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Centralized Control and Digital Registration For Vehicles

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Abstract: Due to the large use of vehicles, government enforces several laws to avoid serious harmful situations to human life. But in day-today life the public and police find much difficulty to keep these laws. Though there are several methods for keeping up these laws, most of these methods are not foot proof. Therefore, here we propose an idea that can technically solve the whole problems and mess in the law enforcement of motor vehicle departments beside, it can help for both public and the vehicle users in a variety of ways. Also in future, it can be modified to any desired level with minimum expenditure. The core idea is that each and every vehicle in the nation should have a unique digital ID which may be the same as the registration number. This unique ID should be encoded in an embedded system designed as per the standards of government regarding this product and it will increase the security of the product. Vehicles manufactured without this circuitry should not be eligible for registration or fitness. This embedded system in the vehicle contains some sub-circuits such as RFID Reader,GPS Chip, Alcohol Detector, Accelerometer, Display etc. which performs functions such as automatic speed limit according to different zones , concentration based warning on dangerous blind spots , automated rash drive penalty, detection of drunken drivers, force-stopping any desired vehicles by department, can recover a stolen vehicle, checking the validity of license, traffic block and location based alert to the driver, automatic accident detection and rescue service which all aredone in connection with stationary RF transceivers which is placed on the road side at a particular distance apart. Thus the system discussed in our project will not only very helpful in solving the problems faced in the law enforcement of motor vehicle department but also of assistance to drivers and public.

Keywords: ECU, GPS, RFID.

I. INTRODUCTION

Vehicles are very important in our daily life. Everybody uses vehicles. Sometimes vehicles can cause serious harmful situations to human life. To reduce this government enforces several laws on the use of motor vehicles.But in day-today life public and police find much difficulty to keep up these laws. The existing method is police or the concern department inspecting random vehicles on the road and charging fine. This method has a lesser possibility to get caught for law violation because inspecting everybody is not practical and, even if caught, officers can be easily bribed. Though government spend lot of money in these areas the problems still remains.

Here we propose an innovative idea that can technically solve the whole problems and mess in the law enforcement of motor vehicle department. Besides, it can help both public and the vehicle users in a variety of ways. Also, in the future it can change to any desired level (all future modifications in the laws can be easily implemented in this system with minimum expenditure). The core idea is that each and every vehicle in the nation should have a unique digital id which may be same of that of the register number. The unique id should be encoded in an embedded system which consists of RFID reader, GPS chip, RFTransceiver, Alcohol detector, Accelerometer, ECU interface and display designed as per the standards of government regarding this product. This device should be manufactured along with the vehicle by the vehicle manufacturer or it can be manufactured by limited manufactures with a liabilityagainst any future override or hack to the system and it will increase the security of the product.Vehicles manufactured without this circuitry should not be eligible for registration or fitness. So, once this law isimplemented, each and every vehicle in the country is equipped with this circuitry and it will turn out to be a good solution for motor vehicle related problems.

II. RECENT RESEARCHES

There are several types of methods to keep up the laws for vehicles. The existing method is police or the concerned department inspecting random vehicles on the road and charging fine.This method has a lesser possibility to get caught for law violation because inspecting everybody is not practical and even if caught officers can be easily bribed. The next method that the govt. Implemented is CCTV camera inspection.But due to large cost for CCTV camera it is placed in special locations such as highways, junctions, etc. So the police can see only the violations that happened in that particular point. Thus the most of the methods that the government introduced has less probability to in catching law violations.

A. Speed Limit Sign Detection and Recognition

In the paper of Abdelhamid Mammeri and team [4], they investigate Speed Limit-Sign (SLS) detection and recognition system of North American speed limit signs,

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including Canadian and U.S signs. A modified version of Histogram of Oriented Gradient (HOG`) is used to detect and recognize speed-limit sign (SLS) through a set of two-level Support Vectors Machine (SVM) based classifiers. They build their online database called North American speed limit sign (NASLS) which includes four SLS categories: white, yellow, black and orange signs.Accuracyof more than 94% of SLS recognition is predicted. The detection and recognition of SLS involves two steps: (i) the detection of potential candidates Regions of Interest (ROI) which possibly contains the signs & (ii) the recognition of these ROI to extract the correct type of signs.

