Remote Vehicle Tracking System through Voice Recognition App Using Smart Phone

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Abstract— The car accidents/thefts in recent times have been increasing rapidly though there are a number of safety measures being installed in them. The new standard technologies designed for the cars can be easily cracked with adequate knowledge about the technology in use. A prototype of what can be implemented in real time applications has been developed in order to overcome the drawbacks in the existing system with an additional option for customization of user needs.

A simple and reliable system has been designed which will give an alert in the form of a text message as soon as any problem arises. The problems here may range from theft to accidents. Minute changes like ignition on and off can also be controlled. The system operates based on speech commands or speech control signals like 'stop', 'left', and 'right', back, 'go' and so on.

Key Words— GPS (Global Positioning System), GSM (Global System for Mobile communication), HCI (Human-Computer Interaction), SMS (Short Message Service)

I. INTRODUCTION

Various technologies have been adopted in the day-to-day life of common man today, one of which being the vehicle tracking system. All the existing vehicular tracking systems support the detection of the place and status of the vehicle. Some of these are GPS/GSM based systems which integrate both GSM and GPS technologies. Vehicular tracking systems are accepted in consumer vehicles as theft prevention and retrieval devices. Once a theft has been detected, the system sends an alert SMS to the vehicle owner who in turn issues the necessary signals to the controller to stop the motor. This concept provides an overview on the subject of Human-Computer Interaction (HCI) which includes the basic definitions and terminology, a survey of existing technologies and recent advances in the field, common architectures used in the design of HCI systems which includes uni-modal and multimodal configurations and the applications of HCI.

With the HCI Concept the system is made to test the accuracy of the location that is send to the user when the vehicle is stationary and in motion in the city and suburb. The system is made by combining a micro controller with GPS and GSM, then comparing it with other similar devices available in the market like Garmin and a reference website to find the radius of error. The hardware and program development are done by research and trial and error as the controller does not interact with both the modules at the same time.

As the number of vehicles increase, the number of problems associated with them also increases such as traffic jam, vandalism and theft. This being a serious concern, if not tackled will cripple the entire motorcycle industry. To prevent such crimes a better security system for the vehicles needs to be developed.

The existing system using GPS and GSM enable users to locate their vehicles with ease with the aid of mobile networks. Current systems support features like remote ignition control, remote lock and unlock, location identification on Google maps, automatic barrier detection and braking systems. In these systems, due to traffic in network if the message fails to be received by the owner or a delay in reception of the message might not allow immediate action.

The proposed system makes use of GPS in order to get the exact latitude and longitude position based on the satellite. The located position will be sent to GSM Module via SMS. A new application which is controlled by one's speech has been designed in order to control the robotic module which is a prototype of what can be done in large scale. With the help of speech recognition systems similar to "Siri of I Phone" or "Cortana of Nokia" which work using voice recognition system, a user friendly system has been developed which will help the car owners to track the movement of the car remotely with ease .

II. LITERATURE SURVEY

In [1] the system utilizes GPS to obtain a vehicle's coordinate and transmit it using GSM modem to the user's phone through the mobile network. The main hardware components of the system are u-blox NEO-6Q GPS receiver module, u-blox LEON-G100 GSM module and Arduino Uno microcontroller. The developed vehicle tracking system demonstrates the feasibility of near real-time tracking of vehicles and improved customizability, global operability and cost when compared to existing solutions.According to [2], a vehicle tracking system that employs a GPS module

