Real Time Monitoring of Defense Vehicles with Authentication based Ignition Control

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Abstract— The monitoring of defense vehicles is very much important, because these vehicles are costly at the same time very much important. This paper provides a real time solution for such vehicles and also an effective authentication for the driver to use the vehicle assigned to him by controlling the ignition of the engine. The authentication is provided by using the RFID (Radio Frequency Identification) technology, in which the RFID tag has to be placed on the RFID reader which continuously reads the data and authenticates. In case of usage of wrong tag, the ignition system will be turned OFF using relays. The communication link is established by using the GSM (Global System for Mobile communication) module through which the messages can be sent and received. The tracking of vehicle is made possible using the GPS (Global Positioning System) technology which sends the exact co-ordinates of vehicle position. The received co-ordinates are extracted and the place is identified on the map using the front end. The GPS fencing is made in which the position of vehicle whether inside or outside the territory can be notified. The speed monitoring is also established using the GPS packet extracted. The speed limit can be set dynamically from the headquarters and on crossing these speed limits the warning will be given and engine will be turned off after a certain delay. The engine heat is also monitored using the temperature sensor and overheat condition will be reported to the headquarters and also engine will be turned off and allowed to cool down. The database of driver is maintained at the headquarters to evaluate the performance of driver.

Keywords: GPS fencing, RFID, Vehicle Tracking System

I. INTRODUCTION

In the contemporary world, the power and progress of any country is mainly defined by its defence sector. The fund allocated to the defence sector in every budget is evident to this. From the allotted fund, a major share goes to purchase and maintenance of the defence vehicles and on research & development, and to upgrade the different resources being used. Hence vehicles have to be under constant surveillance and monitoring. The vehicles should never be accessible to an unauthorized person and also their position has to be known by the authority every second. In case of emergencies there must be a means of communication between the vehicle and authorities to convey the problem faced by them and take necessary actions. Hence the advancement in this sector has to be dynamic to maintain the strength of the nation .The technology being used in this sector has to be high end and highly effective.

In the defense protocols followed the difficult challenge for the authorities is utilization of resources, most of the resources of the defence will be mobile in nature and carry heavy arms and ammunitions and sometimes they contain various confidential information or the confidential objects. In the present scenario, the defence vehicles will be monitored by using the check posts system. The booths will be installed on the way of destination and these will act as the information centres for both the vehicles and the person in-charge at headquarters. If in case a vehicle is lost between any two check posts, headquarters will not be able to immediately check the status of the vehicle. To check the status, another vehicle must be sent to track it which consumes some amount of time and also fuel, if it is not found it creates a chaos all over. So monitoring these defense vehicles is crucial. The authorities should be capable of knowing about these vehicles accurately at any point of time. Also there must an option in the system such that the vehicle can be immediately switched OFF and it can be immobilized whenever the authority finds variation in the protocol being followed.

This paper is organized as follows. Section II describes the block diagram and gives the bird view of the system. Section III explains the methodology of implementation and lists the hardware, section IV gives the flow charts of programs. Section V discusses the experimental results obtained along with some screenshots. Section VI concludes the paper

II. OVERVIEW OF THE SYSTEM

The system can be divided mainly into two modules; one module is kept inside the vehicle and the second is monitored at the headquarters. The on board module is shown in Figure 2.1. It has the following functions;

A. Authentication of the RFID Tag to Turn on the Engine:

The ignition will be ON after verifying the card number and remains ON as long as the card is shownand goes OFF as soon as the tag moves out of the proximity of reader. The message will be sent to the headquarters regarding the starting of the vehicle along with its current position and card number. In case a wrong tag is showed, a siren goes ON to intimate the nearby crowd and also a message will be sent to the headquarters warning the misuse.

B. Vehicle Tracking System:

This facility will provide the exact latitude and longitude of position of the vehicle which will be extracted and then sent to the headquarters via GSM. The NMEA (Northern Marine Electrical Association)GPS decoding system is adopted to get Google co-ordinates.

