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IMPLEMENTATION PAPER ON TRACKABLE WHEEL JAMMER AND DAILY USAGE MONITORING

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ABSTRACT

For effective parking management, several methods such as using traditional equipments like wheel locks are used to raise fine from owner for vehicle encroachment in No parking zones.

The use of the equipments is insufficient to provide complete information about live status of wheel lock and its daily usage log. The design of the existing system is inconvenient to handle and also lacks in technological enhancement.

This proposed Anti-Theft Wheel Lock Tracking System comes with an efficient performance based design to track activities of the wheel lock as per current scenario requirement.

When the wheel lock is subjoined to the wheel, it may act as a stopper which activates the electronic system and also sends current Geolocation to the central server. The system can be used to have better transaction control over wheel lock activity.

Based on this study, problem statement and objectives were jotted down. The system design was sketched, and the methodology is discussed in the upcoming chapters.

Keywords: Geolocation Tracking, Anti-Theft System, Central Server, System Integration.

I. INTRODUCTION

This chapter includes a brief introduction to the project, its problem statement and the purpose behind creating it. It briefly touches on how the idea was born and what are the steps to be conducted further.

1.1 OVERVIEW

Effective transportation and logistics reduce the cost by knowing in realtime the current location of a vehicle such as a truck or a bus. The AntiTheft Wheel Lock Tacking System can be the most efficient tools that can be used to control vehicle encroachment on parking places. With the aim to design and develop GPS based anti-theft wheel lock activity tracker, it can be used to measure the amount of vehicles that are found in no-parking zone and ease the funds generation process.

This new system can create many wonders in keeping a track of rule breaking vehicles. It consists of a wheel lock which is a device that is used in situations where it is necessary to inspect a parked car. This hardware is fitted on to the wheel lock in such a manner that it works according to the lock state or unlock state of the device itself. The hardware includes the GPS that is connected to the server and thus it is used as a covert unit which continuously or by any interrupt to the system, sends the location data to the monitoring unit.

When the wheel lock is put on the vehicle, the location data from tracking system and sends the GPS coordinates to the specified server and keeps the traffic police updated about the actions of the vehicle. The status of the lock or unlock state of the wheel lock will help to identify the number of times wheel lock was used, for how much time was the wheel lock in active state and the required location.

1.2 PROBLEM STATEMENT

The present system relates to providing a means to record and monitor the wheel lock/jammer and the number of times it was used through the day. The system can be used as an evidence so as to have better control over generation process. This system is equipped with a newly designed wheel lock/jammer that comes with enhanced technicalities. It consists of a communication module and a battery box that interacts with the centralized storage and has a native backup in the times of communication network failure. The system is also equipped with geo-location sensor for real time location tracking.

1.3 PURPOSE

In order to inculcate 'parking discipline' the traffic police have resorted to intensifying drives, including locking cars left at 'no parking zones' by clamping the wheels. The Wheel locks are generally used by the traffic control authorities to raise fine from owner for vehicle encroachment in No - Parking zones.

However, due to absence of monitoring in traditional tools there is no exact data or track record of number of times the wheel lock is used by the traffic authorities and has become difficult to regulate government funds. Law enforcing bodies often use such devices to monitor and curb vehicle obstruction and avoid tragedies.

Law enforcing bodies often use such devices to monitor and curb vehicle obstruction and avoid tragedies. However, due to the absence of a proper monitoring and tracking system it has become difficult to regulate government funds.

II. METHODOLOGY

1. PROPOSED SYSTEM

This chapter discusses in detail about the understanding gained from the literature review. Here we discuss the limitations of existing systems, need for the proposed system as well as a structured plan for the proposed system.

2. DRAWBACK OF EXISTING SYSTEM

- The current design is handy but it does not fit properly according to the modern design of the rim of the car wheel.
- The use of the wheel lock is not recorded properly to ease the fund generation process.
- The existing system design provides real-time activity of the wheel lock.

3. NEED FOR PROPOSED SYSTEM

The need of Anti-Theft Wheel Lock Systems is to monitor the use of traditional devices for vehicles are encroached in parking places. The system will monitor by collecting the data of the number of times the wheel lock/jammer was used on a specific day.