B. Localized Adaptive Strategy

In the paper of Tamer Abdelkader[1] [5], For the dynamic nature of vehicle network they introduce backoff interval method, for reducing number of collisions and waiting periods of data packets. It motivates the utilisation of local information to approach the optimal performance compared with other proposed system, this method approaches optimal distance. Application based on location broadcast andgeocast vehicle network are growing to be one of the key application in localised adaptive strategy.MAC technique is efficient for this real time application. MAC protocols classified as contention based and schedule based, co-ordinating each other by utilising localized, distributive, adaptive characteristics. . Their contribution is proposing an adaptive localized strategy logic that uses only local information to generate backoff interval. For achieving this optimal method random access protocol scheme and basics of fuzzy logic scheme performance comparison are introduced. Backoff schemes provide a simple solution to decrease collision and therefore increase through put and fairness. A number of backoff schemes were previously proposed to improve the calculation of backoff intervals.

C. Safety Message Dissemination over 802.11p/Dsr

In the paper of Omar Chakroun [6], direct radio-based vehicle to vehicle (v2v) communication can be used to prevent accidents and to provide accurate information on road state or surrounding vehicle intention. Vehicular adhoc- networks (VANETS) leverage communication device construct global awareness of surrounding environment and vehicle intention.The first concern of using such networks is to extend the driver perception which is generally limited to the line of sight. In high speed environment such as free space and highway the reaction time must be reduced and consequently information designation delay happens. It is clear that major issues arises for VANETS related to other networks causing broadcasting storms and other related high speed topology causing disconnection problems. The network disconnection problem happens when no relaying node is available to forward messages from a particular section of the road to another.This kind of dissemination chain breakage is related to the vehicle velocity and their unpredictable displacement. Considering the challenges while vehicular deterministic access (VDA) constitutes the better access technique and ensures time synchronization between the vehicles, it only operates in two hop vicinity. Multiple schemes have been introduced to overcome messages delivery issues, while respecting bearable delay. Multiple schemes, includes uni-metric schemes, multimetric Scheme. System design analysis and test results include algorithm complexity check, simulation results, end-end delay analysis, and delay PRR trade of metric, adjustment impact on delay and communication density. The particular design use locally connected information and does not need control messages exchange to operate. Adaptive mechanism can be introduced to handle emergency messages and global scheme performance and adaptability.

III. PROPOSED SYSTEM

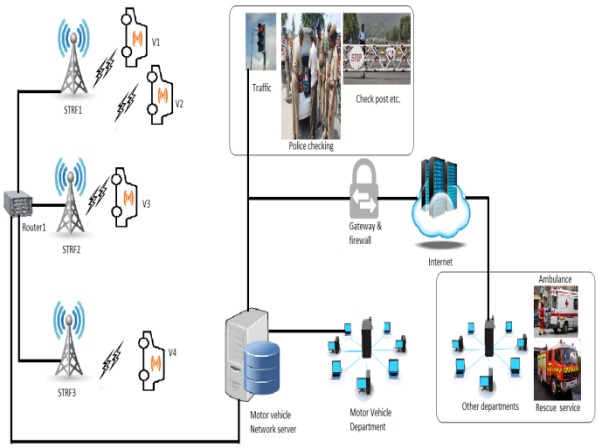

Fig-3.1 Block Diagram

The overall setup is a network based scenario. This network is perfectly isolated from any other network such as telecom and internet because of the security risk. The complete diagrammatic representation of the system is shown in the above figure. In the above Fig: 3.1 there are lot of stationary RF transceivers marked as “STRF” and vehicles marked as “V”. This STRF points are situated throughout the roads at regular separations (the distance falling within the coverage area) that they can act exactly like cells in GSM network. And each STRF is capable of bidirectional communication to each vehicle. These individual STRFs are then connected to local routers and thus form a bigger network. This network is then connected to one or more confidential servers and databases so that the whole data can be processed and managed by server side software and it can be altered and accessed by Motor Vehicle department. The server side software has capability to control traffic signals according to concentration of vehicles, it can force-stop every vehicle automatically on check posts. Police and other related Departments can force-stop any particular vehicle through this software.This network is also connected to the internet through a very secure gateway which is capable with different layers of Firewalls to protect from any hackers through internet. Through the internet any other departments or the public can access relevant data from the database. Other than this the server side software can

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detect any vehicle accidents including the exact Google map location, and this information can beautomatically send to the nearest hospital or rescue service with the help of internet to initiate rescue efforts.

