MKSSS's Cummins COLLEGE OF ENGINEERING FOR WOMEN

ADVANCED PROCESSOR
Full Vehicle Theft Detection System

Gayatri Sadaphal	Manasi Sangamnerkar	Ami Shah	Ishita Shete
UEC2021348	UEC2021350	UEC2021354	UEC2021356

Table of Contents:

1. Abstract

"Integrated Vehicle Security System: Comprehensive Anti-Theft Solution for Full Vehicle, Battery, and Petrol Theft"

In response to the escalating concerns related to vehicle theft, this project, "Integrated Vehicle Security System," introduces a multifaceted approach to safeguarding vehicles against full theft, battery theft, and petrol theft. Our innovative system seamlessly integrates multiple sensors and technologies, including GPS, GSM, Buzzer, Flex sensor, PIR sensor, Vibration sensor, and Gas sensor, to create a robust anti-theft mechanism.

At the heart of this system lies the LPC2148 microcontroller (ARM7TDMI-S), which serves as the central processing unit. Real-time vehicle tracking becomes a reality with the incorporation of a GPS module, enabling owners to monitor their vehicle's precise location at any given time. Suspicious activities such as unauthorized access or vehicle movement trigger immediate alerts, transmitting location data via the GSM module.

To combat battery theft, we introduce a Flex sensor integrated into the battery compartment. Any attempt to tamper with the battery will activate this sensor, sending instant notifications to the vehicle owner. This alert includes the exact vehicle

location, courtesy of the GPS and GSM technologies.

Petrol theft is addressed with a Gas sensor, which detects any unauthorized fuel siphoning. Coupled with the Vibration sensor, it ensures that even the slightest tampering with the fuel tank triggers an alert to safeguard the vehicle's valuable resources.

In addition to notifications, a high-decibel buzzer can be activated to deter potential thieves and alert individuals in the vicinity, enhancing overall security. Our project aims to provide an affordable, reliable, and user-friendly security solution, ensuring comprehensive protection for vehicles against a range of theft threats.

2. Introduction

Given the current security challenges, there has been a noticeable increase in vehicle and battery theft. As a response to this growing concern, high-end automobile manufacturers are now obligated to implement security measures that ensure owner authorization and robust anti-theft systems to protect their vehicles.

Traditional theft systems depend on various sensors like pressure, tilt, shock, and door sensors to deter potential car thieves. However, these systems have limitations, such as cost and an inability to identify and track thieves effectively. Their primary purpose is to prevent vehicle loss.

In contrast, the proposed security system utilizes an Advanced RISC Machine (ARM) processor to enhance anti-theft measures. This advanced system employs the ARM processor to process direction and distance data, which is then transmitted to a GSM module using digital modulation techniques. At the receiving end, the transmitted signal is detected, demodulated, and forwarded to an Android mobile device. This approach provides a comprehensive and technologically advanced method for vehicle security and theft prevention.

Additionally, for addressing specific issues like battery theft, a flex sensor can be incorporated into the system. This flex sensor can detect any tampering or removal of the battery, triggering an alert to the vehicle owner. Moreover, to combat petrol theft, vibration and gas sensors can be integrated. The vibration sensor can detect any unauthorised access to the fuel tank, while the gas sensor can alert the owner in the event of any gas syphoning or tampering. These added features further enhance the overall security of the vehicle and its components.

3. Literature Survey

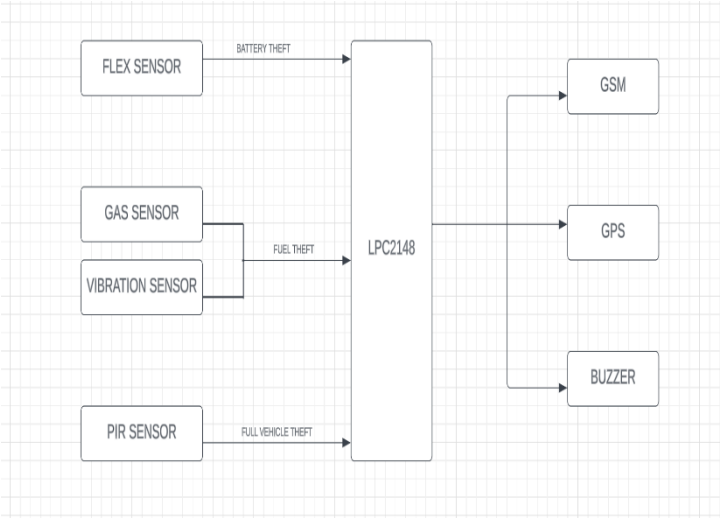
- **“Design of a low-cost anti-theft sensor for motorcycle security devices”**, Accidents on highways due to increased traffic and reckless driving often result in delayed assistance. Our project, the Vehicle Positioning System, employs GPS and GSM technology to address this

issue. It not only aids in early accident detection but also notifies vehicle owners automatically when accidents occur. Additionally, it assists in tracking the vehicle's exact location and provides theft prevention. Owners can send an SMS to immobilise the vehicle in case of theft. The system comprises an ARM 7 controller, accelerometer, GPS module, and GSM module. It uses SMS to alert nearby authorities like hospitals and police, enhancing response time for accident victims and property protection.