and a GSM modem to find the location of a vehicle and offers a range of control features has been presented. To complete the design successfully, a GPS unit, two relays, a GSM Modem and two MCU units are used. There are five features introduced in the project. The aim of this project has been to remotely track a vehicle's location, remotely switch ON and OFF the vehicle's ignition system and remotely lock and unlock the doors of the vehicle. An SMS message is sent to the tracking system and the system responds to the users request by performing appropriate actions. Short text messages are assigned to each of these features. A webpage is specifically designed to view the vehicle's location on Google maps. By using relay based control concept introduced in this paper, number of control features such as turning heater on/off, radio on/off etc. can be implemented in the same fashion.The paper [3] presents the development of the remote vehicle tracking system which integrates the Global System for Mobile Communications (GSM) Modem and Google Map. The GSM modem at the control centre will receive the coordinates through Short Message Service (SMS) and updates the main database. The information then will be accessed by the website and the position of the vehicle will be displayed through the Google Maps application.The expectation in [4] and [8] is that the car should start when authorized persons send predefined message on the External SIM. Otherwise the car is locked. Smart vehicle sends current locations on the different predefined mobile numbers. In this situation owner calls on External SIM for the first time, then the car should stop & when the user calls second time, then the vehicle will start automatically. Also, when the car is in motion and suddenly an obstacle occurs in front of the vehicle, the sensor should detect the barrier (small or big), the car should brake automatically and try to search alternate path in case of an accident. For immediate help, a message needs to be sent to the owner and care centre. In that Short Message Service it is should send current place latitude and longitude, Time, Speed in knots, Date, obtained from Global Positioning. Therefore, using the latitude and longitude, the location on earth is determined and quick help in case of an emergency is provided. The Car should also break if the car is on wrong driving track and automatically re-track car.The Micro Controller PIC18F26K22 interfaces with Infrared sensors and Ultrasonic sensor that continuously detect and track the vehicle in motion. If an Infrared sensor output detects off road path, then Micro controller immediately slows down the vehicle speed and tries to move the vehicle back on path depending on track sensor output. Here the Micro controller is programmed using embedded C language and built using MPLAP.Currently the car guard system is divided into four categories; machinery,

electronics, chip and networks. Machinery guard system is the first method to defense theft, which includes hook lock, redirector lock and gear-box lock and so on. It mainly depends on lock clutch to accomplish the guard of car by applying the brake, accelerograph or redirector, gearshift. It can only guard without alarm. Electronic guard and alarm system is currently used most widely device. It mainly depend on locking retrofire to accomplish guard. It is divided into two categories, one is single direction and the other is bi-direction. Although the guard system of this type has more function, their valid range is within only 100-200 meters. Furthermore, it is subjective to the disturbance so that alarm is erroneous. The principle of chip guard system is to lock the engine, circuit and gasoline pipe of car. The car cannot be started without the key. So this method has higher safe performance. But input device uses the specific foreign chip which is expensive. By network, the system controls the opening and closing of car door, start of engine,and pause of car. In addition, localization and status report of car can be attained according to the requirement of owner. Now the main network is GPS satellite track system. The low power consumption microcontroller-MSP430 is used in the guard system design. GPS module is used to receive the localization information, with which the longitude, latitude, velocity and direction of car can be calculated. Moreover, by use of message of GSM or telephone, the guard system can receive/transmit and control the localization information. Its error is less 10m. The guard system is low power consumption, cheap expense, mini volume so as to be placed secretly. It has reliable performance. It can satisfy the user's demand for acquiring the status of car far away [5].The paper [6] describes a practical model for routing and tracking with mobile vehicle in a large area outdoor environment based on GPS and GSM. The supporting devices, GPS module-eMD3620 of AT&S Company and GSM modem-GM862 of Telit Company, are controlled by a 32bit microcontroller LM3S2965 implemented in a new version ARM Cortex M3 core. The system is equipped the Compass sensor-YAS529 of Yamaha company and Accelerator sensorKXSC72050 of Koinix company to determine moving direction of a vehicle. The device will collect positions of the vehicle via GPS receiver and then sends the data of positions to supervised centre by the SMS or GPRS (General Package Radio Service). The supervised centre is composed of a development kit that supports GSM techniques-WMP100 of the Wavecom company. After processing data, the position of the mobile vehicle will be displayed on Google Map.The paper [7] introduces an Android based tracking and theft prevention system. Vehicle tracking system is a miniature model of GPS. GPS is used to find out the position or location of the vehicle around

