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IoT based Location Tracking System for Advanced Electric Vehicle

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Abstract-The Location Tracking System is a critical component of modern technology, playing a pivotal role in various industries and applications, including transportation, logistics, emergency services, and personal navigation. This abstract provides an overview of the key components and functionalities of such a system, emphasizing its significance, challenges, and potential benefits. The system permits localization of a portable tracked unit and transmitting the position to the tracking centre. The GPS tracking system consists of portable tracked device attached to a person, vehicle or any asset, and the tracking center where the portable device's location should be monitored. The mobile tracked device receives its coordinates from the GPS and sends these coordinates as SMS via GSM modem to the tracking centre, which is simply a personal computer with many interface programs to display the location on Google maps using free version of Google Maps application programming interfaces.

Keywords: Vehicle Controlling, Monitoring and Tracking, Road Network, Electric Vehicle, Smart Grid, Path Adaptation

1. INTRODUCTION

A Location Monitoring System is nothing but a system that will monitor the location of any object and will send the updates about the location to the user. The object can be anything or anyone- vehicle, old people, and hikers and so on. Here the user may
want to set a boundary region of the object. If that object goes beyond that specified boundary Intentionally or unintentionally, our system will give updates to the user about the where about of the object. If suppose the user is not connected to the internet, there is also a facility of receiving an update Through text message or SMS. The GPS is a "constellation" of 24 well-spaced satellites that orbit the earth and make it possible for people with ground receivers to pinpoint their geographic location. The location accuracy is anywhere from 100 to 10 meters for most equipment. Accuracy can be pinpointed to within one meter with special military-approved equipment. GPS equipment is widely used in science and has now become sufficiently low-cost so that almost anyone can own a GPS and many do in a smartphone, tablet or GPS navigation device.[1]

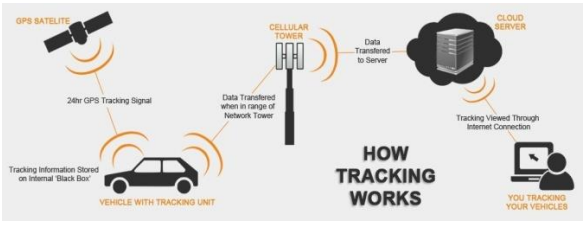

Figure1: Vehicle Controlling, Monitoring and Tracking System

GPS tracking is invaluable for police, fire fighters, military personnel and large courier businesses. Many of these use automatic vehicle locator (AVL) systems. AVL systems generally include a network of vehicles that are each equipped with a mobile radio receiver, a GPS receiver, a GPS modem and a GPS antenna. This network connects with a base radio consisting of a PC computer station as well as a GPS receiver and interface. GPS uses interactive maps rather than static map images on the Web. AVL systems can be used to increase the accountability of field personnel and boost the efficiency of a company's dispatching procedure through tracking and communication.

Other GPS tracking technologies include GPS guns that law enforcement can fire at a fleeing car, avoiding a dangerous pursuit. In some places, law enforcement representatives also use GPS dust, which consists of GPS trackers so small they

might be blown or rubbed on a target's clothing.GPS devices in smart-phones and other mobile devices are often used to track employee location. Privacy advocates warn that the technology can also make it possible for advertisers, government, hackers and cyber-stalkers to track users through their mobile devices.[2]

The mobile tracked device receives its coordinates from the GPS and sends these coordinates as SMS via GSM modem to the tracking centre, which is simply a personal computer with many interface programs to display the location on Google maps using free version of Google Maps APIs (application programming interfaces).[3]

2. LOCATION TRACKING SYSTEM

Traditional tracking systems use Global Positioning System and Global System for Mobile Communication i.e. GPS-GSM based systems for tracking the location of any object, say a vehicle. Global Positioning System contains a module that receives the GPS signal using which it will calculate the co-ordinates. These co-ordinates will then decide the location of the vehicle. The GSM modem relays this calculated location to the user through an SMS.