The Anti-Theft Wheel Lock Tracking System would consist of the wheel lock which has enhanced performance based design and also efficient technical performance which lacks in traditional equipment. The Anti-Theft Wheel Lock Tracking System would also consist of processing, communication, tracking modules which are composed of Arduino, Sim module, GIS module.

These modules would combinely use to track process and send the real time data to the central server/ storage unit. The wheel lock will also update the status of "lock" and "unlock" states which would ultimately help in updating the data in the central storage and in turn the officials.

4. PROPOSED WORK

The proposed Anti –Theft Wheel Lock Tacking System has an enhanced design of the Wheel lock/jammer. It is technically equipped with components like an automated switch, geo- navigation, battery, connection to the central storage. This model can be easily used on cars, motorcycles and can be clipped around and placed in proper alignment unlike the existing one. It consists of a lock and claws with push-back-forward mechanism for wheel area adjustment.

The claws are made adjustable designed in such a way that they can fit perfectly according to the width and diameter of the wheel of the vehicle. One of the claws can be pulled out and adjusted to the width of the tyre and the clipped around the wheel easily. The grooves are used during the locking process. This design doesn't require a key to lock the jammer/wheel lock. Once the jammer/wheel lock gets to the ground, the lock is simply pressed down.

5. REQUIREMENT ANALYSIS

Requirements analysis is critical to the success or failure of a systems or software-hardware project. The requirements should be documented, actionable, measurable, testable, traceable, related to identified business needs or opportunities, and defined to a level of detail sufficient for system design.

Requirements analysis is a team effort that demands a combination of hardware, software and human factors engineering expertise as well as skills in dealing with people. The main steps involved in requirement analysis are the following:

- Identify the needs of the project.
- Evaluate system for feasibility.
- Perform economic and technical analysis.
- Allocate functions to system elements.
- Establish schedule and constraints.
- Create system definitions and design.

With the above steps in mind, we performed the requirement analysis for our proposed system and established the prime requirements. As the system is partly hardware based, the major prerequisites can be divided into two – hardware and software and are listed as follows.

6. HARDWARE REQUIREMENTS

The main hardware requirements lie in deciding the device structure and its components. For our proposed system, the hardware required are the following:

- Arduino UNO
- GPS+GSM module
- Mini Limit-Switch

7. SOFTWARE REQUIREMENTS

The fundamental components of the software are as follows:

- Windows 10
- Arduino software for computing platform

8. SYSTEM ANALYSIS

System analysis is a critical thinking technique that includes looking at the more extensive framework, separating the constituent parts and making sense of how it functions to accomplish a specific objective. The initial phase in tackling an issue is breaking down that framework into smaller components. This includes separating it into the parts that influence it to up and perceiving how those parts cooperate. Some of the time making sense of how a framework functions can include killing pieces of the framework and seeing what occurs or changing pieces of the framework and seeing what the outcome is.

Following is the detailed analysis of the framework in the stream graph, information stream chart and arrangement outline.

9. FLOW CHART

A flowchart is a type of graphical representation of an algorithm, workflow or process which is presented graphically via patterns of interconnected boxes, circles or lines with their order being indicated by an arrow. A flow chart is a simple representation of a complex problem for a layman to understand. Flow charts are very helpful during the process of analyzing, documenting, designing or managing a process in any given context or subject of study. It can similarly be applied to programs.

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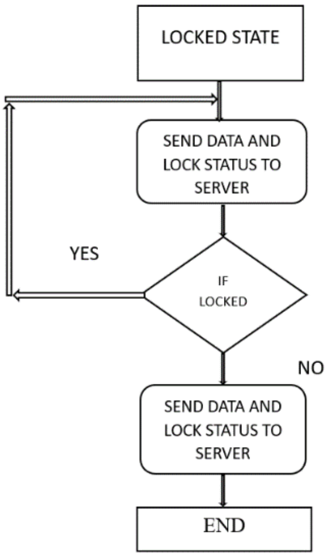

Fig 2.1: Flow structure of the proposed system

III. MODELING AND ANALYSIS

1. SYSTEM DESIGN AND ARCHITECTURE

As mentioned above, it was decided to create a device that allowed recording the movements and sending the collected data in real time to a computer, for later processing. This chapter deals with on the design of the device and the construction of the overall system architecture.