- **"Design of a low-cost anti-theft sensor for motorcycle security device"**, this paper introduces a cost-effective anti-theft sensor for motorcycle security, focusing on detecting handlebar rotation. A motorcycle security device based on this sensor has been developed. Unlike the often-frustrating vibration sensors currently used, our sensor only triggers a theft alert when the handlebar rotates from left to right or vice versa, an action necessary for riding a bike. The device includes a GSM-GPRS module, microcontroller, relay, buzzer, SOS button, and other components powered by a lithium-ion battery. It offers features such as remote ignition control, status updates via SMS, offline vehicle location using cellular triangulation, and alerts in case of accidents. This low-cost system is particularly valuable for rural vendors heavily reliant on motorcycles, ensuring robust security with minimal false alarms.

- **"RTOS-based vehicle tracking system",** the development of a vehicle tracking system, utilising GPS and GSM modem technology, aims to enhance the ease and utility of locating vehicles for various applications, such as personal vehicle security, public transportation systems, and school buses. This system enables users to remotely track their vehicles through mobile networks, offering better supervision and monitoring. Built on ARM7, GSM, and GPS, the system utilises GSM to transmit vehicle information, including its precise location. An ARM7TDMI core LPC 2148 processor collects and sends this data to the monitoring system via a GSM modem. The monitoring system employs a GUI to display the received information on Google Maps, enhancing vehicle tracking and management.

4. Block Diagram



5. Explanation of Block Diagram

The flex sensor is intricately linked to the vehicle's battery, designed to monitor any significant bending or flexing that occurs during a potential battery removal attempt. This innovative approach allows the system to promptly detect any unauthorised access to the battery compartment, thus enhancing the security measures for the vehicle.

In a similar fashion, the gas sensor and vibration sensor are strategically positioned along the fuel supply line leading to the engine. This placement enables them to efficiently detect any illicit interference with the fuel system. The vibration sensor is sensitive to any unauthorised manipulation of the fuel pipe, while the gas sensor is designed to identify the presence of hydrocarbon fumes, providing a comprehensive solution to petrol theft prevention.

Furthermore, a Passive Infrared (PIR) sensor is affixed to the vehicle's tires. This sensor plays a crucial role in monitoring tire movement, and it is programmed to trigger an alert if the tires move a distance greater than 500 metres. This additional layer of security ensures that any unauthorised vehicle movement is swiftly detected.

Once any of these sensors detect an unusual event or breach, the information gathered is seamlessly relayed to the LPC2148 microcontroller. This central processing unit serves as the hub for processing and coordinating the sensor data. In response to a detected security breach, the system activates a combination of measures, including activating the GSM module to send an alert to the owner, utilising the GPS system to pinpoint the vehicle's location, and activating a loud buzzer to deter the potential thief.

This integrated security system not only provides advanced detection mechanisms but also offers a multi-pronged response strategy to safeguard the vehicle against theft and unauthorised access, ensuring the utmost protection for the owner and their valuable assets.

6. Component-wise explanation of block diagram

a. LPC2148: The ARM7TDMI-S microcontroller plays a crucial role in a vehicle theft detection system by serving as the central processing unit. This microcontroller is responsible for coordinating various components and functions within the system. It collects data from sensors, such as accelerometers, and processes information related to vehicle movement and security. The LPC 2148 communicates with other modules, like GPS and GSM, to analyse data and trigger alarms or actions in the event of unauthorised vehicle access or movement. It acts as the brain of the system, making decisions based on sensor inputs and enabling real-time responses to potential theft or security breaches in vehicles.

b. GSM Module: It serves as the communication link between the vehicle and the owner or monitoring centre. The module allows for real-time alerts and notifications, enabling the system to send messages or make calls in case of unauthorised access or theft, ensuring rapid response and recovery. It also facilitates remote control and tracking of the vehicle, enabling actions like immobilisation or location monitoring. In essence, the GSM module is the critical component that enhances the overall security and effectiveness of the vehicle theft detection system.