C. Communication Link:

The GSM module acts as the communicating agent between the vehicles and headquarters. Status request message can be sent at any instant of time from headquarter to the vehicle in motion and reply is obtained via GSM. In case if vehicle crosses the speed limit or goes in a wrong path or any other violation happens then OFF order can be sent to turn off the

vehicle. It will again start working only on the clearing orders from concerned authority.

D. Super User Facility:

This also has a "super user" mode to facilitate the user to drive the vehicle when the tag is lost. To enter this mode the user has to give a password pre-set at the time of installation. The password can be requested from the headquarters. Once the password is sent, he can use the car. User can use this facility only once and the system works in this mode only for few hours and after that the system crashes.

E. Distant Informer:

This feature is used to intimate the predetermined people in case of emergencies just by pressing the panic switches. This feature will have important numbers saved in the memory of the device, and on pressing the panic switch all these saved numbers will receive the alerting message along with the GPS co-ordinates of the vehicle's position. In case of health emergency a nearest hospital can be intimated to reach the location. Suppose vehicle breakdown occurs or any problem with tyres or any part of the vehicle, intimation can be sent to the mechanic to support at the earliest. Thus the emergency faced can be solved.

F. Speed Monitoring:

The speed of the vehicle at any instant of time can be easily known by the speed request sent from headquarters. The speed is set for threshold and crossing of this speed will warn the user and later turns down the engine. This threshold can be dynamically set by the authority depending on the road and need of the travel.

G. Engine Heat:

The overheat engine may cause accidents due to wear and tear of certain parts. So this can be avoided by using the temperature sensor. When certain heat level is exceeded then the engine is allowed to cool down for certain time and then vehicle is allowed to move further.

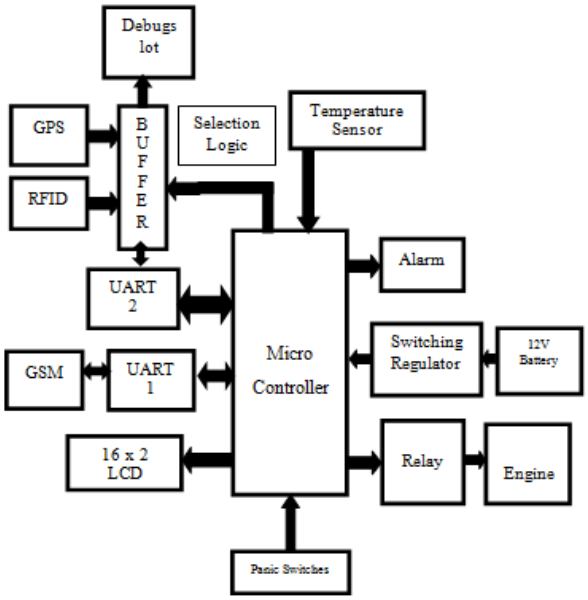

Fig. 1: Block Diagram of the System on Board the Vehicle

The module at headquarters is shown in Fig.2 which has a PC connected to GSM module. The intimation messages sent form the vehicle are received using this GSM module and then the messages are decoded using the front end. Also any other information to be conveyed to the user in vehicle can be sent from here. The request for position and also speed of the vehicle are sent from the headquarters only.

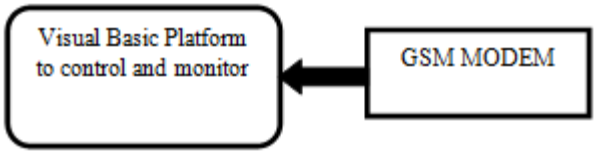

Fig. 2: The Module Placed at Headquarters

III. METHODOLOGY OF IMPLEMENTATION

The components along with their usage in the system are described in the following section.

