Embedded Automated Vehicle Location System

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Abstract - A GPS tracking unit is a device that uses the Global Positioning System to determine the 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 or SMS), 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 analysing the track later, using GPS tracking software.

Keywords - Data pullers, Data pushers, Data loggers & GPS tracking architecture.

I. INTRODUCTION

Smart objects are small computers with a sensor or actuator and a communication device, embedded in objects such as car engines, light switches and industry machinery [1]. Smart objects enable a wide range of applications in areas such as home automation, building automation, factory monitoring, smart cities, structural health management systems, smart grid and energy management, and transportation [1]. Smart things can explore their environment, communicate with others smart things and interact with humans therefore helping users to cope with their tasks in new and intuitive ways [2].

Smart embedded systems are very interesting and rapidly growing areas in recent days. Many organizations are working on different daily routine applications to make them intelligent like smart homes and smart phones.

In this current era the vehicle security is a big issue. Although different safety measures are taken like GPS tracking systems, remote based car locking system, safety switches and other systems. Also the vehicle navigation is quite significant especially for vehicle tracking. All these advancements have been done to facilitate the humans in the environment. In this way many smart systems are researched and developed to reduce the human effort and increase the system reliability and security through various state of the art technologies. That is why we decided to enhance these systems by reducing human interaction with machine directly.

These days people use LCD screens in cars for watching DVD and use remote control for car security. Keeping these in mind, the smart system is developed which uses video interfaces for graphic display, human profile display and GPS navigation system on remote server, real time image capturing of the driver through media processor DM642 and CCD camera and then displays the snapshot of user with all of his profile settings on LCD Screen. Beside all these things, the peripherals (rear and side mirror with seat adjustment) in the smart car are also controlled automatically using speech recognition systems.

This paper discusses the implementation of such smart systems in a normal car which makes it intelligent. This embedded system is based on PIC 18F877 microcontroller which is the main part of the system and controls all of the system operations. The work has been done to design the system to memorize the customize settings of seat adjustment, side view mirror and rare view mirror automatically using voice recognition for the authorized driver. The authorized driver will store all of his customize settings of rear, side mirrors and seat adjustment using his secret word. Whenever the drive sits in the car again he will say the secret word again and the system restores all of his settings automatically[4]. For speech recognition system, HM2007 IC is used to store and recognize the speech. It is also interfaced with the micro-controller. If the user is authorized through his speech then microcontroller initiates the user settings.

The status of car door locks can also be checked through Short Message Services (SMS) using GSM modem. The authorized user sends particular SMS to the GSM modem in the car and it will reply the
current status of car locks. The authorize driver can also lock or unlock the car remotely by sending SMS to the GSM modem connected with the car.

The system has an advance feature of GPS, which provides navigation and tracking of the car. It gives the position of latitude and longitude to the microcontroller.

The micro-controller further sends these values to the user PC using GSM modem. The GSM modem sends the SMS messages regularly to the mobile connected with the PC for navigation. The exact location of the car is also plotted on the map.

The LCD screen is also used to display the current snapshot taken by the camera with the user profile. For this purpose DM642 media processor kit is used.

The rest of the paper is organized as follows: section 2 will present the overall system model. Section 3 will discuss the working of the system. Section 4 briefly discusses the software used in the work. Section 5 presents the discussions and results and finally section 6 will end the paper with conclusion and future work.

II. SYSTEM DESIGN:
GPS tracking unit Architecture

2.1 Typical GPS tracker architecture

A GPS tracker essentially contains GPS module to receive the GPS signal and calculate the coordinates. For data loggers it contains large memory to store the coordinates, data pushers additionally contains the GSM/GPRS modem to transmit this information to a central computer either via SMS or via GPRS in form of IP packets. The diagram depicts a hardware architecture of an advanced GPS tracker.

fig:2.2 GPS architecture

TYPES OF GPS TRACKERS

Usually, a GPS tracker will fall into one of these three categories, though most smart phones, being GPS Phones, can work in all these modes, depending on which mobile applications are installed:

DATA LOGGERS

A GPS logger simply logs the position of the device at regular intervals in its internal memory. Modern GPS loggers have either a memory card slot, or internal flash memory and a USB port. Some act as a USB flash drive. This allows downloading of the track log data for further analyzing in a computer. The track list or point of interest list may be in GPX, KML, NMEA or other format. Most digital cameras save the time a photo was taken. Provided the camera clock was reasonably accurate or used GPS as its time source, this time can be correlated with GPS log data, to provide an accurate location. This can be added to the Edify metadata in the picture file. Cameras with GPS receiver built in can directly produce such a geo tagged photograph. In some Private cases, data loggers are used to keep track of a target vehicle. The PI need not follow the target so closely, and always has a backup source of data.

2.1 SYSTEM MODEL

DATA PUSHERS
Data pusher is the most common type of GPS tracking unit, used for asset tracking, personal tracking and Vehicle tracking system. Also known as a GPS beacon, this kind of device pushes (i.e. "sends") the position of the device as well as other information like speed or altitude at regular intervals, to a determined server, that can store and instantly analyze the data. A GPS navigation device and a mobile phone sit side-by-side in the same box, powered by the same battery. At regular intervals, the phone sends a text message via SMS or GPRS, containing the data from the GPS receiver.

Newer GPS-integrated smart phones running GPS tracking software can turn the phone into a data pusher (or logger) device; as of 2009 open source and proprietary applications are available for common JavaME enabled phones, iPhone, Android, Windows Mobile, and Symbian. Most[14] 21st-century GPS trackers provide data "push" technology, enabling sophisticated GPS tracking in business environments, specifically organizations that employ a mobile workforce, such as a commercial fleet. Typical GPS tracking systems used in commercial fleet management have two core parts: location hardware (or tracking device) and tracking software. This combination is often referred to as an Automated Vehicle Location system. The tracking device is most often hardware installed in the vehicle; connected to the CAN-bus, Ignition system switch, battery. It allows collection of extra data, which later get transferred to the GPS tracking server, where it is available for viewing, in most cases via a website accessed over the interest, where fleet activity can be viewed live or historically using digital maps and reports.

GPS tracking systems used in commercial fleets are often configured to transmit location and telemetry input data at a set update rate or when an event (door open/close, auxiliary equipment on/off, geofence border cross) triggers the unit to transmit data. Live GPS Tracking used in commercial fleets, generally refers to systems which update regularly at 1 minute, 2 minute or 5 minute intervals, whilst the ignition status is on. Some tracking systems combine timed updates with heading change triggered updates. GPS tracking solutions are recently being used in mainstream commercial auto insurance these are sometimes called Telematics 2.0. The applications of these kind of trackers include:

### 2.2 PERSONAL TRACKING

Law enforcement. An arrested suspect out on bail may have to wear a GPS tracker, usually an ankle monitor, as a bail condition. Race control. In some sports, such as gliding, participants are required to carry a tracker. This allows, among other applications, for race officials to know if the participants are cheating, taking unexpected shortcuts or how far apart they are. This use has been featured in the movie Rat race. Espionage surveillance. When put on a person, or on his personal vehicle, it allows the person monitoring the tracking to know his/her habits. This application is used by private investigators. These devices are also used by some parents to track their children. The supporters claim that if cleverly used, this actually allows children more independence. GPS personal tracking devices assist in the care of the elderly and vulnerable. Devices allow users to call for assistance and optionally allow designated carers to locate the user's position, typically within 5 to 10 metres. Their use helps promote independent living and social inclusion[11] for the elderly. Devices often incorporate either 1-way or 2-way voice communication which is activated by pressing a button or sliding a switch. Some devices also allow the user to call several phone numbers using pre-programmed speed dial buttons. Trials using GPS personal tracking devices are also underway in several countries for use with early stage dementia.

Internet Fun. Some Web2.0 pioneers have created their own personal web pages that show their position constantly, and in real-time, on a map within their website. These usually use data push from a GPS enabled cell phone or a personal GPS tracker.