MODEL:

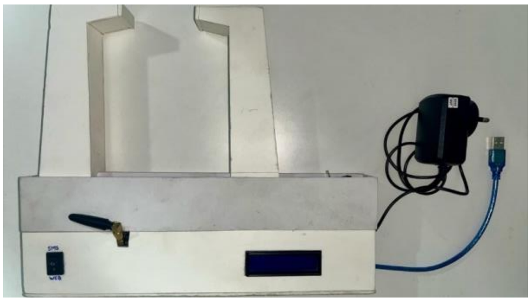

Fig 3.1: Original model of Trackable Wheel Jammer

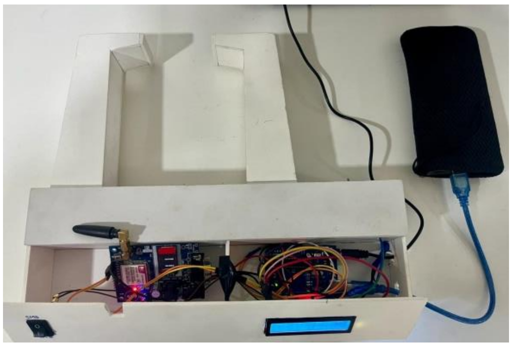

Fig 3.2: Activated With Internal Structure of Trackable Wheel Jammer

2. SYSTEM DESIGN

System design is the process of defining the elements of a system such as the architecture, modules and components, the different interfaces of those components and the data that goes through that system.

User Interface Design is concerned with how users add information to the system and with how the system presents information back to them. Data Design is concerned with how the data is represented and stored within the system.

The hardware used in here is explained in details:

2.1 Arduino UNO:

The Arduino UNO is a standard board of Arduino. Here UNO means 'one' in Italian. It was named as UNO to label the first release of Arduino Software. It was also the first USB board released by Arduino. It is considered as the powerful board used in various projects. Arduino.cc developed the Arduino UNO board.Arduino UNO is based on an ATmega328P microcontroller. It is easy to use compared to other boards, such as the Arduino Mega board, etc. The board consists of digital and analog Input/Output pins (I/O), shields, and other circuits.

The Arduino UNO includes 6 analog pin inputs, 14 digital pins, a USB connector, a power jack, and an ICSP (In-Circuit Serial Programming) header. It is programmed based on IDE, which stands for Integrated Development Environment. It can run on both online and offline platforms.The IDE is common to all available boards of Arduino.:

Fig 3.3: Arduino UNO

Component in detail.

- **ATmega328 Microcontroller-** It is a single chip Microcontroller of the ATmel family. The processor code inside it is of 8-bit. It combines **Memory (SRAM, EEPROM, and Flash), Analog to Digital Converter, SPI serial ports, I/O lines, registers, timer, external and internal interrupts, and oscillator.**
- **ICSP pin -** The In-Circuit Serial Programming pin allows the user to program using the firmware of the Arduino board.
- **Power LED Indicator-** The ON status of LED shows the power is activated. When the power is OFF, the LED will not light up.
- **Digital I/O pins-** The digital pins have the value HIGH or LOW. The pins numbered from D0 to D13 are digital pins.
- **TX and RX LED's-** The successful flow of data is represented by the lighting of these LED's.
- **AREF-** The Analog Reference (AREF) pin is used to feed a reference voltage to the Arduino UNO board from the external power supply.
- **Reset button-** It is used to add a Reset button to the connection.
- **USB-** It allows the board to connect to the computer. It is essential for the programming of the Arduino UNO board.
- **Crystal Oscillator-** The Crystal oscillator has a frequency of 16MHz, which makes the Arduino UNO a powerful board.
- **Voltage Regulator-** The voltage regulator converts the input voltage to 5V.
- **GND-** Ground pins. The ground pin acts as a pin with zero voltage.
- **Vin-** It is the input voltage.
- **Analog Pins-** The pins numbered from A0 to A5 are analog pins. The function of Analog pins is to read the analog sensor used in the connection. It can also act as GPIO (General Purpose Input Output) pins.