A. Microcontroller -PIC18:

The heart of the system is microcontroller. All the modules are interfaced to this and it controls and co-ordinates all the activities. The programming [1] of PIC18 is done using the IDE MPLAB. The LCD display is achieved by sending commands using controller. The supply for the entire system is derived from the battery and current surge is prevented by using switching regulators.

B. GSM Module -SIM300:

The module works with AT commands [2], the messages are sent by using the controller. The GSM module is enabled and the status of inbox is continuously checked for any new message .The messages are decoded and necessary actions are carried out at the vehicle as well as at the headquarters.

C. GPS Module – 634R:

The module continuously transmits the different types of NMEA [3] data on its TX pin. Out of these the RMC (Recommended minimum specific GPS) format of data is decoded because it will give the information regarding latitude, longitude, date, time and speed. Whenever a requesting message for Location comes then the GPS module is enabled by sending select lines and then the packets (both speed as well as latitude, longitude) are extracted and sent via GSM.

D. RFID – Continuously Reads the Data:

The passive RFID technology continuously reads the data and puts it on the TX pin and this contains the card number. The correct card number is verified and allowed to use only for authenticated cards. Each vehicle is provided with one card that must be used for driving it. There is one super card that allows using all the vehicles. The database of the card allotted for that particular user is recorded and whenever changes are seen it is updated.

E. Buffer – 74HC244:

The three modules communicate with controller using the serial port. Two serial ports are available. One is dedicated to GSM and other two are interfaced using buffer. The GPS is connected at channel-1, RFID on channel-2. The particular module is selected based on the select lines given from the controller. Both the modules just put the data into the port and data from the controller is taken out for debugging purpose.

F. Switching Regulator – LM2576:

The battery present in the vehicle itself is used for powering the system. Thus there may be chances of getting current spikes or voltage excess from it. To avoid this regulator is used to give a constant safe voltage to the system.

G. Temperature Sensor – LM35:

The prototype developed with the bike can be demonstrated using the sensor LM35 only for other vehicles the selection of sensor must be done separately.

The other components used are 16X2 LCD display, SPDT relays, alarm and keypad. The keypad is used as panic switches as well as for password. The keys are connected to 5V by default, and when they are pressed the connection to ground takes place which corresponds to zero. This is sensed by controller and necessary actions are taken further.

H. Visual Basic:

The PC monitoring at the headquarters is carried out in a front end created using VB. The different windows required for specific function are created [4]. The database for allotting the user with vehicle is created in MS access and then it is linked to VB. The dynamic changes and updating of database is performed in one form of VB.

The messages to be sent such as turn off, location request, speed request etc., are performed using the class modules by establishing the communication. The messages received are decoded and the respective actions are carried out. Suppose if the co-ordinates are received then they are sent on to the Google map and actual location is found on the map by placing the marker and tracking is made for further movements. The vehicle when moves out of the boundary specified, message box will prompt reporting the violation of boundary and displays the current position. The speed can be dynamically set from the headquarters.

IV. SOFTWARE DESCRIPTION

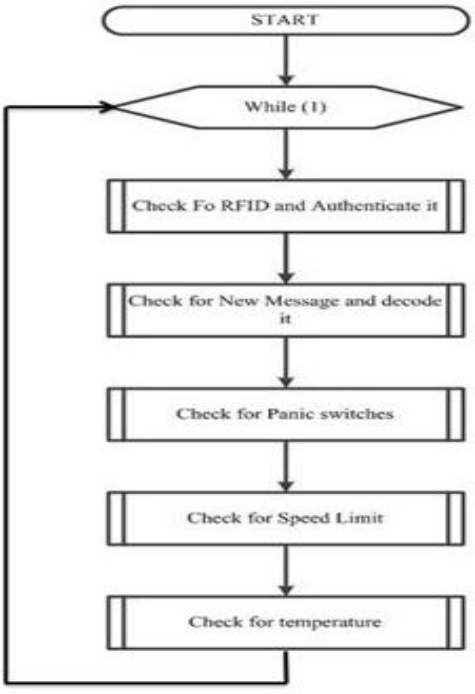

Fig. 3: Flowchart of the Main Function

The programs which are programmed into the controller are depicted in the following flowcharts. The main function is shown in Fig.3 it has sub-routines to perform continuously. All the functions are called and return to main function upon completion