the world. The peltier unit is attached at the exhauster along with the Thermal Electric Generator (TEG). Through this unit the heat energy is converted into power using the peltier effect. The generated power will be stored in battery used in two wheelers. GPS will be fixed in the vehicle to monitor current position of the vehicle. With the help of the GPS value, the distance can be computed with respect to time. The direction and the distance are fed into the microcontroller and that will be transmitted to GSM through digital modulation techniques. At the receiver end the signal will be detected and demodulated with digital demodulation technique. The signal will then be given to Android mobile. Android mobile is used to control the air solenoid, water solenoid and power cable in vehicle engine system.

III. GPS TRACKING SYSTEM

A GPS tracking unit is a device that uses the Global Positioning System to determine the precise location of a vehicle, person, or other asset to which it is attached and to record the position of the asset at regular intervals. The recorded location data can be stored within the tracking unit, or it may be transmitted to a central location data base, or internet-connected computer, using a cellular GPRS, radio, or satellite modem embedded in the unit. This allows the asset's location to be displayed against a map backdrop either in real-time or when analyzing the track later, using customized software. A GPS tracking system uses the GNSS (Global Navigation Satellite System) network. This network incorporates a range of satellites that use microwave signals which are transmitted to GPS devices to give information on location, vehicle speed, time and direction. So, a GPS tracking system can potentially give both real-time and historic navigation data on any kind of journey. A GPS tracking system can work in various ways. From a commercial perspective, GPS devices are generally used to record the position of vehicles as they make their journeys. Some systems store the data within the GPS tracking system itself (passive tracking) and some send the information to a centralized database or system via a modem within the GPS system unit on a regular basis (active tracking).The Global Positioning System (GPS) is actually a constellation of 27 Earth-orbiting satellites (24 in operation and three extras in case one fails). The U.S. military developed and implemented this satellite network as a military navigation system, but soon opened it to the rest of the world. Each of these 3,000 to 4,000 pound solar-powered satellites circles the globe at about 12,000 miles (19,300 km), making two complete rotations every day. The orbits are arranged so that at

anytime, anywhere on Earth, there are at least four satellites "visible" in the sky. A GPS receiver's job is to locate four or more of these satellites, figure out the distance to each, and use this information to deduce its own location. This operation is based on a simple mathematical principle called trilateration.
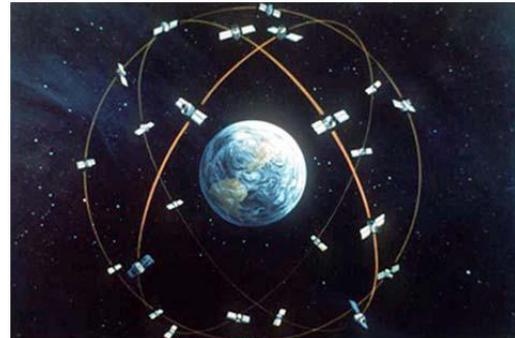
Fig.1. GPS Satellite Constellation

A. Types of GPS Tracking System: There are currently three categories of GPS tracking units. The categories are split into how GPS data is logged and retrieved.

i. Data Loggers: Data loggers are usually the most basic type of GPS tracking; a GPS data logger simply logs the position of the object at regular intervals and retains it in an internal memory. Usually, GPS loggers have flash memory on board to record data that is logged. The flash memory can then be transferred and accessed using USB or accessed on the device itself.

iii. Data Pushers: Data Pushers are GPS tracking units that are mainly used for security purposes. A data pusher GPS tracking unit sends data from the device to a central database at regular intervals, updating location, direction, speed and distance. Data pushers are common in fleet control to manage trucks and other vehicles.

iv. Data Pullers: The last category of GPS tracking units is the data pusher units. These types of units push data or send data when the unit reach a specific location or at specific intervals. These GPS units are usually always on and constantly monitoring their location. Most, if not all data puller unit also allow data pushing (the ability to query a location and other data from a GPS tracking unit).

