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Vehicle Location Tracking and Control using Secured Wireless Networks

[1] Mukund B Wagh, [2] Dr. N. Gomathi
[1] Associate Professor, RDTC, Shri Chhatrapati Shivajiraje College of Engineering, Pune.
[2] Pofessor, VelTech Dr. RR and Dr. SR University, Avadi, Chennai

Abstract: **- Now a days, automobile thefts are great concern increasing at an alarming rate all over the world. Increasing the density of vehicles creates a problem in large number security of vehicle. Solution to this problem new approach is developed for providing security to vehicle by developing secured vehicle management system for control and tracking. In this system the user will control his vehicle through an android application. A secured mode of communication between Smartphone and vehicle is established via GSM network where authentication is done before establishing communication. Using Smartphone, the owner will be able to lock/unlock the vehicle and track the vehicle in case of theft. If the GSM network is not available then the secured Bluetooth mode is used for communication. The performance of the proposed scheme is evaluated on the metrics such as end to end communication between user and vehicle.**

***Index Terms*— Global Positioning System, Subscriber Identity Module, GSM network, Bluetooth.**

I. INTRODUCTION

Vehicles are expensive other than a house, perhaps, few purchases will compare to a new vehicle. In order to this just like any other expensive asset, a vehicle brings with it a secondary cost, the risk of theft. In some laid-back parts of the world, locking the doors may be enough to ward off the threat. Everywhere else, it's a good idea to arm yourself, and your vehicle, with some security. In these days, automobile thefts are increasing rapidly all over the world. So to escape from these thieves most of the vehicle owners have started using the theft control systems.

The aim is to provide a user an innovative way to control (lock, unlock) and track vehicle through the secured wireless networks so that owner can access vehicle via Smartphone and to develop a database management system for RTO officials so that, work of RTO documentation becomes paperless. The system focuses on development of vehicle locking and tracking system. With this, the owner will be able to have secured communication between owner's phone and the vehicle via wireless network viz. GSM network and Bluetooth. In the network mode, the owner can access the vehicle from anywhere using web based technology. If this network mode is not available then system uses Bluetooth as alternative for which user needs to be in Bluetooth range to connect the vehicle. The system will include a module with microcontroller installed in the vehicle which will communicate with Smartphone application through GSM network and depending upon the command received from the Smartphone app, the device in the car will respond and act accordingly. To enforce the security, the system will comprise of central cloud storage where the authentication will be done before granting the access of car to its owner. Plus, when data network is not available, there will be availability of Bluetooth as an alternative way to establish the communication.

II. LITERATURE REVIEW

2.1 Existing System

In 2012 Dhotre et al [2] using GPS (global positioning), it is possible to get the location of the vehicle. So, we can track the vehicle using this technique. In 2011 Jayanta et al [3] the ignition locking from remote place by using cell phone is possible. This can be used as antitheft or theft prevention.

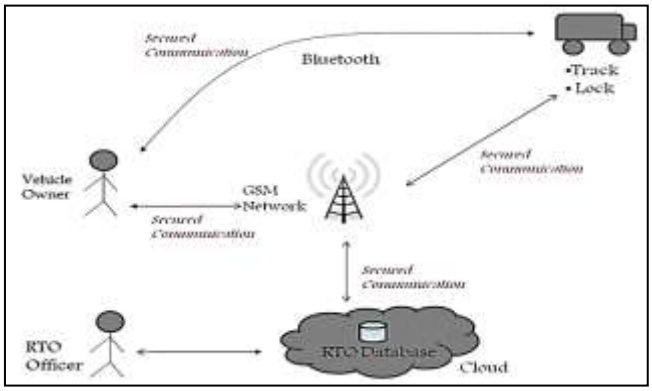

Fig 3.1 Overview of System

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For short range communication Bluetooth can be used as wireless medium of communication. So, system can use Bluetooth [5] to communicate between Smartphone and vehicle but there are many security related problems with Bluetooth [5] which system can overcome through proper security techniques. For security in wireless networks, the system can use various data and file encryption methods [10] also, for encryption of messages there are techniques like triple DES [1] and advanced encryption standard (AES) [9]. Triple DES is use of DES [8] three times DES [1] which enhances security.