### 2.3 ASSET TRACKING

Solar Powered. The advantage of some solar powered units is that they have much more power over their lifetime than battery powered units. This gives them the advantage to report their position
and status much more often than battery units which need[13] to conserve their energy to extend their life. Some wireless solar powered units, such as the Rail Rider can report more than 20,000 times per year and work indefinitely on solar power eliminating the need to change batteries. Animal control. When put on a wildlife animal (e.g. in a collar), it allows scientists to study its activities and migration patterns. Vaginal implant transmitters mark the location where pregnant females give birth. Animal tracking collars may also be put on domestic animals, to locate them in case they get lost.

2.4 DATA PULLERS

GPS data pullers are also known as GPS transponders. Contrary to data pushers, that send the position of the devices at regular intervals (push technology), these devices are always-on and can be queried as often as required (pull technology). This technology is not in widespread use, but an example of this kind of device is a computer connected to the Internet and running gpds. These can often be used in the case where the location of the tracker will only need to be known occasionally e.g. placed in property that may be stolen, or that does not have constant source of energy[12] to send data on a regular basis, like freight containers. Data Pullers are coming into more common usage in the form of devices containing a GPS receiver and a cell phone which, when sent a special SMS message reply to the message with their location.

2.5 USERS IN MARKETING

In August, 2010, Brazilian company Unilever ran a promotion where GPS trackers were placed in boxes of Omo laundry detergent. Teams would then track consumers who purchased the boxes of detergent to their homes where they would be awarded with a prize for their purchase. The company also launched a website[6] (in Portuguese) to show the approximate location of the winners' homes.

3. SYSTEM OPERATION ELECTRONIC TAGGING

Electronic Tagging is a form of non-surreptitious surveillance consisting of an electronic device attached to a person or vehicle, especially certain criminals, allowing their whereabouts to be monitored. In general, devices locate themselves using GPS and report their position back to a control centre, for example via a cellular (mobile) phonenetwork. This form of criminal sentencing, or increasingly a form of pre-release from detention monitoring, is known under different names in different countries; for example in New Zealand it is referred to as "home detention", and in North America "electronic monitoring" is a more common term. Electronic monitoring has been said to be particularly useful for early detection of flight when defendants have been granted pretrial release, or for preparing incarcerated individuals for release back into the community. Increasingly, electronic tagging has become a tool for courts, penal institutions or hospital facilities, to manage individuals both within their facilities and external to their premises[10]. Typical European usage of electronic tagging includes pre-trial and pre-release management of the person monitored. Use of tagging instead of incarceration reduces custody population and verifies that the person will obey conditions of release from custody. The same technology can be used for covert surveillance, particularly of vehicles, but would be called "tracking" rather than "tagging".

3.1 BACKGROUND

In 1964 Ralph Kirkland Schwitzgebel (family name later shortened to "Gable") headed a research team at Harvard that experimented with a prototype electronic monitoring system. In 1969 he and William S. Hurd were granted patent #3,478,344. Also in 1969, Robert Schwitzgebel ("Gable"), a professor at UCLA and Claremont Graduate University in California, wrote an article in Psychology Today about an FCC-licensed experimental radio station to locate and send two-way radio signals to juvenile offenders. A collection of tagging devices used in the United States between 1970 and 1990, and a summary of their early history, with photographs, is housed at the Archives of the History of American Psychology, University of Akron, Akron, Ohio, USA.

In 1981 writer Tom Stacey took to the British Home office a proposal for the electronic tagging of offenders to track their movements, or fix a home curfew, using cellular radio telephone technology. Stacey had been briefly imprisoned abroad in his former role as a foreign correspondent and had for several years served as a Prison Visitor in England. He followed his presentation to the Home Office with a letter to The Times (published October 6, 1982) outlining the proposal and his immediate formation of the Offender's Tag Association, composed of electronic scientists, penologists and prominent citizens. The term 'tagging' thus entered the vocabulary in the penal context. In March 1983 the Offender's Tag Association held a national press conference. Later that year, a district court judge, Jack Love, persuaded Michael Goss, a computer salesperson, to develop a system to monitor five offenders in...
Alberto, New Mexico. Judge Love was supposedly inspired to act based upon a storyline in a Spider-man comic, specifically the newspaper comic strip version where the Kingpin puts an electronic bracelet on the superhero primarily to follow his movements.[3] This was probably the first court-sanctioned use of electronic monitoring.