B. Features of GPS Tracking System: Generally all of the GPS Tracking System has some of the common features that are listed below:-

i. GSM/GPRS Module: It is used to send the location to the user online. In some case, if the user wants the location through the internet then this module is very useful. With the help of the GSM/GPRS module, we can send data in real time. It can be seen on the

internet in any enabled device as a PC, mobile phone, PDA, etc.

ii. Track Playback: Animates the driver's daily driven route so that every move can be followed. The track animation line is color coded to indicate the speed the driver was traveling in during his route.

iii. Idle Time Report: Gives an accurate report indicating when the driver stopped and when he left the engine running on the vehicle. This report was designed with input from the existing customers who were concerned about high fuel bills.

iv. Track Detail: Provides you with a split screen view when reviewing your driver's route. Stop and transit times, as well as speed information, are displayed in the bottom pane. One can easily toggle between stops by clicking the stop number on the track detail pane.

IV. SYSTEM DESIGN

System design is the process of defining the architecture, components, modules, interfaces and data for a system to satisfy specified requirements. The proposed system has modules which have been listed below. Before that fig.2., the system architecture is shown which will give the overall understanding of how the system is actually implemented.

A. System Architecture:
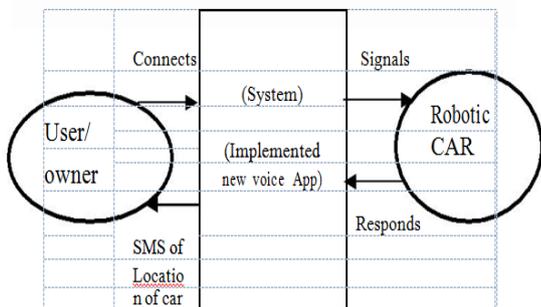
Fig.2. Overall System Architecture

The user will install this app in his/her smart phone, preferably Android. The application will be running in the background without causing any problems to foreground applications like Whatsapp, Face book, Twitter, Instagram, etc,. The user will give commands to the car or any vehicle which has implemented this design. When the user gives commands like "Go", the car or any vehicle should move

forward and stop when the user gives the command "Stop". The commands will be converted to signals with the help of our app and that signals will be fed into the microcontroller installed in the car or any vehicle. The microcontroller will act upon the signals received from the app through a voice recognition system which has been used. This design can also be used to identify the location of the car or any vehicle in case of any theft provided the design has been installed.

B. Data Flow Diagram: As depicted in fig.4, the user sends commands through voice recognition app, that command is converted into signals and then it is compared with a simple string algorithm which will check whether the command given by the user is correct and matches it with
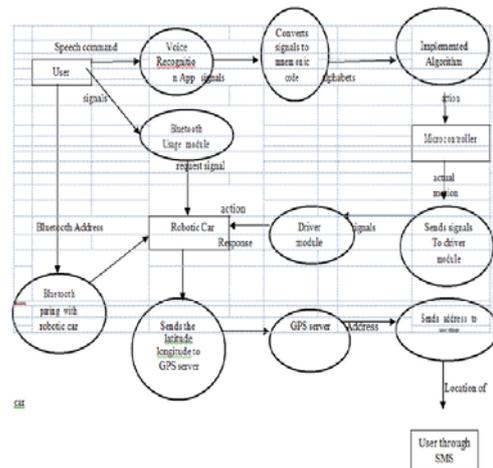
Fig 3. Interaction with vehicle using voice recognition app

