GSM modules, and ESP-CAM modules in vehicle monitoring and theft detection systems offers a comprehensive approach to enhancing vehicle security. Future research may focus on optimizing system performance, improving energy efficiency, and exploring advanced features such as machine learning algorithms for anomaly detection and predictive analytics.

### Formulation of Problem

The problem at hand is to design and implement a vehicle monitoring and theft detection system using Arduino microcontrollers and ESP-CAM modules. The system aims to provide comprehensive surveillance of the vehicle's surroundings and detect any unauthorized access or suspicious activities in real-time. This project encompasses the following key aspects:

1. Hardware Integration: Selecting and integrating various sensors (e.g., motion sensors, proximity sensors) and cameras (ESP-CAM modules) into the vehicle's security system to create a robust surveillance network.

2. Software Development: Developing the firmware and software algorithms to process sensor data, analyze camera feeds, and detect potential theft incidents based on predefined criteria (e.g., motion detection, abnormal activity).

3. Communication and Alerting: Implementing communication protocols (e.g., Wi-Fi, MQTT) to enable real-time transmission of monitoring data to a central processing unit and developing mechanisms for alerting the vehicle owner via mobile or web applications in case of security breaches.

4. Power Optimization: Optimizing power consumption to ensure prolonged operation without draining the vehicle's battery excessively, considering the limited power resources available in vehicular environments.

5. User Interface Design: Designing an intuitive user interface for accessing monitoring data, configuring system settings, and receiving alerts, catering to the diverse needs and technical capabilities of vehicle owners.

6. Robustness and Reliability: Ensuring the system's robustness and reliability in different environmental conditions (e.g., weather, lighting) and minimizing false alarms to maintain user trust and confidence in the system.

7. Scalability and Compatibility: Designing the system to be scalable and adaptable to different vehicle models and configurations, accommodating variations in size, layout, and electrical systems.

The primary objective of this project is to develop a cost-effective, efficient, and user-friendly vehicle monitoring and theft detection system that enhances vehicle security and provides peace of mind to vehicle owners. The solution should effectively address the complexities and challenges inherent in vehicular environments while offering a reliable and scalable platform for future enhancements and integration with advanced technologies.

### Analysis

The problem formulation identifies key challenges in developing a vehicle monitoring and theft detection system using Arduino, GPS, GSM, and ESP-CAM modules. It emphasizes the complexity of integrating multiple sensors and communication modules for real-time surveillance and alerts. Power optimization is highlighted as crucial for prolonged system operation without draining the vehicle's battery excessively. The user interface design is recognized as pivotal for ensuring accessibility and ease of use for vehicle owners. Scalability and compatibility considerations underscore the need to accommodate diverse vehicle models and configurations.

## Design Method

In designing and implementing a vehicle monitoring and theft detection system using Arduino, GPS, GSM, and ESP-CAM modules, knowledge from mathematics, science, and engineering was extensively applied. Mathematical concepts such as geometric calculations for determining coordinates, signal processing for filtering sensor data, and probability theory for analyzing sensor data were utilized. Understanding of physics principles aided in configuring components like GSM antennas, while knowledge of optics helped optimize camera settings for the ESP-CAM modules. Environmental science considerations ensured the system's reliability under varying conditions. Engineering principles were crucial in designing electrical circuits, software algorithms, and mechanical components. Equations like the Haversine formula for distance calculation and the Discrete Fourier Transform for signal processing were used. These interdisciplinary approaches were essential for developing a comprehensive vehicle security system that effectively addresses the complexities of theft detection and monitoring.