c. GPS Module: The GPS module in an LPC 2148-based vehicle theft detection system plays a pivotal role in accurately determining and relaying the vehicle's real-time geographical coordinates. This information is crucial for monitoring and tracking the vehicle's location, which is essential for theft detection and recovery. By continuously providing the exact position data, the GPS module enables the system to alert the owner or authorities when the vehicle deviates from its expected route or is moved without authorization, ensuring swift response to potential theft incidents and aiding in the quick recovery of stolen vehicles.

d. PIR Sensor: In an LPC2148-based vehicle and battery theft detection system, the PIR (Passive Infrared) sensor plays a critical role. It functions as a motion detector, monitoring the surroundings for changes in infrared radiation. When an unauthorised person or thief approaches the vehicle, the PIR sensor detects the motion of the vehicle.

e. Flex Sensor: A flex sensor is a bend-sensitive device that changes its electrical resistance when subjected to bending or flexing. Typically made of flexible materials with conductive properties, it finds application in various fields, from human-machine

interfaces to robotics and automotive control systems, providing valuable feedback on positional changes through its analog voltage output.

f. Vibration sensor: A vibration sensor is an electronic device that detects and measures mechanical vibrations and oscillations. It typically converts these physical movements into electrical signals, which can be analysed to monitor equipment health, detect anomalies, or ensure structural integrity in various applications, including machinery, automotive systems, and structural health monitoring.

g. Gas Sensor: A gas sensor is a device that detects and measures the presence and concentration of specific gases in the surrounding environment. It works by interacting with the gas molecules, causing a change in electrical resistance or voltage, providing valuable data for applications such as air quality monitoring and safety in industrial settings.

7. Mechanical Placement

a. LPC2148 Microcontroller
- Install the LPC2148 microcontroller inside a secure, weatherproof box or enclosure within the two-wheeler. Make sure it's tucked away to prevent tampering.
- Connect the microcontroller to the two-wheeler's battery and ground to ensure it operates smoothly.

b. GSM Module:
- Place the GSM module in an area of the vehicle where it can maintain a strong cellular signal. This might require using an external antenna.
- Connect the GSM module to the microcontroller via suitable communication interfaces.

c. GPS Module:
- Mount the GPS module on the outside of the two-wheeler or another location with a clear line of sight to the sky to receive GPS signals.
- Link the GPS module to the microcontroller, usually through UART or similar communication protocols.

d. PIR Motion Sensor:
- Position the PIR motion sensor in key areas inside the vehicle where unauthorised access is likely to occur. These could be near doors, the dashboard, or other entry points.
- Wire the PIR sensor to the microcontroller using appropriate GPIO connections.

e. Power Supply:
- Ensure a stable power supply for all components, including the microcontroller, GSM module, GPS module, PIR sensor, Flex sensor, and Gas Sensor.

- Use voltage regulators and filters to keep the power clean and reliable.

f. Wiring and Enclosure:
- Use quality wiring and connectors to establish secure connections between the components, safeguarding them against vibrations and harsh environmental conditions.
- House the entire system in a protective, tamper-resistant enclosure.

g. Programming and Control:
- Develop and load the necessary software onto the LPC2148 microcontroller. This software will control how the system operates, process data from the GPS module and PIR sensor, and manage communication with the GSM module.

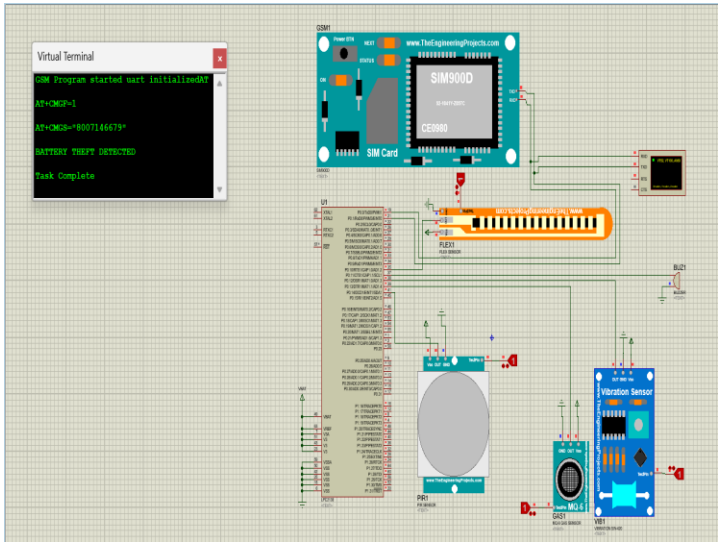
h. Notifications and Alerts:
- Set up the system to send out notifications, such as text messages or data alerts, to a predefined phone number or a central server whenever it detects signs of theft or unauthorised access.

i. Gas Sensor and Vibration Sensor:
- These sensors should be placed near the pipe that is present near the engine from where petrol theft often occurs.