A. Subsystems

The AD9361 is a high performance, highly integrated radio frequency (RF) Agile Transceiver™ designed for use in 3G and 4G base station applications. Its programmability and wideband capability make it ideal for a broad range of transceiver applications. The device combines an RF front-end with a flexible mixed-signal baseband section and integrated frequency synthesizers, simplifying design-in by providing a configurable digital interface to a processor. The AD9361 operates in the 70 MHz to 6.0 GHz range, covering most licensed and unlicensed bands. Channel bandwidths from less than 200 kHz to 56 MHz are supported.The two independent direct conversion receivers have state-of-the-art noise figure and linearity. Each receive (RX) sub-system includes independent automatic gain control (AGC), dc offset correction, quadrature correction, and digital filtering thereby eliminating the need for these functions in the digital baseband. The AD9361 also has flexible manual gain modes that can be externally controlled. Two high dynamic range ADCs per channel digitize the received I and Q signals and pass them through configurable decimation filters and 128-tap finite impulse response (FIR) filters to produce a 12-bit output signal at the appropriate sample rate. The transmitters use a direct conversion architecture that achieves high modulation accuracy with low noise. This transmitter design produces a best in class transmit (TX) EVM of <−40 dB, allowing significant system margin for the external PA selection. The on-board TX power monitor can be used as a power detector, enabling highly accurate TX power measurements.The fully integrated phase-locked loops (PLLs) provide low power fractional-N frequency synthesis for all receive and transmit channels. Channel isolation, demanded by frequency division duplex (FDD) systems, is integrated into the design. All VCO and loop filter components are integrated.The core of the AD9361 can be powered directly from a 1.3 V regulator. The IC is controlled via a standard 4-wire serial port and four real-time I/O control pins. Comprehensive power-down modes are included to minimize power consumption during normal use. The AD9361 is packaged in a 10 mm × 10 mm, 144-ball chip scale package ball grid array (CSP_BGA).

Routers are devices whose primary purpose is to connect two or more networks and to filter network signals so that only desired information travels between them. For example, routers are often used to regulate the flow of information between school networks and the Internet. However, routers can inspect a good deal more information than bridges and therefore can regulate network traffic more precisely. They also have another important capability: they are aware of many possible paths across the network and can choose the best one for each data packet to travel. Routers operate primarily by examining incoming data for its network routing and transport information (for example, information carried within the TCP/IP, IPX/SPX, or AppleTalk portions of the network signal). This information includes the source and destination network routing addresses. (Remember that every client, server, and peripheral on the network maintains multiple addresses, including both a data link and network routing addresses. The two addresses are used for different purposes. Among other things, the network routing address provides information on which routers is based traffic management decisions).However, most routers also include the same functionality as bridges. That is, they can inspect the data link level portions of the network signals for such information as the Ethernet or Local Talk destination address. Based on complex internal tables of network information that it compiles a router then determines whether or not it knows how to forward the data packet towards its destination. If the router has been configured with sufficient information to know which of its ports is en route to the destination, it transmits the packet. If the router has not been so configured, it typically drops the packet. Dropping unknown packets provides an important service to your network by eliminating restricted, wayward, or damaged information from your network. Bridges lack this capability (they forward unknown packets to all ports), and the misinformation they forward often creates extra network traffic. Routers can be programmed to prevent information from being sent to or received from certain networks or computers based on all or part of their network routing addresses. If you have sensitive student records on a server, for example, you can use a router to filter packets headed for the server so that only authorized personnel (for example, personnel whose network addresses match a specified list) can connect to it. Routers also determine some possible routes to the destination network and then choose the one that promises to be the fastest.As network traffic patterns change during a day, routers can adjust their route recommendations. (Very large routers route your information across the Internet in this manner.) There is a good deal of jargon associated with the art and science by which routers select paths, and a whole host of protocols that define their methods (for example, OSPF [Open Shortest Path First], RIP [Routing Information Protocol], or RTMP [Routing Table Maintenance Protocol]). Defining these schemes—and the costs and benefits of each—could occupy another volume the same size as this one; we suggest that you review other network references for routing protocol information. Routers must learn formidable amounts of information about your network in order to inspect network routing and data link level portions of network packets, and to route information along the best path to its destination. Unfortunately, routers do not learn this information without human intervention. Installing routers is a complex task that involves configuring each network interface that connects the router to your network. First, you must enable support for the desired protocols on each network interface. Then, for each interface-protocol combination, you must either define routing tables or configure support for an automatic