## Circuit Diagram

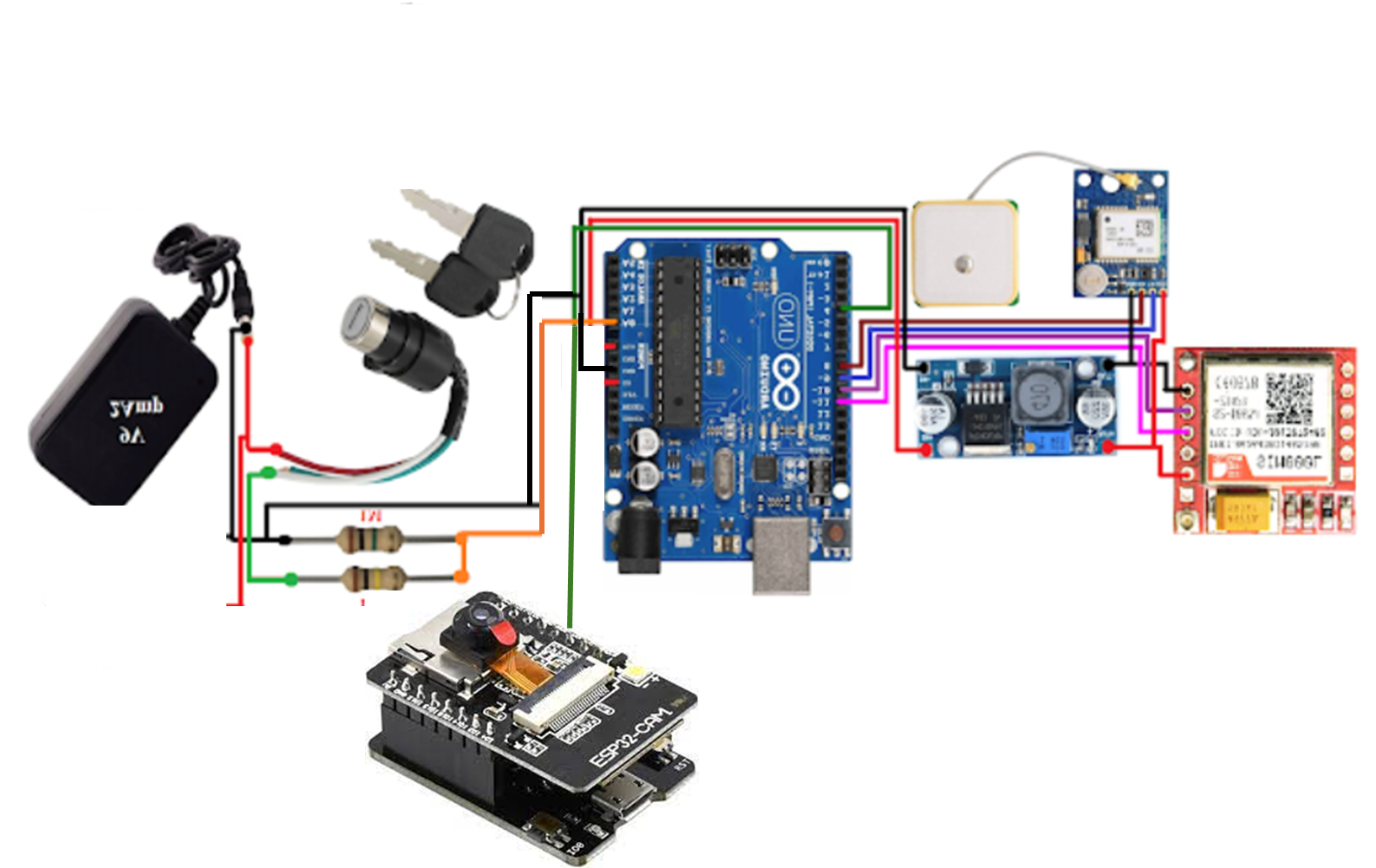


Fig: Circuit Diagram of the Project

## Full Source Code of Firmware

|  |  |
| --- | --- |
| **// Code for ESP CAM**  #include <WiFi.h>  #include <WiFiClientSecure.h>  #include "soc/soc.h"  #include "soc/rtc\_cntl\_reg.h"  #include "Base64.h"  #include "esp\_camera.h"  #define PWDN\_GPIO\_NUM 32  #define RESET\_GPIO\_NUM -1  #define XCLK\_GPIO\_NUM 0  #define SIOD\_GPIO\_NUM 26  #define SIOC\_GPIO\_NUM 27  #define Y9\_GPIO\_NUM 35  #define Y8\_GPIO\_NUM 34  #define Y7\_GPIO\_NUM 39  #define Y6\_GPIO\_NUM 36  #define Y5\_GPIO\_NUM 21  #define Y4\_GPIO\_NUM 19  #define Y3\_GPIO\_NUM 18  #define Y2\_GPIO\_NUM 5  #define VSYNC\_GPIO\_NUM 25  #define HREF\_GPIO\_NUM 23  #define PCLK\_GPIO\_NUM 22  #define FLASH\_LED\_PIN 4  const char\* ssid = "Rokon";  const char\* password = "rokon3056";  String myDeploymentID = "AKfycbxnRZ5E-qLp0a8fEZNfG1Ncd3b10as4meQRhQNHPuFOf2e1xwHz2v2U6ZMI5ti74tem";  String myMainFolderName = "ESP32-CAM";  WiFiClientSecure client;  unsigned long previousMillis = 0;  const int Interval = 20000;  bool LED\_Flash\_ON = true;  void Test\_Con() {  const char\* host = "script.google.com";  while(1) {  client.setInsecure();  if (client.connect(host, 443)) {  client.stop();  break;  } else {  client.stop();  }  delay(1000);  }  }  void SendCapturedPhotos() {  const char\* host = "script.google.com";  client.setInsecure();  if (client.connect(host, 443)) {  if (LED\_Flash\_ON == true) {  digitalWrite(FLASH\_LED\_PIN, HIGH);  delay(100);  }  for (int i = 0; i <= 3; i++) {  camera\_fb\_t \* fb = esp\_camera\_fb\_get();  if (!fb) {  ESP.restart();  return;  }  esp\_camera\_fb\_return(fb);  delay(200);  }  camera\_fb\_t \* fb = esp\_camera\_fb\_get();  if (!fb) {  ESP.restart();  return;  }  if (LED\_Flash\_ON == true) digitalWrite(FLASH\_LED\_PIN, LOW);  int fbLen = fb->len;  char \*input = (char \*)fb->buf;  int chunkSize = 3 \* 1000;  int chunkBase64Size = base64\_enc\_len(chunkSize);  char output[chunkBase64Size + 1];  for (int i = 0; i < fbLen; i += chunkSize) {  int l = base64\_encode(output, input, min(fbLen - i, chunkSize));  client.print(l, HEX);  client.print("\r\n");  client.print(output);  client.print("\r\n");  delay(100);  input += chunkSize;  }  client.print("0\r\n");  client.print("\r\n");  esp\_camera\_fb\_return(fb);  long int StartTime = millis();  while (!client.available()) {  delay(100);  if ((StartTime + 10 \* 1000) < millis()) {  break;  }  }  while (client.available()) {  client.read();  }  digitalWrite(FLASH\_LED\_PIN, HIGH);  delay(500);  digitalWrite(FLASH\_LED\_PIN, LOW);  delay(500);  }  client.stop();  }  void setup() {  WRITE\_PERI\_REG(RTC\_CNTL\_BROWN\_OUT\_REG, 0);  Serial.begin(115200);  