2.2 GPS+GSM module:

SIM808 module is a GSM and GPS two-in-one function module. It is based on the latest GSM/GPS module SIM808 from SIMCOM, supports GSM/GPRS Quad-Band network and

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combines GPS technology for satellite navigation. It features ultralow power consumption in sleep mode and integrated with charging circuit for Li-Ion batteries, that make it get a super long standby time and convenient for projects that use rechargeable Li-Ion battery. It has high GPS receive sensitivity with 22 tracking and 66 acquisition receiver channels.

Besides, it also supports A-GPS that available for indoor localization. The module is controlled by AT command via UART and supports 3.3V and 5V logical level. A power-saving technique the keeps the current consumption is as low as 1.2mA in sleep mode (with GPS engine powered down).

This module in the project helps to locate the current position of the jammer and also record its total time of usage. When an activation message is sent to the module and it will text back the longitude and latitude information of the module location because of the integrated TCP/IP protocol and extended TCP/IP AT commands, this component becomes very useful for data transfer applications.

Fig 3.4: GPS+GSM Module

2.3 Mini Limit-Switch:

Limit switches are used to automatically detect or sense the presence of an object or to monitor and indicate whether the movement limits of that object have been exceeded. The original use for limit switches, as implied by their name, was to define the limit or endpoint over which an object could travel before being stopped. It was at this point that the switch was engaged to control the limit of travel.

A standard limit switch used in industrial applications is an electromechanical device that consists of a mechanical actuator linked to a series of electrical contacts. When an object (sometimes called the target) comes in physical contact with the actuator, the actuator plunger’s movement results in the electrical contacts within the switch to either close (for a normally open circuit) or open (for a normally closed circuit) their electrical connection.

Limit switches use the mechanical movement of the actuator plunger to control or change the electrical switch’s state. Similar devices, such as inductive or capacitive proximity sensors, or photoelectric sensors, can accomplish the same result without requiring contact with the object. Hence, limit switches are contact sensors in contrast to these other types of proximity sensing devices.

The micro limit switch, or micro switch, is another type of limit switch commonly found on control circuits. These switches are much smaller than their standard counterparts, allowing them to be installed in narrow or cramped spaces that would normally be inaccessible to other switches.

Depending on the particular model, subminiature switches have contacts with electrical ratings ranging from about 1 to 7 amperes due to the reduced size of the switches themselves.

Fig 3.5: Mini Limit-Switch

3. SYSTEM ARCHITECTURE

System architecture is basically a conceptual model that defines the structure, behavior and more views of a system. A system architecture comprises of system components that will work together to implement the overall system.

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The Sim808 module works with Arduino Nano board, a GPS module and a battery. The module basically reads down the current location and posts the results to the connected web-server so as to keep the track in the database.

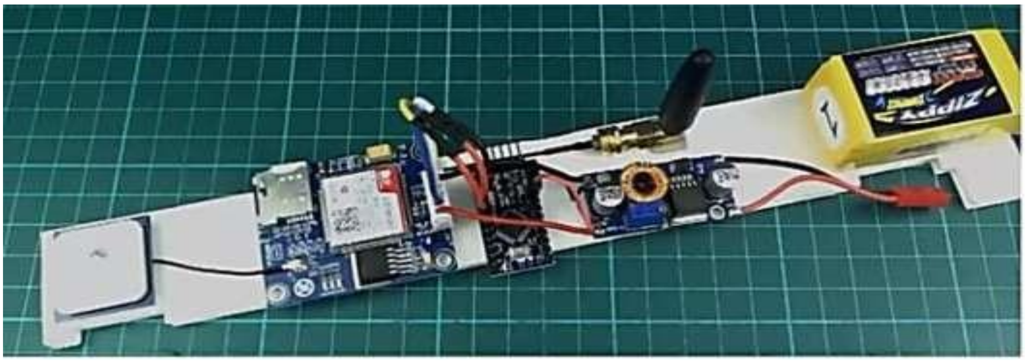

Fig 3.6: Circuit Setup

The GSM module already has a built-in GPS system so there is no need of attaching any external connection for GPS. The whole circuit setup requires a very decent power supply say 2mA-5.2V.