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routing table update protocol. If you have defined enterprise-wide policies for security (rules that define the kinds of information that must be restricted), you must also define filters that implement these policies for each interface protocol combination. Needless to say, you should make sure that qualified personnel (either your network integrator or your staff) install and manage them. Since routers play a key role in connecting networks, they can cause significant problems if they malfunction. As part of your network plan, you should consider how you might deal with the failure of key routers on your network. Many sites include redundant connections additional routers and network cable connections configured to take over if one router or connection fails.Like bridges, routers connect two or more networks. However, routers are much more powerful than bridges. Routers can filter traffic so that only authorized personnel can enter restricted areas. They can permit or deny network communications with a particular Web site. They can recommend the best route for information to travel. As network traffic changes during the day, routers can redirect information to take less congested routes. If your school is connected to the Internet, then you will most likely use a router to make that connection. Routers ensure that your local area network traffic remains local, while passing onto the Internet all your electronic mail, Web surfing connections, and other requests for Internet resources. Routers are generally expensive to purchase and difficult to configure and maintain. Be sure that your staffs have the resources necessary to manage them well. Routers quickly become critical components of your network. If they fail, your network services will be significantly impaired. As part of your network plan, you should consider how you might deal with the failure of key routers on your network.

IV. GENERAL DESCRIPTION

The core idea of the project is that each and every vehicle in the nation should have a unique digital ID which may be the same as the registration number. This unique ID should be encoded in an embedded system designed as per the standards of government regarding this product and it will increase the security of the product. Vehicles manufactured without this circuitry should not be eligible for registration or fitness. So, once this law is implemented each and every vehicle in the country is equipped with this circuitry. The following modules are also included in the circuitry to get maximum control over the vehicle. RFID Reader, GPS Chip, RF Transceiver, Alcohol Detector, Accelerometer, ECU (Engine Control Unit) Interface, Display.

RFID in the figure 4.1 is a well-known technique used in many fields. In this system we recommend that each and every driver should have a unique RFID tag instead of his driving license. This RFID tag should be provided by the Motor vehicle department as a part of the driving license. This unique number can be used as a reference to the original document which can be available through internet. So, if and only if the driver shows a valid RFID tag on the RFID reader of the vehicle, the ECU interface unit allows the engine to start. This method thus ensures that a person having a valid driving license can only drive a particular vehicle.GPS chip is an integrated circuit developed to work with GPS systems. This chip can calculate the latitude and longitude of the current positions which can be used to plot an exact location on a map.

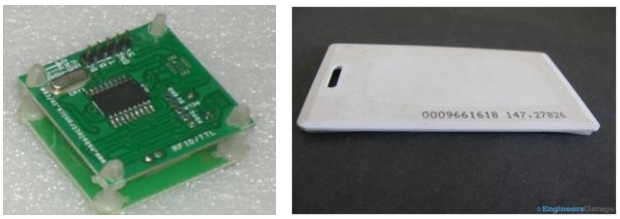

Fig:4.1 RFID Reader and Tag

Other than this it can calculate current speed with which it travels. These two parameters are important in our system because the exact position of the vehicle can be calculated through this chip and current speed of the vehicle also can be calculated. The positional information can be used in accident rescue and theft recovery. Speed can be used to find rash driving and over speed.

RF Transceiver is the heart of the system. This RF transceiver will transmit the following parameters from the device continuously.Vehicle ID (Register No), License No (From the RFID), Alcohol sensor reading, Accelerometer reading, Latitude & Longitude (from GPS), Speed (from GPS), Error code (This can be used to report any malfunction or malpractice happened in the device),These transmitted parameters are received by the nearest stationary RF transceiver point fitted throughout the roads and other important places. From this point it will reach on the centralized server containing huge database to store these parameters from each vehicles. The vehicle side transceiver receives the following parameters from the stationary RF transceiver. Location (Name of the place),Text message from department, Concentration/ traffic block alert (numbers of vehicle present within a distance limit), Zonal speed limit value, Trap ID (which can be used to trap a particular vehicle wanted by police).These parameters are received by the vehicle and the controller will take care of the necessary actions required in the vehicle. Location can be used to indicate the driver about the current location concentration can be used to predict traffic blocks and to alert the driver. Also it can sense the presence of other vehicles in a blind spot. The zonalspeed limit can be used to display the speed limit and reduce the speed of the vehicle into the desired level. Trap ID can stop a particular vehicle from moving any further.