2.2 Proposed System

There are two wireless modes of operation that have been proposed for this system, Network mode and Bluetooth mode. The communication between Owner's Smartphone and vehicle will be established in network mode i.e. GSM mode. If GSM network is not available then automatically the system will switch to Bluetooth mode. The whole system will communicate using triple DES algorithm for security

III. OVERALL DESCRIPTION OF SYSTEM

The system would be Smartphone based application software that would ensure secured communication between user and vehicle. A database will be created for the information management and tracking of all vehicles. Fig. 3.1 shows overall system and focuses on development of vehicle locking and tracking system.

3.1 Proposed System Functions:

1. Create a database.
2. Create entry for new user.
3. Edit the current database.
4. Update the database.
5. Send lock command.
6. Send unlock command.
7. Send track command.
8. Switch to Bluetooth mode.
9. Check the user authenticity.

3.2 Functional Requirement

3.2.1 Vehicle lock/unlock:

On receiving the lock/unlock command from the authenticated user, the vehicle side module should be able to recognize the command received and should be able to execute the corresponding action correctly.

3.2.2 Vehicle track:

SOn receiving the track command, the GPS installed in the vehicle module should be able to track its co-ordinates and send them to owner`s Smartphone, where the received co-ordinates would be used to show the exact location of vehicle on the map integrated in system's application

3.3.3 Database maintenance:

In the proposed system, the database which is playing crucial role in enforcing the security by the mean of authentication and helping RTO official by making the documentation paperless should be easy to maintain and modify as per requirements.

3.3.4 Performance requirement:

•For scalability & high performance the cloud service is used.

• Faster data networks for network mode of operation are required for in time and speedy operation.

3.3 Non Functional Requirement

3.3.1 Performance requirement:

•Memory management should be taken into heavy consideration, objects should not be created unless needed and memory should not be unnecessarily used.

•CPU usage should be taken into consideration with every function of the application, high CPU usage can drain the battery of the mobile device, and therefore all control structures and algorithms should be designed with CPU efficiency in mind.

3.3.2 Safety and security requirements:

The cloud database makes sure that the database will remain stable. The system will not involve rooting of OS and thus will not be able to replace or modify the operating system itself. It will not degrade, harm or interfered with any other running application.

3.3.3 Software quality attributes:

Reliability: Use of modern cryptography ensures that the system is reliable.

Scalability: Use of cloud computing will ensure the system is scalable.

Testability: Writing the application as a set of small modules will enable us to Unit test the individual components of the system more effectively.

• Reusability: Writing the application as a set of small modules will enable us to reuse the code for any additional development in isolation.

• Usability: All care should be taken to abstract unnecessary details away from the view of the end user.

3.4 Project Process Modeling

The incremental build model is a method of software development where the model is designed, implemented and tested incrementally (a little more is added each time) until the product is finished. It involves both development and maintenance. This model combines the elements of the waterfall model with the iterative philosophy of prototyping. Proposed system uses incremental model as shown in fig. 2.1.

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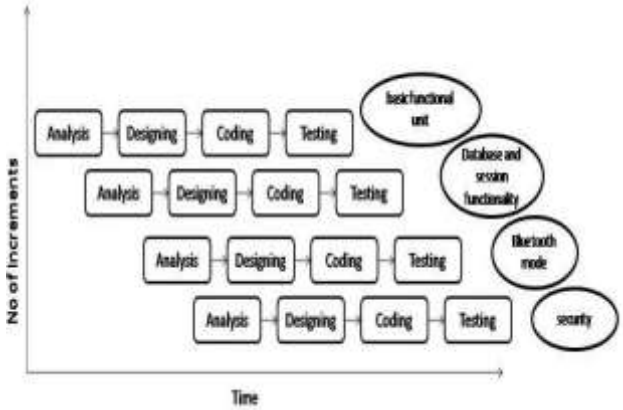

Fig. 3.2 Incremental Model

The fig. 3.2 gives the idea of how the incremental model working; system gives basic functioning at the end of first phase. In the next phase/ increment, the database and session functionality is completed successfully, in the third increment, Bluetooth mode is implemented successfully. And in the last increment, security is enforced successfully.