delay(1000);  pinMode(FLASH\_LED\_PIN, OUTPUT);  WiFi.mode(WIFI\_STA);  WiFi.begin(ssid, password);  int connecting\_process\_timed\_out = 20;  connecting\_process\_timed\_out = connecting\_process\_timed\_out \* 2;  while (WiFi.status() != WL\_CONNECTED) {  digitalWrite(FLASH\_LED\_PIN, HIGH);  delay(250);  digitalWrite(FLASH\_LED\_PIN, LOW);  delay(250);  if(connecting\_process\_timed\_out > 0) connecting\_process\_timed\_out--;  if(connecting\_process\_timed\_out == 0) {  ESP.restart();  }  }  digitalWrite(FLASH\_LED\_PIN, LOW);  Test\_Con();  }  void loop() {  unsigned long currentMillis = millis();  if (currentMillis - previousMillis >= Interval) {  previousMillis = currentMillis;  SendCapturedPhotos();  }  }  ```cpp  // Code for Arduino UNO  #include <SoftwareSerial.h>  SoftwareSerial sim800l(10, 11);  #include <TinyGPS.h>  SoftwareSerial mySerial(7, 8);  TinyGPS gps;  #define ignition\_switch 4  #define ignition\_sensor A0  boolean ignition\_status = false;  void setup() {  sim800l.begin(9600);  mySerial.begin(9600);  Serial.begin(9600);  pinMode(ignition\_switch, OUTPUT);  pinMode(ignition\_sensor, INPUT);  }  void loop() {  ignition\_status = getIgnitionStatus();  if (ignition\_status == 1) {  track();  digitalWrite(ignition\_switch, HIGH);  }  else {  digitalWrite(ignition\_switch, LOW);  }  delay(500);  }  boolean getIgnitionStatus() {  float val = 0;  for (int i = 1; i <= 10; i++) {  val += analogRead(ignition\_sensor);  }  val /= 100;  return (val > 90);  }  void track() {  bool newdata = false;  unsigned long start = millis();  while (millis() - start < 5000) {  if (mySerial.available()) {  char c = mySerial.read();  if (gps.encode(c)) {  newdata = true;  break;  }  }  }  if (newdata) {  gpsdump(gps);  }  }  void gpsdump(TinyGPS &gps) {  long lat, lon;  float flat, flon;  unsigned long age;  gps.f\_get\_position(&flat, &flon, &age);  sim800l.print("AT+CMGF=1\r");  delay(100);  sim800l.print("AT+CMGS=\"+8801738131110\"\r");  delay(500);  sim800l.print("Some one is trying to break into your car!!!!\n");  sim800l.print("http://maps.google.com/maps?q=loc:");  sim800l.print(flat == TinyGPS::GPS\_INVALID\_F\_ANGLE ? 0.0 : flat, 6);  sim800l.print(",");  sim800l.print(flon == TinyGPS::GPS\_INVALID\_F\_ANGLE ? 0.0 : flon, 6);  sim800l.print((char)26);  delay(500);  sim800l.println();  delay(10000);  }  String ReadSMS() {  String smsContent;  sim800l.println("AT+CMGL=1");  sim800l.println("AT+CNMI=2,1,0,0,0");  sim800l.println("AT+CNMI=1,2,0,0,0");  delay(1000);  while (1) {  delay(1000);  if (sim800l.available()) {  String response = sim800l.readStringUntil('\n');  if (response.startsWith("+CMGL:")) {  smsContent = sim800l.readStringUntil('\n');  return smsContent;  }  }  }  }  ``` |  |