Motor vehicle law in India strongly prohibits drunken driving. The alcohol detector in the figure 4.2 used along with this circuitry can measure the level of alcohol consumed by the driver.If the level is higher than a threshold the Trap ID is activated and the vehicle cannot move further and apenalty is charged automatically to the vehicle's owner.Accelerometer in the figure 4.3 is a device which can sense linear acceleration (a sudden change in velocity or shake). By scaling this linear acceleration it is

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able to find rash driving and accident. These accelerometer readings can be taken for penalty or as a future reference for an accident cases in the court to find out faulty driving. In addition to that it can be also used to detect severe accidents. If an accident is detected the location information is plotted on a Google map and it will be sent to the nearest ambulance and rescue service department/hospital immediately to initiate speedy rescue service.

Fig 4.2: Alcohol Detector

Accelerometer in the figure 4.3 is a device which can sense linear acceleration (a sudden change in velocity or shake). By scaling this linear acceleration it is able to find rash driving and accident. These accelerometer readings can be taken for penalty or as a future reference for an accident cases in the court to find out faulty driving. In addition to that it can be also used to detect severe accidents. If an accident is detected the location information is plotted on a Google map and it will be sent to the nearest ambulance and rescue service department/hospital immediately to initiate speedy rescue service.

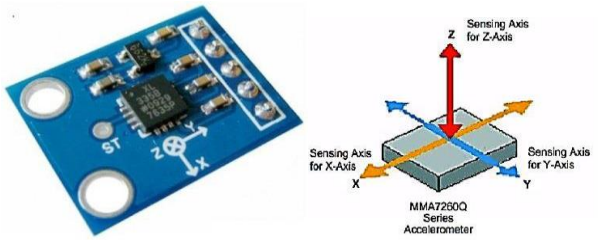

Fig 4.3: Accelerometer

The ECU in figure 4.4 provides controls for a variety of systems within the engine. The following sections will examine these systems (including the control of air): fuel ratio, ignition timing, and idle speed.

In the proposed system there should be an interface between this ECU and the circuitry so that the system can have access to the engine and control the vehicle's ignition fuel flow, RPM and other important parameters. For example, if the system gives a command to reduce the speed the ECU will decrease the fuel flow and reduces the speed; and if the system gives a command to turn off the vehicle the ECU will turn off the Ignition. The Display is fitted to help driver by giving alerts such as location name, speed limits, railway gate proximity, etc.

It can display warnings on a blind spot, such as a curve or over-taking, by calculating the concentration of vehicles present within a 100m. It can also display any particular message from the department to the driver.

Fig 4.4: ECU

Thus the above discussed modules, all together will help to solve most of the issues faced in motor vehicle law enforcement and also will be of real assistance to drivers.