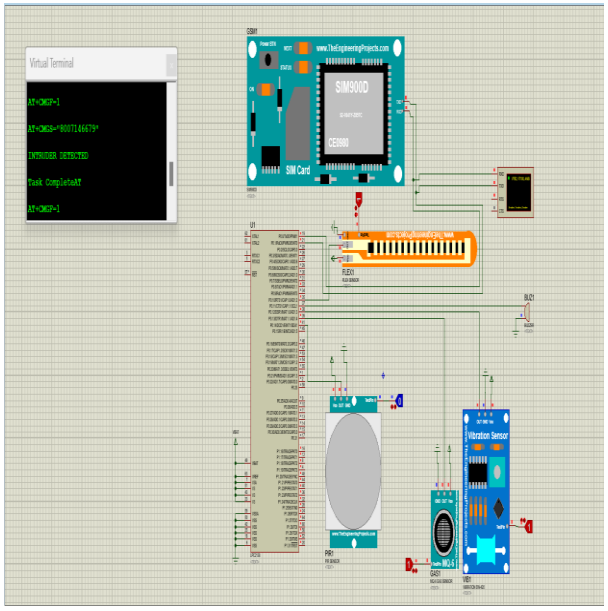
k. Flex Sensor:
- The flex sensor is placed near the battery and even slight bending of the sensor will activate the buzzer and activate the GSM and GPS of the module.
-

8. Simulation

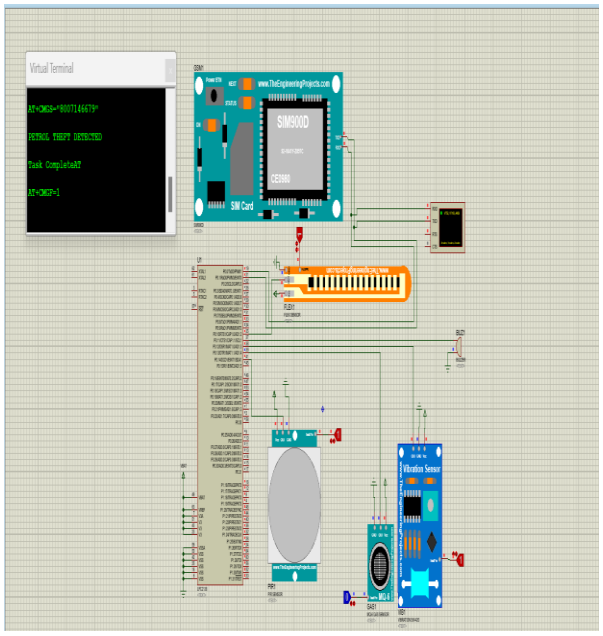
Battery theft detection:



Full vehicle theft detection:



Petrol theft detection:



9. Conclusion

The experiment successfully showcased the vehicle theft detection system's effectiveness. With the LPC2148 microcontroller at its core, it adeptly managed all system components, such as the GSM module, GPS module, PIR motion sensor, Flex Sensor, Gas sensor, and Vibration sensor, ensuring their seamless collaboration in the pursuit of unauthorized access or theft detection. Strategic component placement played a pivotal role in the system's performance: the GSM module relied on a robust cellular signal, the GPS module demanded an unobstructed view of the sky, and the PIR sensor strategically guarded potential entry points to the vehicle. This smart system was programmed to promptly dispatch notifications and alerts, which could take the form of SMS messages or data alerts, to predefined recipients upon detecting any suspicious activity.

10. References

1. R. Vijay Shashanka, B. Suneetha, G. Neelima, B. Krishna Prasad, K. Ashok Reddy, K. Vijay Bhaskar, 2016, Identifying Vehicle Positioning System, Accident Detection and Theft Control by using ARM 7 LPC 2148 Microcontroller, INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH & TECHNOLOGY (IJERT) NCACSPV – 2016 (Volume 4 – Issue 18)
2. M. M. Hossain, M. S. Islam, N. F. Dipu, M. T. Islam, S. A. Fattah and C. Shahnaz, "Design of a low-cost anti-theft sensor for a motorcycle security device," 2017 IEEE Region 10 Humanitarian Technology Conference (R10-HTC), Dhaka, Bangladesh, 2017, pp. 778-783, doi: 10.1109/R10-HTC.2017.8289072.
3. S. P. Metkar and G. L. Deshmukh, "RTOS based vehicle tracking system," 2015 International Conference on Information Processing (ICIP), Pune, India, 2015, pp. 621-624, doi: 10.1109/INFOP.2015.7489458.