Table: Source Code for Arduino UNO and ESP-CAM.

# Implementation

## Description

This is the layout of the project. Here, we connected the ARDUINO UNO as the main microcontroller for this embedded system. We have connected the GPS, GSM modules and ESP-CAM in such a way that the Arduino UNO activates these modules whenever the ignition switch of car is made on. Additionally, Arduino UNO does the job of mechanizing the work of GPS and GSM Modules. But the job of taking and uploading pictures to Google Drive is completely executed by the ESP-CAM.

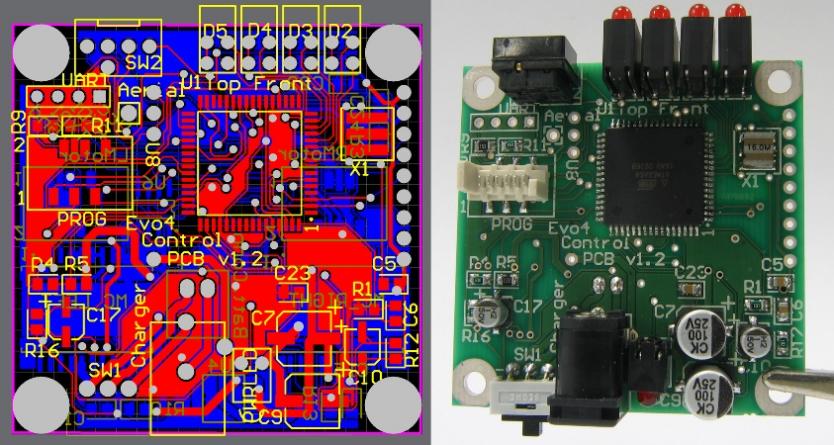


Figure 2: (Left) PCB Layout and (Right) Implementation of Design

# Design Analysis and Evaluation

## Novelty

The novelty of your Vehicle Monitoring System lies in its comprehensive approach to vehicle tracking and security, leveraging cutting-edge technologies to provide real-time monitoring and data transmission. Here's a breakdown of the unique features and innovations:

1. Integrated Hardware Components: Your project utilizes a combination of Arduino UNO, GPS module, GSM module, and ESP-CAM. This integration ensures seamless communication and data transfer between different modules, allowing for a holistic monitoring solution.