2.1LOCATION TRACKING SYSTEM ARCHITECTURE

The technology can pinpoint longitude, latitude, ground speed, and course direction of the target. Other GPS tracking technologies include GPS guns that law enforcement can fire at a fleeing car, avoiding a dangerous pursuit. In some places, law enforcement representatives also use GPS dust, which consists of GPS trackers so small they might be blown or rubbed on a target's clothing

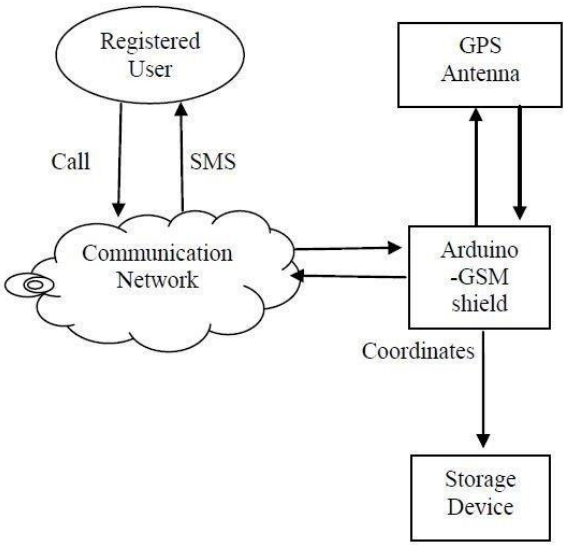

Figure2: Architecture of Real-time GPS tracking system

A. Block Diagram

Automobiles are necessary for the movement of goods from one location to another. Consumers may face several problems as a result of delays in the delivery of goods.[6] This delay may be due to drivers choosing incorrect or longer routes when delivering. To avoid these challenges, the Global Positioning System (GPS) is increasingly being used for management of vehicle fleets, recovery of stolen vehicles, mapping and surveillance

3 METHODOLOGY

The GPS/GPRS/GSM SIM900A module get communicate with ELB-REV4 iSCADA. The longitudes and latitudes of the present path caused by GPS navigation get in comparison with the stored longitudes and latitudes within the file format inside the database of iSCADA. If longitudes and latitudes not complement the stored one then wrong path recognition alert massage can get delivered to vehicle's owner mobile. Likewise, safety mechanism supplied by system. Vehicle's right and wrong path tracking algorithm using Smartphone

3.1 Implementation:

Continuously monitoring and monitoring the school vehicle at real-time atmosphere using web site in Smartphone and when the automobile chooses wrong path then system provide the aware of the owner's Smartphone as well as on device pi's sound system. Storing and upgrading the actual time database of the vehicle like its Speed, Time, Location, and Date which is helpful just in case of car thievery recognition.

The suggested system would get controlled with the aid of ELB-REV4 iSCADA which placed within the vehicle. Even the longitudes and latitudes of the present path received from Gps navigation can get delivered to the server with the aid of GPRS which helps you to track the vehicle's current location on the internet page using Smartphone. For monitoring the automobile, the proposed system provides login facility on web site for vehicle's owner, students as well as their parents. Also proposed system provides student's safety with the aid of DS18B20temperature sensor and gas leakage sensor MQ6. These sensors get interface with raspberry pi. When the temperature inside the vehicle crosses the value or LPG gas get leakage inside, he vehicle then your alert message will be delivered to the vehicle's owner.. The proposed system provides more safety and secure solution using android application for wrong path alert. The vehicle owner's Smartphone having an android application that provides the information regarding selection of path from A to B through which the vehicle supposed to travel.

At first vehicle's owner trace the decided path A to B on android application that gives longitude and latitude of that path. Then android application saves that longitudes and latitudes of traced path in a file format such that owner can send that file to the raspberry pi database using Bluetooth or USB port. And hence the proposed system can process further on that data. Now whenever driver drives the vehicle on the owner's decided path i.e. A to B, GPS/GPRS/GSM SIM900A module inside that vehicle sends the longitudes and latitudes of current location to the raspberry pi through USB interface. Now using file system programming, the current longitudes and latitudes received from GPS. [1]

3.2 Global positioning system:

(GPS) works by utilizing a network of satellites in Earth's orbit to determine the precise location, velocity, and time information of GPS receivers on or near the Earth's surface. Here's a simplified overview of how GPS works:

Figure 3: GPS for Location Tracking

3.2.1 Satellite Constellation: The GPS system consists of a constellation of at least 24 satellites orbiting the Earth. These satellites are spread across six orbital planes and are positioned in such a way that at least four satellites are visible from any point on Earth at any given time.