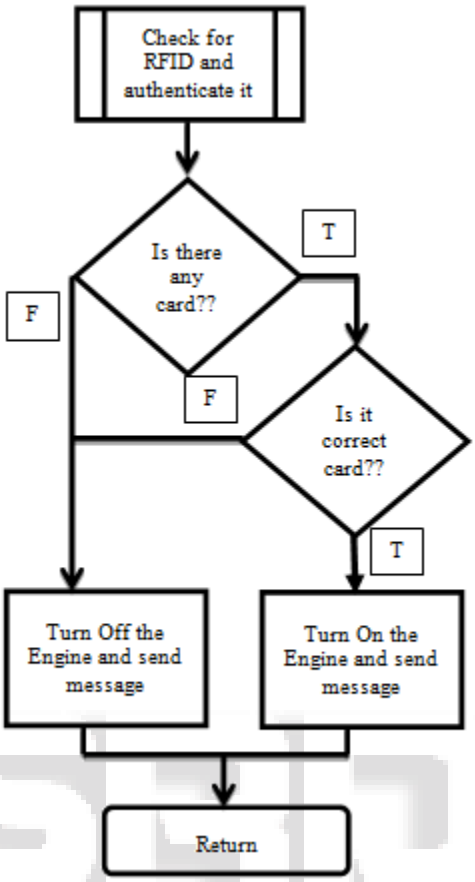

Fig. 4: Sub Routine to Verify RFID Card

A. Monitor for RFID:

The subroutine is shown in Fig.4 When this function is called the first step it checks to see if any card present. If at all card is present then it verifies it. If it is an authenticated card it allows starting the engine and initial start-up message will be sent, an invalid card or any other means will send a warning message to the authority. The subroutine will be called continuously and thus card must be always placed in the vehicle.

B. Check for Inbox:

This routine will monitor the GSM module. Whenever a message is received by the module, it will be stored in its sim memory. The function will check for a new message, and decodes the message if any present. If the decoded message is "OFF" it will turn off the engine using relays else if it is "LOC" then it will send back the GPS co-ordinates and return to main function. The messages are decoded only if it is sent form a valid number. The invalid messages and invalid numbers have no effect on the system. If no message is received then also the system remains unaffected. The flow chart is shown in Fig. 5