V. FLOW CHART

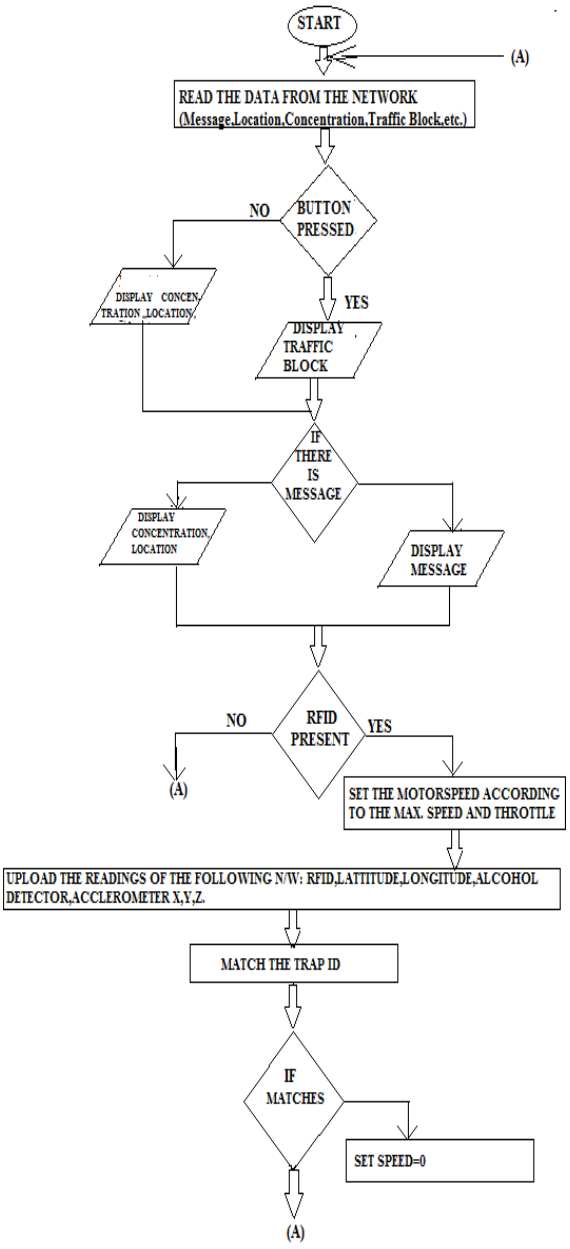

Fig 5.1: General Flowchart

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In the above fig 5.1, general working of the system in the form of flowchart is showed. The first step is start. Then the RF transceiver in the vehicle will check if the stationary RF transceiver contains any data to show on the LCD display which contains message, concentration, block, locations etc. This datas except block of large area are displayed on the display continuously. If yes, it will read those data. Then on the circuit there is a button. By pressing that button we can see the traffic block or concentration of large area. If the button is not pressed, the normal datas will displayed. Then the transceiver will check whether there is any message or not. If there is a message to display, it will display it. If there is no message, it will display all other data that is concentrationand location. Then next is RFID checking. Here the transceiver checks whether the driver swipes the RFID Tag over the RFID reader. If RFID is present, the ECU will allow the vehicle to start. If there is no speed limit on the road he can drive the vehicle with the maximum speed limit on that road. After that the transceiver will send all the details about the vehicles which contains latitude longitude of the vehicle, license number, current speed, alcohol reading, accelerometer readings etc. to the server software via stationary transceiver , thereby Motor Vehicle Department(MVD) get a solid proofabout the vehicle. Thus the MVD can understand the current behavior of the vehicle. If the vehicle is violating laws, they can take actions then very easily by generating Trap ID. The next step is Trap ID matching.. MVD will generate a Trap ID for catch a vehicle and is send via stationary transceiver. The stationary transceiver will transmit that ID to all the transceivers on every vehicles. So if the Trap ID is matched with any vehicle, MVD can force stop that vehicle at that moment.

VI. SIMULATION RESULTS

The results of our project are shown below with the help of snapshots. Here we usedVB.NET software.

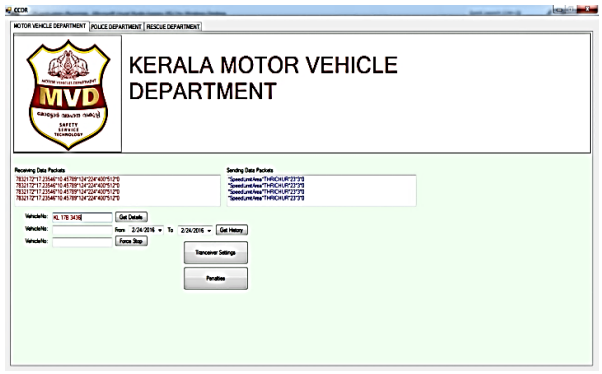

Fig 6.1:Main Page

The figure 6.1 shows the main page of our software display which will only handle by the Motor Vehicle Department. By opening this software they can see new updates, can check or force stop any vehicle which shows violations, check the histories of particular vehicles, can send any warning, messages etc.

To the vehicles via transceivers, inform police, inform rescue department etc.