Hence, to regulate the voltage flow a simple voltage regulator is attached with converts the on-going power supply to 5-5.3V.

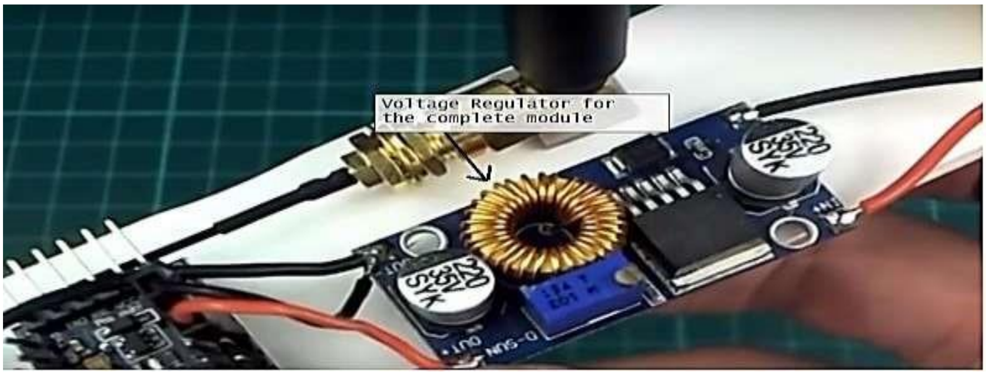

Fig 3.7: Attached Voltage Regulator

The voltage regulator can be used to power the Arduino Nano probe in the circuit. For the GPS module to detect coordinates, it is connected to the GPS antenna. To initiate communication, a simcard is activated using the module.

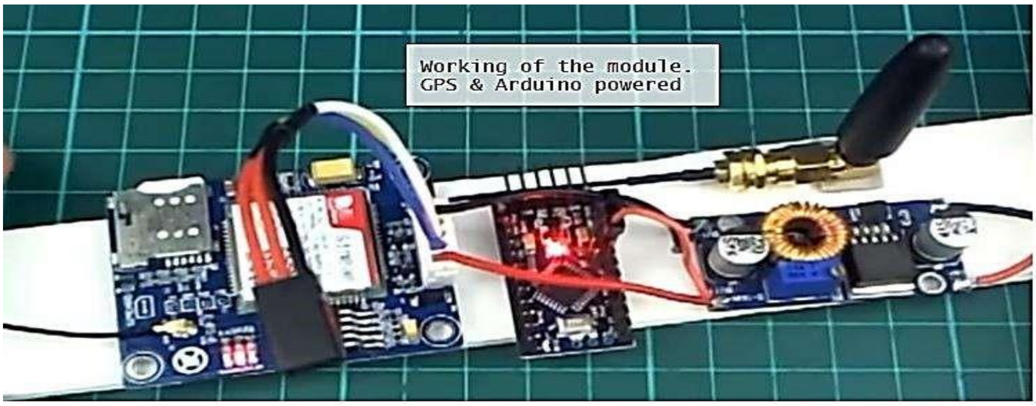

Fig 3.8: Circuit Activated

`Now, between the Arduino module and the GSM/GPS module we have the Rx (receiver pin), Tx (transmitter pin) and Ground wirings attached. To communicate with the setup, a Serial monitor is used from the Arduino application. The module has a benefit of re-testing its power supply, voltage, etc. to be confirmed of its required usage.