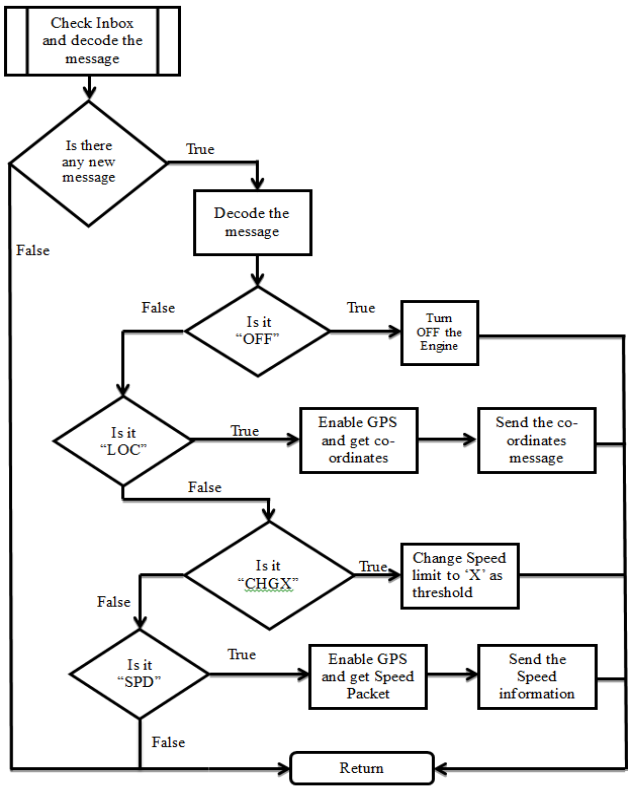

Fig. 5: Sub-Routine for Verifying Inbox

C. To Monitor Panic Switches:

There are switches provided which can be pressed at the time of emergency. The pressed switch will be identified for what reason it is pressed and then the location and health emergency/vehicle breakdown is sent using the GSM. Fig.6 depicts the flow of sub-routine.

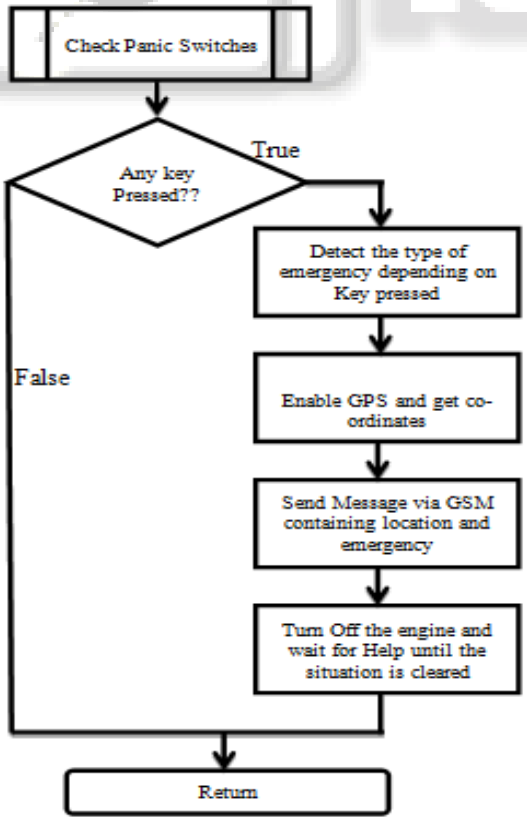

Fig. 6: Panic Condition Monitoring

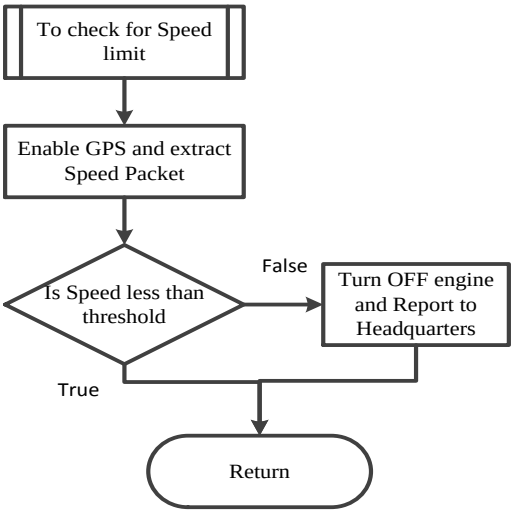

Fig. 7: Speed Monitoring

D. Speed Monitoring:

The speed limit is a criterion for safety of the vehicle for this speed monitoring is required. The flow chart in Fig.7 does this. The threshold value can be dynamically set from the headquarters.