the dictionary maintained by the app and then it is given to microcontroller where actual motion takes place and this in turn has a driver module which controls the wheel movements of the robotic car and then using Bluetooth device. The design proposed here uses GSM and GPS in the robotic car which provides the location of the car to the owner via SMS every single minute. This assures the owner about the safety of his vehicle. In case the SMS shows a difference in latitude and longitude, he knows that his car is in trouble and using the voice app he can control his car. When he gives stop command the car will shut down and then he can go and retrieve his car with the help of the SMS which he gets. As depicted in fig.3, user sends commands through voice recognition app, that command is converted into signals and then it is compared with an simple string algorithm which will check that command given by the user is it correct and matches with the dictionary maintained by the app and then it is given to microcontroller where actual motion takes place that is in turn having a driver module which controls the wheel movements of the robotic car and then using Bluetooth device we have been implemented this project the GSM and GPS in the robotic car gives the location of the car every minute to the user through the SMS so the owner will be knowing that the car is safe. In case if the SMS shows the different longitude and longitude then the owner knows his car is been in a problem and using the voice app he

can control his car when he gives stop command the car will shut down and then the user can go and retrieve his car with the help of the SMS he has been received.

V. SYSTEM IMPLEMENTATION

Systems implementation is the construction of the new system and the delivery of that system into production. The complete implementation can be categorized into three major modules, namely, speech recognition, microcontroller and location identification modules.
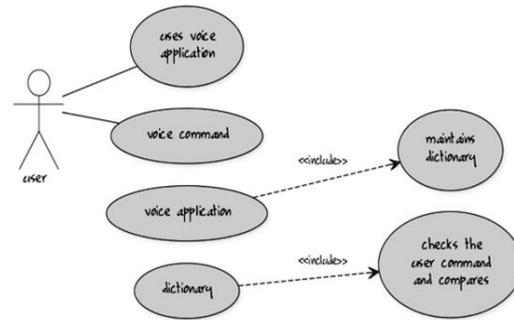
A. Speech Recognition Module: The following are the functionalities performed by this module. This is the important module which starts the app and will take the first input from the user through voice commands.

A dictionary of English words is maintained which is mapped with alphabets so that whenever a user gives commands like "Left" which is mapped with alphabet "C". Similarly for a set of functions we have set few alphabets which will help the microcontroller to perform further actions. For example, "Right" → "D", "Back" → "B", "Go" → "A", "Stop" → "S", etc.

After identifying the functionality which was given through speech, we will use an algorithm which we have designed to compare the voice commands given by the user.

Bluetooth Configuration Module- The functionalities which are been performed through voice can also be performed using Bluetooth also. Every car will have a Bluetooth device installed in it and we can make use of it with our application also. We can pair the devices (car with our smart phone) and give commands instead of using GPS and GSM. But the drawback with this is that the user must be within range and the range will be specified by the device signal strength or Bluetooth range. The maximum Bluetooth range which can be used is 100metres.

i. Use Case Diagram: As shown in fig.4, in the use case diagram the user using the voice app which has been installed in his smart phone gives the commands to the car for its movement. Voice app in turn will be maintaining a dictionary where it compares the commands given by the user. If it matches then it is forwarded to next step that is microcontroller module.

Fig.4. Use Case Diagram for Speech Recognition Module

B. Microcontroller Module: This module is a hardware module which will be installed in the car to control the functionalities of the robotic car which we have designed. This module also helps to convert signals received through the app into mnemonic codes which will be compared with the alphabets stored in the dictionary.

The following are the functionalities which are performed in this module.

The signals received from above modules will be converted into mnemonic's and then will matched with the help of our algorithm which is implemented based on string matching concept. The mnemonics are then fed into next functionality which is explained below.

The mnemonic is compared and after comparison, a decision will be taken. Decision means what action has to be performed according to the mnemonic generated. The decision varies for different commands given by the user which is already been discussed in the system design phase. Our robotic car will perform a set of functions like going forward, going back, moving left, moving right and stop. For all these movements or functionalities, we have defined a set of mnemonics which will help the microcontroller driver module to perform that specific task.