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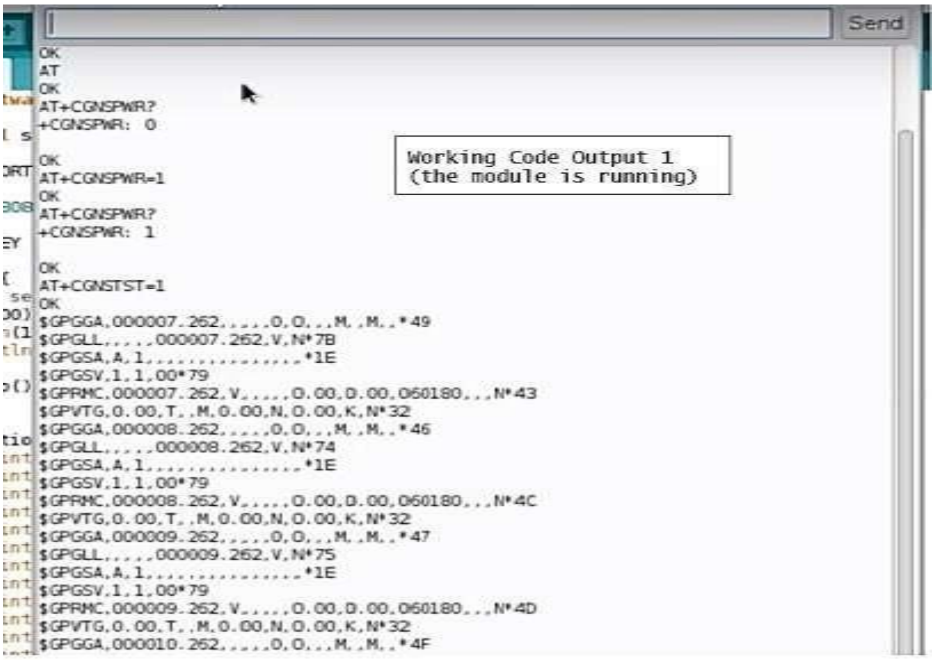

Fig 3.9: Used AT Command

The re-testing is done using AT commands as follows:

- To power the circuit: AT+CGNSPWR
- To check if the circuit works or not: AT+CGNSTST (is set to 1)
- To get the required information: AT+CGNSINF

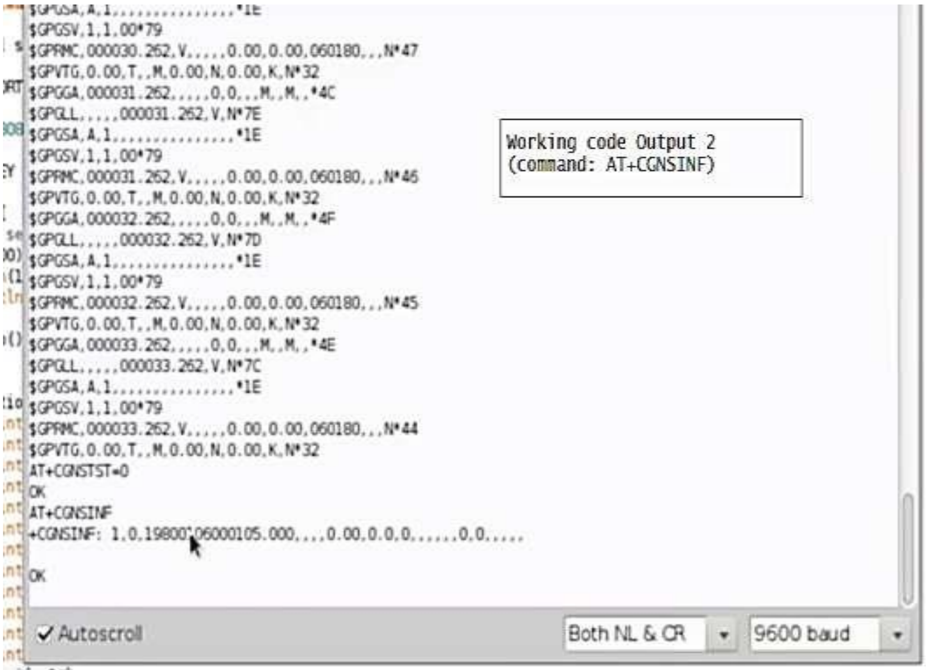

Fig 3.10: Information using AT+CGNSINF Command

IV. RESULTS AND DISCUSSION

The "AT+CGNSINF" command displays the <GPS run status>, <date & time>, <latitude & longitude>, <speed over ground> (in Kilometers(s)/hour), <mode of the device> and <course over ground> (in Degrees). The information is separated by 'commas'.