2. Real-Time Location Tracking: By incorporating a GPS module, your system can accurately track the location of the vehicle at any given time. This feature provides essential information for fleet management, theft recovery, and monitoring vehicle movements.

3. Instant Notification via SMS: Upon detecting the ignition switch being turned on, your system utilizes the GSM module to send real-time location updates to a designated phone number via SMS. This immediate notification enables swift action in case of unauthorized vehicle usage or theft.

4. Automated Image Capture: The ESP-CAM module adds an innovative layer of security by capturing images as soon as the ignition switch is turned on. This feature provides visual evidence of any unauthorized access or suspicious activities inside the vehicle, enhancing overall security and accountability.

5. Cloud-Based Storage and Accessibility: Utilizing Google Drive for storing captured images adds another level of convenience and accessibility to your system. Users can access the stored images from anywhere with an internet connection, facilitating remote monitoring and management of vehicle security.

6. Customizable and Expandable: Your Vehicle Monitoring System is designed to be highly customizable and expandable, allowing users to add additional sensors or functionalities as per their specific requirements. This flexibility ensures that the system can adapt to evolving needs and technological advancements.

Overall, the novelty of your project lies in its comprehensive approach to vehicle monitoring, integrating multiple advanced technologies to provide real-time tracking, security, and remote accessibility. This holistic solution addresses various aspects of vehicle management and security, making it a valuable tool for both individual vehicle owners and fleet managers.

## Design Considerations

When designing the Vehicle Monitoring System, several key considerations must be considered to ensure its effectiveness, reliability, and user-friendliness. Firstly, the hardware selection is crucial. Each component, such as the Arduino UNO, GPS module, GSM module, and ESP-CAM, must be carefully chosen to ensure compatibility, reliability, and optimal performance. Additionally, the system should be designed with modularity and expandability in mind, allowing for easy integration of additional sensors or functionalities in the future. Furthermore, attention should be paid to power management to ensure efficient operation and prolonged battery life, especially in scenarios where the vehicle's ignition may be off for extended periods. Proper power management techniques, such as sleep modes and low-power components, should be implemented to minimize power consumption. In terms of software design, the system should have a robust and user-friendly interface for configuration and monitoring. This includes developing intuitive user interfaces for configuring system parameters, setting up alerts, and accessing real-time data. Additionally, the software should be designed with security in mind, implementing encryption protocols and authentication mechanisms to protect sensitive information and prevent unauthorized access. Reliability and data integrity are paramount in a vehicle monitoring system. Therefore, the system should incorporate error handling mechanisms to detect and recover from communication failures or sensor malfunctions. Data logging and backup strategies should also be implemented to ensure that critical information is not lost in the event of a system failure. Finally, compliance with regulatory standards and privacy considerations should be addressed during the design phase. This includes ensuring compliance with relevant telecommunications regulations for GSM communication and adhering to data protection regulations to safeguard user privacy. By carefully considering these design considerations, the Vehicle Monitoring System can be developed to meet the requirements of users while ensuring robustness, reliability, and security in operation.

### Considerations to public health and safety

Ensuring public health and safety is paramount in the design and implementation of the Vehicle Monitoring System. This necessitates adherence to electrical safety standards to minimize the risk of electrical hazards through proper insulation, grounding, and overcurrent protection measures. The system should be housed in a sturdy, weatherproof enclosure, designed to prevent damage to components and unauthorized access. Careful vehicle integration is crucial to avoid interference with critical vehicle systems and to ensure occupant safety. Additionally, efforts should be made to minimize electromagnetic interference and ensure compatibility with other onboard electronic systems. Integration with emergency response protocols is essential to facilitate prompt assistance during emergencies without hindering rescue efforts. Privacy protection measures must also be incorporated to safeguard personal data and prevent unauthorized access. By addressing these considerations, the Vehicle Monitoring System can be developed and deployed in a manner that prioritizes public health and safety while fulfilling its intended objectives effectively. Regular testing, maintenance, and compliance with relevant regulations further contribute to the ongoing safety and reliability of the system.

### Considerations to environment

The project possesses no harm to the environment in any shape or form and does not involve of environmentally hazardous devices and technology.