The figure 6.2 shows the menu1 Police Department. In this menu the police can search or track any vehicle and even they can force stop particular vehicle with the permission of MVD. In the figure 6.1 there is an option1 Transceiver setting. Here the department can check about transceivers performance and can add new transceivers on the road. After the implementation department can send any information to that and department will receive the information of the vehicles that cross the transceiver

Fig 6.2: Police Department

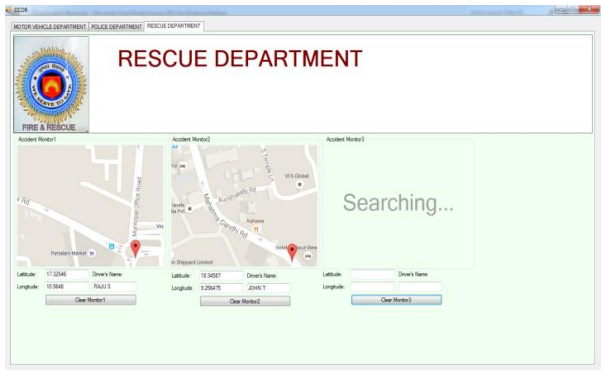

Fig 6.3: Rescue Department

Fig 6.4: GPS Tracking

And also there is option2 Force Stop a vehicle. In this option the department can force stop any vehicle which shows serious problems to the society. Whenever any vehicle shows problems to the society, the MVD will generate a trap ID corresponds to that vehicles registration

number (digital) and then send that to the stationary RF Transceivers on the road. Then these RF transceivers will check all the vehicles by comparing this. If that vehicle passes through any of the RF transceivers it will match with the trap ID and then it will force stop. The figure 6.4 is option3 GPS Live Tracking. Here the MVD can track any vehicles in the road and the results will be shown on the display with the help of Google map. With the help of this MVD can estimate the speed and current positions of the vehicles.The option5 are Penalty. Here MVD can see the vehicles having penalty and cause of that penalty like over speed, alcohol consumption etc. The figure 6.3 shows Rescue Department. Here MVD can search any vehicle accidents, search the information, and they can send that to the rescue department immediately. The option4 is Vehicle history. In this MVD can check the histories of vehicles thereby they can check vehicles having criminal background and also they can track the stolen vehicles.The option5 Vehicle Details. In this MVD can see all the information of the vehicles such as registration number, address of the owner etc. so with the help of this MVD can make relevant documents about the vehicles if needed.

VII. APPLICATIONS AND ADVANTAGES

- Automatic speed limit according to different zones such as school
- Concentration based warning to the driver on dangerous blind spots such as curves and over-taking situations
- Automated rash drive penalty
- No vehicles with drunken drivers on the road
- Police, MVD or any other related department can force-stop any desired vehicles anywhere
- Police can easily find and recover a stolen vehicle
- Concentration based efficient traffic control
- No one drives a vehicle without having a valid driving license
- MVD data can be used as proof for vehicle related cases in court
- Traffic block and location based alert to the driver for the easiness of driving
- Automatic accident detection and rescue service
- Easy attachment of pledged vehicles through MVD (Motor Vehicle Department)
- No vehicle can go without any control of MVD
- Number of accidents and law violation will reduce rapidly
- No vehicle can go dangerously hence it is controlled by the MVD.

VIII. FUTURE SCOPE

- RF coverage can be extended to rural areas where accurate localization is needed
- Combination of magnetometer, accelerometer, and gyroscope can be used to find the orientation and heading of the vehicle
- Combination of GPS data with the RF localizing algorithm can be used to increase the precision of localization of the vehicle
- Face recognition templates can be used to validate the driver
- Trained neural network models can be used to increase the flexibility and accuracy in relevant areas such as traffic signals, blind spot warnings and rash drive detections

IX. CONCLUSION

With the proposed system a new methodology has been defined which obeys almost all vehicle laws in a controlled manner. Research and studies prevail that we can control several violations on road. In a pre-defined logic it is also user-friendly and department-assisting.In this scenario no vehicles can go invisible. It increases the possibility of more centralized control on vehicle. As the system works online any future law implementation/ change can be easily affected with the system. The system works on software and it will decrease corruptions in the related departments. We hope the system will decrease road accidents and efficiently help the law enforcement as well as judiciary. And also if this project is implemented with the help of law, no vehicle can go without this system. Thus we can assure that our project will be a great factor for the prevention and reducing of traffic violations.

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