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This chapter forms an important part of this report as it embodies the final result achieved during the design and implementation of the proposed system.

The result obtained is shown below:

(Hardware)

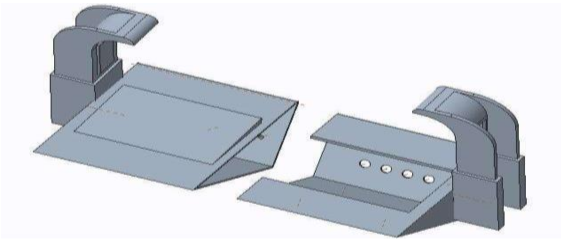

Fig 4.1: Wheel lock in completely open state

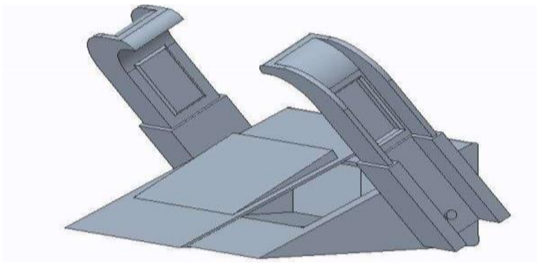

Fig 4.2: Circuit box placement

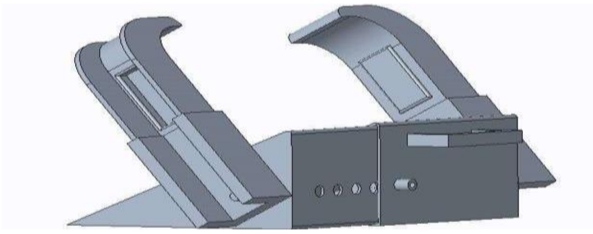

Fig 4.3: Back view of wheel lock with key-holes

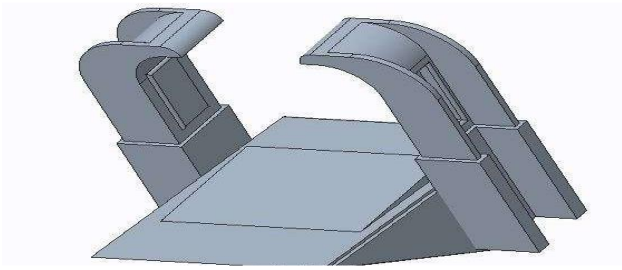

Fig 4.4: Enclosed wheel lock in ideal state

(SOFTWARE)

Fig 4.5: Track Tracked By Circuit

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(SOFTWARE)