IV. EXPERIMENTAL RESULTS

4.1 ALGORITHMS USED

4.1.1 Storing data on hardware and in database:

Input: Owner and Vehicle Information

Output: Data on to the small hardware module and in database.

A. Algorithm Steps:

1) Go to given domain name
2) Go to admin login
3) Enter Login and password
4) If credentials are not valid go to step 2 else go to next step
5) Enter Owner Information
6) Store owner information into the database
7) Enter Vehicle Information
8) Store owner information into the database
9) Write all data to hardware module memory

4.1.2 Vehicle Access (Network Mode)

Input:-Login ID and Password

Output:-Vehicle Locking/Unlocking and Tracking

Algorithm:

1) Application in owner's phone is in Network mode
2) If owner wants switch to Bluetooth mode else go to next step
3) Go to given domain name
4) Enter Login and password
5) If credentials are not valid go to step 2 else go to next step
6) Select your vehicle from vehicle lists that you own
7) Send Lock/Unlock command or Track Vehicle
8) Get acknowledgement
9) Go to step 5 or go to next step

4.1.3 Vehicle Access (Bluetooth Mode)

Input:-MAC address and Radio Frequency

Output:-Vehicle Locking/Unlocking and Tracking

A. Algorithm Steps:

1) Application in owner's phone is in Bluetooth mode
2) Enter MAC address and Radio Frequency
3) If credentials are not valid go to step 2 else go to next step
4) Send Lock/Unlock command
5) Get acknowledgement
6) Go to step 3 or go to next step

4.2.1 Security Algorithm

In both modes for encryption the proposed system uses Triple DES algorithm [1] [8]. The high level description of this security algorithm is as: Triple DES uses a "key bundle" which comprises three DES keys, K1, K2 and K3, each of 56 bits (excluding parity bits).

V. RESULT DISCUSSION

Login form designed for the administrator where the administrator enters ID and password to login. Each administrator has a different login so that they can see the different entries for the vehicles present. The administrator can view all the vehicles, make new entry, edit data, change password. In fig 5.1 the administrator is making a new entry for a new vehicle. In this the owner is automatically given an ID which he can use to control his vehicle. The various details entered in the table are Owner Name, Owner Address, Owner City, and Password. All the entries are entered in the table to create a record.

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5.1 Make New Entry

In fig 5.2 the administrator clicks the view all tab and gets the list of various owners along with the ID and IP. Different owners have different IP to operate their vehicle in order to differentiate the different vehicles of the same owner. In view all option the whole details of the owner are given i.e. the address, city, chassis Id etc.

View All | Make Owner Entry | Make Vehicle Entry | Flash data | Edit Data | Delete Vehicle Entry | Change Password | Logout

Owner(s) Information

ID	Name	Address	City	Login ID
106	Ricky	Tahrir Square	Sydney	106
109	Ricky	Jadhav Nagar	Pune	109
101	Rajesh	Saint Gajanan Road	Shegaon(MH)	1
102	Aniket Kapse	Panhala Fort	Kolhapur	2
103	Priya Kaul	Elphinston Street	Delhi	3
104	Prasad Bidwai	Ganesh Nagar	Nanded	4
105	Adam	Pune	Pune	5

Vehicle(s) Information

ID	IP	Owner ID	Description
555	192.168.43.17	101	CAR
777	192.168.43.1	102	PULSAR
888	192.168.1.3	102	ACTIVA
999	192.168.1.40	103	CBZ XTREME
500	192.168.120.1	104	saab
501	192.168.120.11	105	volvo