This sub module is pre-installed in microcontroller. We are using this functionality to make sure that our robotic car moves as per instructions or commands given by the user. This sub module actually controls the wheel movement. If the instruction was to move forward then this sub module will rotate the wheel in forward motion. If the instruction was to move backward then the wheel will move in backward direction or anti-clockwise direction.
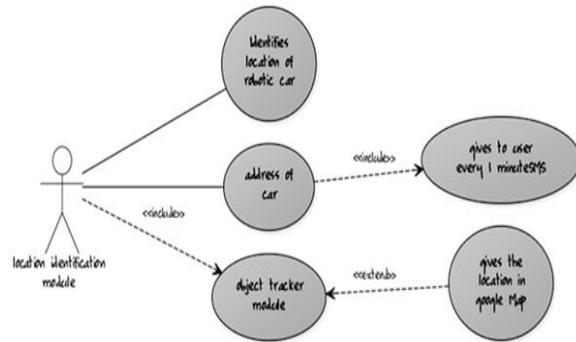
i. Use Case Diagram:
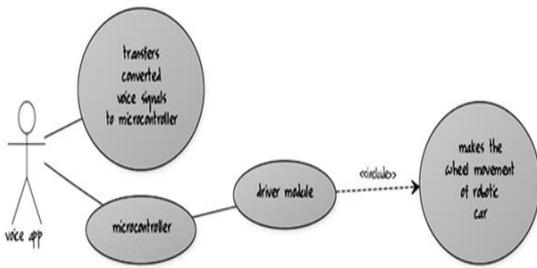
Fig.5. Use Case Diagram of Microcontroller Module

As shown in the use case diagram (fig.5), voice app will be the main actor which transfers the voice signals to microcontroller, once the microcontroller receives the signals it then gives this signal to its sub module which controls the wheels of the robotic car and makes the wheel rotate as per the user command.

C. Location Identification Module: This module will help the user identify the location of the robotic car in case of theft. The address of the location of the car will be sent to the user every minute in the form of text message. This text message will have the location. The location is obtained by taking the latitude and longitude of the device installed in the robotic car. The car's GPS system will always fetch the Lat Long of the device but ones the user or owner identifies the car has been stolen, he/she can initiate this system which will take the Lat Long of the car at that instance and send that coordinates to Google Maps where we will fetch the address of the location of the car. This address will be updated every minute to the user about safety of his car. The following are the functionalities performed by this module:Initiate the Tracking operation with the help of GPS and GSM. The coordinates of the robotic car will received and will be mapped with Google Maps.

Get the address of the robotic car and keep updating every minute.

i. Use Case Diagram: Fig.6, shows the use case diagram of location identification module. Location identification module main part of work is to send the details of car location of the car every minute to his owner. The message will be showing the actual longitude and latitude of the car position. Using object tracker one of the Google app the user can get the Google map picture view of where his car right at that time.

Fig.6. Use Case Diagram of Location Identification Module

VI. CONCLUSION AND FUTURE ENHANCEMENT

A. *Conclusion*: As stated in my hypothesis, conclusion for the project experiment which I did as given many positive results and can be practical applied in the real world. it gives more accurate and 100% results of finding their vehicle with short span of time. And moreover in today era each individual is using Smartphone with this the new voice recognition app can be installed for their own vehicle safety. and it affordable and it provides good results and they can protect their own vehicle i have mainly discussed about three modules which will work together to the user speech command and respond to user command accurately and user will ultimately will get the SMS to his mobile in terms longitude and latitude of the car position, later the user for his clear reference can copy this latitude and longitude to an object tracker(an app) which gives user the clear view in the Google map then the user can take action immediately for protecting his car. Which is more secure compared to previous result and also guarantees the user of getting back his car.

B. *Future Enhancement:* A new Smart device can be discovered to implement in the car itself during the time of manufacturing and check the results .so that it can provide still more security enhancements for the vehicle and this will stop the vehicle theft crime completely.

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