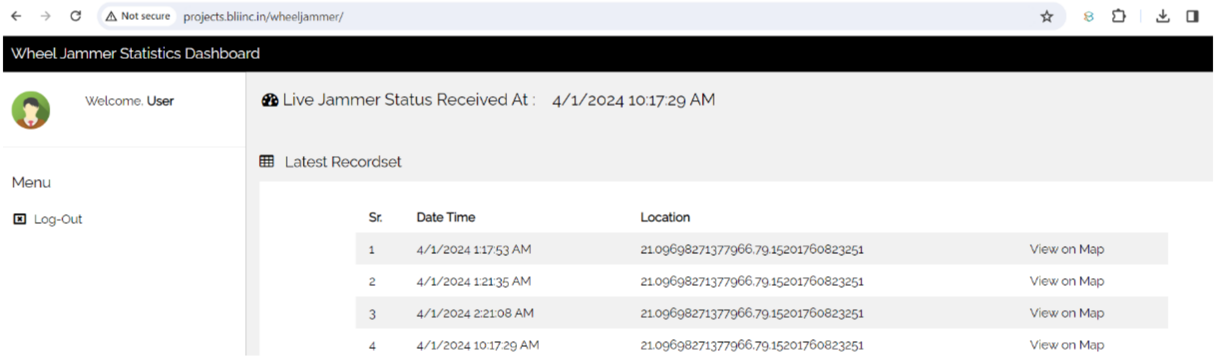

Fig 4.6: Website Live Jammer Status Update

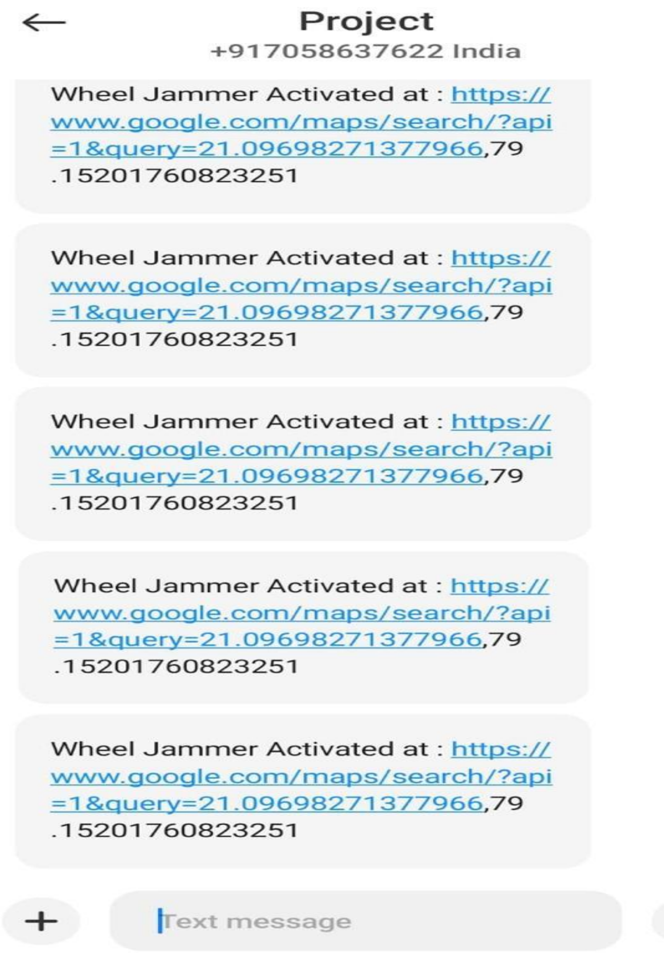

Fig 4.7: Authority Department get SMS OF Activated Jammer Geo-location

V. CONCLUSION

This chapter basically states the conclusion of our project

In conclusion, the current methods of parking management, particularly the use of traditional wheel locks, are insufficient in providing comprehensive real-time data and efficient handling. The proposed Anti-Theft Wheel Lock Tracking System offers an innovative solution, utilizing an integrated design that enables continuous monitoring and tracking of wheel lock activities. By incorporating a stopper mechanism that triggers the electronic system and sends immediate geo-location data to a central server, this system significantly enhances transaction control and provides a more streamlined approach to parking management. The development of this system has the potential to revolutionize the way parking violations are managed, contributing to better enforcement and improved efficiency in urban traffic management.

The Anti-theft wheel lock tracking system comprises of **Design**, **Networking**, **Hardware** and **Tracking**.

Design:

The new design of the tool is adjustable and supportable to different sizes of wheels of various vehicles.

This new design mechanism gives accurate status of wheel lock to the central server when the mechanism detects pressure by the surface of the wheel.

Networking:

The continuous flow of data will be stored in the central server/central storage unit and communicates to the central server via a wireless connection channel.

The central server will always maintain status data of the wheel lock. Therefore, minimizing misuse by any third parties.

Hardware:

The power to the system is provided by means of a rechargeable power supply system in the form of a rechargeable battery.

Tracking:

It also provides real-time data and status of the wheel lock to the central server by using a communication module.

While sending data from the system to the server, the security, integrity & confidentiality of the data is ensured as various transmission control protocols are used to secure the connection channel.

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