Fig 5.2 Database Entries

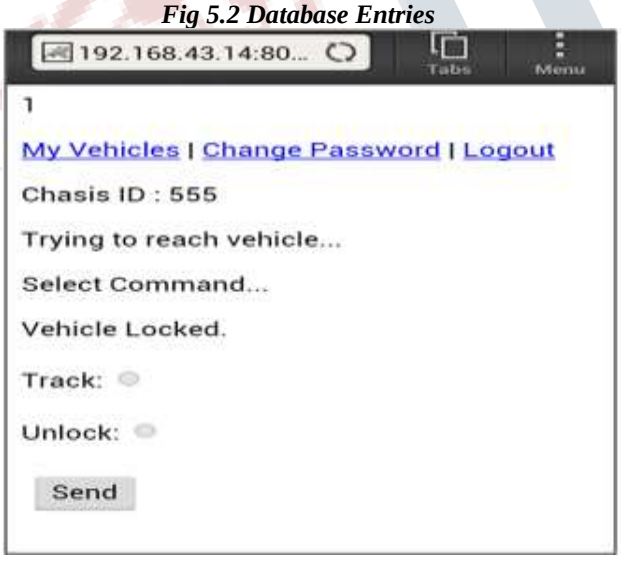

Fig. 5.3 Vehicle Information

Fig.5.3 shows the menu which the user will get after he chooses the vehicle he wants to control. He can either lock/unlock or track his vehicle. Most important thing is if the vehicle is in lock state the user will get unlock in the menu and if vehicle is in unlock state the user will get lock in the menu.

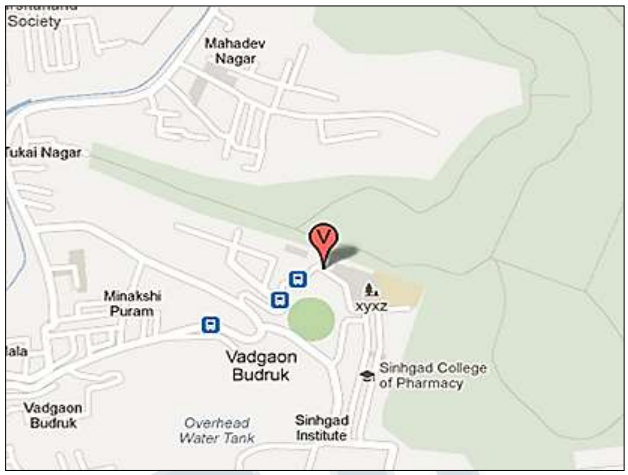

Fig. 5. 4 Vehicle Locations Map

Fig 5.4 shows the map view of coordinates which the Smartphone receives from the vehicle. The user will be provided with the current location of the vehicle at desired intervals of time.

VI. CONCLSION AND FUTURE SCOPE

A system has been implemented which can effectively perform various control actions on the remote vehicle. Operations such as ignition lock, door lock will be performed remotely and securely to ensure safety. As this is being done over the web, there are no range limitations involved. The same operation can be performed from a short range in case of network failure using Bluetooth. The enforced security algorithm for Bluetooth makes it extremely difficult to breach. Additionally, location information is also given to the vehicle owner if he wants to do so. All the stated functions are performed using a Smartphone which makes the system portable and more convenient and facilitates ease of use so owner doesn't need to carry keys. Digitization of records provides efficient management for the authorities unlike the traditional paper work which is still being followed. Using this system people can govern their vehicles with and improved accessibility and less active involvement. By using this system with high security measures, cost effectiveness and easy operability, vehicle theft rates can be reduced significantly. This system can be used in fleet tracking and traffic management once implemented on a large scale. Fleet tracking is the use of GPS technology to identify, locate and maintain contact reports with one or more fleet vehicles in real-time.

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