Until the widespread adoption of cellular and broadband internet networks in the mid-1990s, electronic monitoring devices were typically home-based, dependent on a dedicated land line, and able to report only whether or not the criminal being tracked was remaining at home. This was useful for criminals on work-release, parole, or probation, for example DWI offenders who were allowed to leave home to go to work during daytime hours but had to return home and remain there after a certain time of the evening. More recent technology such as GPS and cellular networks have permitted courts to order more specific restrictions, such as permitting a registered child sex offender to leave his home at any time of day, but alerting authorities if they come within 100 metres of a school, park, or playground.

4. THE DEVICE

The current UK G4S administered ankle device is made up of a black band, approximately 2.5 cm in width, with an 8 cm long x 3 cm wide grey 'heart'. Along the length of the black strap at the edges run 2 length of fibres which only appear to add strength to the black strap. Additionally, and presumably to record any deliberate cutting of the strap, runs what appears to be a 10-or-so core fibre optic cable which pulses roughly every[9] 1/2 second. Each ankle device has a serial number and a telephone number imprinted on it, should one need to contact the control room.

5. ALGORITHM

Based on previous comments, the only remained action is that central computer receives quantity sent from GPS and shows its corresponding point in two dimensional space of computer displayer digital map. To apply this stage[8], already provided digital map is required in order to test points and to adapt them sent from GPS with inner points of the map Data Base (for instance, shiraz city avenue map). All of the maps prepared by different organizations in IRAN so far, have used LAMBERT projection system. So to implement AVL system in IRAN country, the usage of formulations including LAMBERT system for converting coordinate must be applied. To perform the conversions, based on data sent from GPS (figure No.1), as one float number longitude, latitude and altitude could be calculated. For instance, the number 5247.861 converts to 52 degree, 47 minute and 51.66 second. Now obtained latitude and longitude should be converted to two amounts PHY (latitude) and LAMBDA (longitude) with following formulation written with MATLAB software [7].

6. CONCLUSION

Tagging fish with electronic tags can generate numerous biases, the extent of which and duration of varies between species and environments. However, successes have been associated with attachment procedures tailored to the species of interest during the course of feasibility studies. Scientists using electronic tags are increasingly selecting surgical techniques, mainly because adverse effects decrease over time. Surgery, however, involves longer training and more practice than is required for other attachment procedures. In all tagging studies, attention should be paid to the size of the tag since excessive added weight is the most widely cited adverse bias. Fish species have anatomical, physiological and behavioural peculiarities that make them unique, and it is thus worthwhile designing a feasibility study before implementing any field research, both for animal welfare reasons and reliability of results. Increasing[5] attention should be dedicated to lesser studied factors, such as attachment threads, closing material, tag shape and coating, pre- and postoperative care and confinement, since these may condition the actual success of tagging, and duration of post-tagging perturbation. Identifying the duration of the post-operative perturbation is a sensible goal in any feasibility study, especially since electronic tags can now be programmed to transmit or collect data after delayed starts. DSTs can also be used to record postoperative effects, and thus observe directly how long the process lasts.

7. FUTURE SCOPE

Automatic Packet Reporting System (APRS) is an amateur radio-based system for real time tactical digital communications of information of immediate value in the local area.[1] In addition, all such data is ingested into the APRS Internet system (APRS-IS) and distributed globally for ubiquitous and immediate access. Along with messages, alerts, announcements and bulletins, the most visible aspect of APRS is its map display. Anyone may place any object or information on his or her map, and it is distributed to all maps of all users in the local RF network or monitoring the area via the Internet. Any station, radio or object that has an attached GPS is automatically tracked. Other
prominent map features are weather stations, alerts and objects and other map-related amateur radio volunteer activities including Search and Rescue and signal direction finding. APRS has been developed since the late 1980s by Bob Bruninga, call sign WB4APR, currently a senior research engineer at the United States Naval Academy. He still maintains the main APRS website. The acronym "APRS" was derived from his call sign.

8. REFERENCES


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