3.2.2 GPS Receiver: A GPS receiver is a device that you carry or install in your vehicle or smart phone. The receiver is equipped with a GPS antenna and a processor.

3.2.3 Triangulation: To determine your precise location, the GPS receiver needs signals from at least four GPS satellites. Each satellite continuously broadcasts signals that include the satellite's location and a timestamp. The GPS receiver listens for these signals.

3.2.4 Signal Travel Time: The GPS receiver calculates the distance between itself and each of the four or more satellites by measuring the time it takes for the signals to travel from the satellites to the receiver. Since the signals travel at the speed of light, the receiver can calculate the distance based on the time delay.

3.2.5 Trilateration: Once the GPS receiver has determined its distance from at least four satellites, it uses a mathematical technique called trilateration. The trilateration involves finding the intersection point of spheres (or spheres in three dimensions) to determine the receiver's exact location in space.

3.2.6 The intersection of these spheres represents the latitude, Longitude, and sometimes altitude (if there are enough satellites and the receiver supports it) of the GPS receiver.

3.2.7 **Position Calculation:** The GPS receiver's processor performs the necessary calculations to convert the distance measurements into geographic coordinates (latitude and longitude) and may also calculate altitude.

3.2.8 **User Output:** The calculated coordinates are then displayed on the GPS device's screen, showing your current location on a map or providing navigational instructions.

3.2.9 **Continuous Update:** The GPS receiver continues to receive signals from the satellites and updates your position in real-time, providing continuous tracking and navigation information as you move.

3.2.10 **Outdoor Recreation:** GPS is popular among outdoor enthusiasts for activities such as hiking, camping, and geo caching. It helps users track their routes, mark waypoints, and ensure they can find their way back.

3.2.11 **Precision Agriculture:** Farmers use GPS technology for precision agriculture. GPS-guided tractors and equipment can optimize planting, fertilizing, and harvesting operations, leading to increased efficiency and reduced resource use.

3.3.1 Design:

There are already a lot of applications which use the geo-positioning. Garmin, one of the famous GPS manufacturers, proposes maps of almost every country in the world ready to be downloading into their panel of GPS devices.

Different kind of applications for different kind of public road maps and tracking, topologic maps for Technical job like geologist (for instance), light's map for pilots, etc.

Also it exists, for mountain activities like free ride, hacking, and those automatic signalling systems which switch on as soon as the rider gets caught by an avalanche for example. It transmits a radio signal to the closest relay and indicates the exact position of the victim.

It helps for the search and often save lives.[4] The portable Tom-tom GPS proposes a full navigation system with vocal indication. The list of geo-positioning applications is huge and a simple search on the Internet gives hundred web sites talking about the topic this real-time technology enables businesses to ascertain that the drivers are driving organization's vehicle safely, track accurate location and movement of commercial vehicles.

Our GPS system also provides a comprehensive set of graphical reports such as total distance travelled, idling time, over speeding, stoppages and utilization. It also imparts an additional feature of live tracking and provides the feature of customized report generation as per client's requirements.[5] The GPS vehicle tracking system sends the vehicle's information using GPRS connectivity and GSM-based signals.

The continuous global coverage capability of GNSS permits aircraft to fly directly from one location to another, provided factors such as obstacle clearance and required procedures are adhered to. Incorporation of a data link with a GNSS receiver enables the transmission of aircraft location to other aircraft and to air traffic control (ATC). This function, called automatic dependent surveillance (ADS), is in use in various classes of airspace.