E. Temperature Monitoring:

The threshold is set for the engine temperature, if it exceeds the limit, overheat of engine may lead to accidents. Thus to prevent this a turn off is issued when the temperature exceeds safer limit and allows back at usage when it comes down again. The sub-process is depicted in Fig.8 the conversion factor is used to achieve compatibility between the sensor and ADC inside the controller

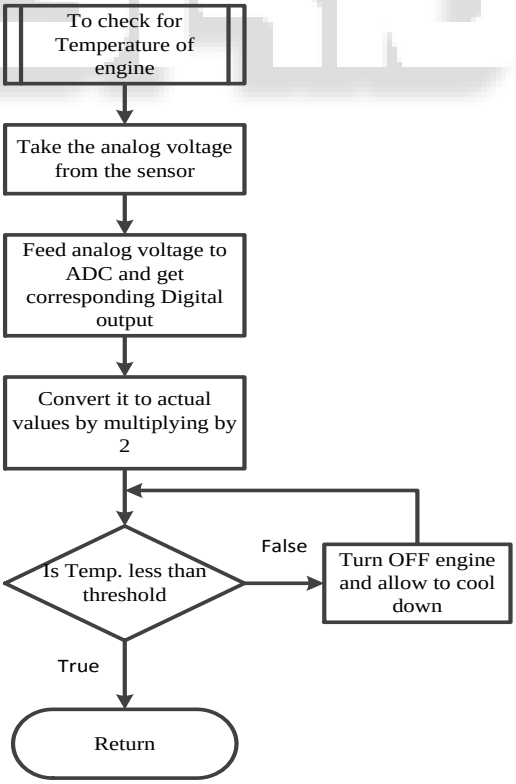

Fig. 8: Temperature Monitoring

V. EXPERIMENTAL RESULTS

The entire module is mounted on the vehicle and successfully tested. The headquarters unit is placed separately and controlling is achieved using the VB front end. The screenshot in Fig.9 shows how the vehicle is tracked at different positions. The screenshot in Fig.10 and Fig.11 describes the vehicle when monitored in fencing mode where, vehicle when moves outside the territory is notified. The driver is indicated by the LCD display on the vehicle and one such display is shown in Fig.12 Similarly all other displays are intimated to him on LCD and the ongoing progress like current speed, the mode of running, orders issued, request sent etc. are displayed. Fig.13 shows the snapshot of the device.

Fig. 9: Tracking of Vehicle

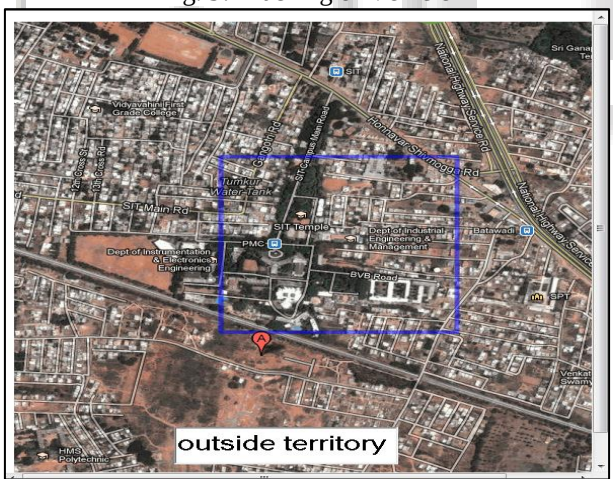

Fig. 10: Vehicle when Moved Outside Territory

Fig. 11: Vehicle Inside Territory

Fig. 12: LCD Showing the Speed Set Dynamically to 40 as Threshold

Fig. 13: Snapshot of the Device Mounted on Vehicle

VI. CONCLUSIONS

The aim to bridge the communication gap between the vehicle and the headquarters is easily implemented using the GSM technology. The system is simple and powerful, it secures the vehicle usage. The tracking of the vehicle is possible and time required for the journey is recorded. The location is identified on the map at the time of emergencies too and help can be extended as soon as possible. Vehicle can be monitored within the boundary specified.

The system can be advantageous in following conditions;

- Security of defence vehicles and avoids misuse or theft of vehicles.
- At war times the vehicle tracking will be useful and the lost vehicle can be found.
- Communication is possible with vehicle whenever it is required.
- It can be employed for Government vehicles to avoid their unnecessary personal usage.
- In case of health emergency or any accidents immediate intimation to required person can be given

REFRENCES

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