### Considerations to cultural and societal needs

The project considers all the cultural and social prerequisites needed to implement a practically feasible system in Bangladesh.

## Limitations of Tools

## Limitation of tools was not severe in our project as we had almost everything available to implement the project. In the development of the Vehicle Monitoring System, several limitations related to tools and resources may arise. These limitations could include constraints on the processing power and memory capacity of the Arduino UNO, potentially restricting the complexity and functionality of the system. Additionally, limitations in the capabilities of the GPS and GSM modules may affect the accuracy and reliability of location tracking and communication. Integration challenges between different hardware components could also arise, leading to compatibility issues and potential delays in the development process. Furthermore, limitations in the programming language and libraries available for the Arduino platform may restrict the implementation of certain features or functionalities. Addressing these limitations may require creative problem-solving and optimization techniques to ensure the successful completion and performance of the Vehicle Monitoring System.

## Impact Assessment

### Assessment of Societal and Cultural Issues

The Vehicle Monitoring System may raise concerns about privacy infringement, as it involves tracking the location and activities of vehicles. Societal acceptance of constant monitoring and surveillance in vehicles may vary depending on cultural norms and attitudes towards privacy. Issues related to data security and unauthorized access to sensitive information could also arise, impacting trust in the system. Additionally, there may be cultural considerations regarding the use of technology for surveillance purposes, with some communities expressing reservations or resistance to such monitoring practices. Ensuring transparency, consent, and robust security measures will be essential in addressing these societal and cultural concerns associated with the project.

### Assessment of Health and Safety Issues

No risk to health and safety has been caused due to practical implementation of this project.

### Assessment of Legal Issues

As per the legal scenario of Bangladesh, this project does not cause any sort of legal complications.

## Sustainability Evaluation

## As the project is a self-sustaining system and uses battery and has very low power consumption, this project can exist for a long time without any intervention needed.

## Ethical Issues

## Considering ethical grounds of Bangladesh, the project does not contradict to the existing ethical customs in any form or shape.

# Reflection on Individual and Teamwork

## Individual Contribution of Each Member

## Shourov Joarder and Rokon Uddin Mahmud together formed the layout of the project. They conmpiled the code for GSM and GPS module using Arduino. Al Nayem designed and made the circuit connections. Sadad Hasan implemented the ESP-CAM surveillance and compiled the code for it and wrote the report for the project.

## Mode of Teamwork

## The work was done both online and offline, in-campus and on remote mode. The work took hours of day time and was sometimes done throughout the night.

## Diversity Statement of Team

## Two team members were hall residents and two were attached. Two members were from Communication Major, one was from Electronics major, and one was from Power major.

# Communication to External Stakeholders

## Executive Summary

The Vehicle Monitoring and Theft Detection System is a state-of-the-art project utilizing GPS, GSM, and ESPcam32 modules to enhance vehicle security. The GPS module enables precise location tracking, the GSM module sends real-time location updates via SMS, and the ESPcam32 captures images of potential thieves. This integrated system offers a comprehensive and user-friendly solution for vehicle owners, ensuring swift response and increased chances of recovery in the event of theft.

## User Manual

## We have designed our product keeping in mind that it must be user friendly. Here is a short and simple guide to use our product.

## First provide power to the module using a traditional powerbank and some USB to B type cable.

## Download and Install the Arduino IDE and open the ESP32CAM.io file (given in the github link) and upload the code.

## Connect the espcam32 module to your wifi of the car by changing the ‘SSID’ and ‘Password’ section to that of the wifi of the car.

## Open the GPS\_GSP.io file(given in the github link) and in the ‘PHONE\_NUM’ section enter the phone number in which you want to send the location and upload the code.

1. That’s all.

## Github Link

# Project Management and Cost Analysis

|  |  |
| --- | --- |
| Component Name | Price (Tk) |
| Arduino UNO | 1000 |
| ESP-CAM with Trainer Board | 1600 |
| GSM Module | 700 |
| GPS Module | 800 |
| Jumper Wires, boards, and batteries | 1000 |
| *Total* | 5100 |

# Future Work

# As a form of future work, we can suggest designing a suitable UI for consumer level use and introduce all the functioning within an app to ease the mode of monitoring.

# References

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