In oceanic airspace, ADS is implemented using a point-to-point link from aircraft to oceanic ATC via satellite communications (SATCOM) or high-frequency data link. Key benefits are ATC monitoring for collision avoidance and optimized routing to reduce travel time and, consequently, fuel consumption.[7]

Autonomous vehicles equipped with integrity augmentation systems offer the potential to increase safety, efficiency and sustainability of airport ground operations. The model predictive behaviour of these systems supports a timely detection of any deviations from the Required Navigation Performance (RNP), producing useful alerts for onboard mission management.

Firstly, the system architecture of a Navigation and Guidance System (NGS) for autonomous airport surface vehicle operations based on Global Navigation Satellite System (GNSS) measurements is described. Subsequently, an integrity augmentation module is implemented in the NGS by modelling the key GNSS signal degradation phenomena including masking, multipath and signal attenuation. [8]

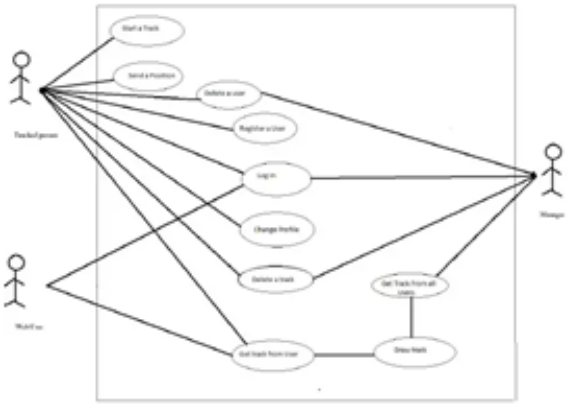

Figure 4: GPS use case diagram

4. RESULT

Global Positioning System to determine the precise location (Longitude &Latitude) 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 analyzing the track later.

Figure 5: GPS Tracking System can be used to track things and people. [4]

4.1 System testing:

System testing of software or hardware is testing conducted on a complete, integrated system to evaluate the system's compliance with its specified requirements. System testing falls within the scope of black box testing, and as such, should require no knowledge of the inner design of the code or logic. As a rule, system testing takes, as its input, all of the "integrated" software components that have successfully passed integration testing and also the software system itself integrated with any applicable hardware system. The purpose of integration testing is to detect any inconsistencies between the software units that are integrated together (called assemblages) or between any of the assemblages and the hardware. System testing is a more limited type of testing; it seeks to detect defects both within the "inter-assemblages" and also within the system as a whole

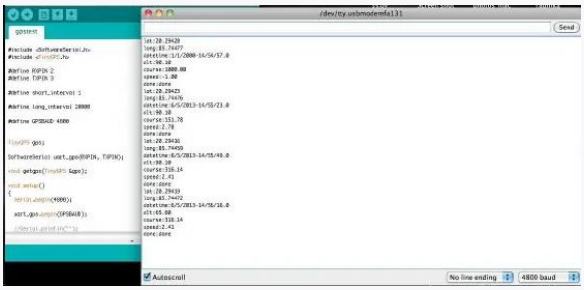

Figure 6: System programming and testing on arduino IDE

This is a screenshot of Serial Monitor tool of Arduino environment. It's baud rate is set to 4800. It shows that the GPS Module is working as expected and the Arduino is sending the data to the serial port. One set of data is received every 20seconds. The position data is accurate. Date and time are not correct at first, but then after a few minutes it starts sending correct date-time

5. CONCLUSION

The proposed system plays a huge role instantly tracking and monitoring of car by upgrading vehicle real time information around the server side after certain interval of your time in order to supervised vehicle continuously. The suggested system hence made use of Smart phone technology by supplying safety and secure travelling towards the traveller using wrong path alert mechanism. Whenever driver drives vehicle around the wrong path or just in case of vehicle's accident situation happens, the suggested system provides the vehicle's current location, speed towards the vehicle owner's mobile. Hence this advantages to track the automobile as soon as possible. Student's safety mechanism also will get

provided using temperature and LPG gas leakage sensors. Within this certain situation, according to student's safety concern, the suggested system also gives alert massage on student parents mobile so that parents also learn about their children's safety.

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