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GPS BASED VEHICLE TRACKING SYSTEM

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***Abstract*—**The ability to track vehicles is useful in many applications including security of personal vehicles, public transportation systems, fleet management and others. Furthermore, the number of vehicles on the road globally is also expected to increase rapidly. Therefore, the development of vehicle tracking system using the Global Positioning System (GPS) is undertaken with the aim of enabling users to locate their vehicles with ease and in a convenient manner. The system will provide users with the capability to track vehicle remotely through the mobile network. This paper presents the development of the vehicle tracking system's hardware prototype. Specifically, the system will utilize 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 GSM module and AT89C51 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**.**

***Index Terms*— Global Positioning System(GPS),GSM modem, Vehicle tracking system**

INTRODUCTION :

1.1 The need for GPS based vehicle location Tracking System.

In today's fast paced world, having the correct information at the right time is crucial. Any person or organization that owns a large fleet of vehicles faces the problem of not knowing where each and every vehicle in the fleet is at any given time. Let's consider the example of a bus based public transport system. Fleet management is the most important function for any bus based public transport organization. This involves scheduling and planning of routes and at the same time ensuring that the buses run as per the schedule. This becomes exceptionally difficult in bigger cities where the number of buses involved is very high and all these buses perform repetitive trips. The failure of management in ensuring timely operations has resulted in the bus

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system becoming unpopular and shift in traffic to the personalized modes of transport. However GPS based vehicle tracking systems provide the possibility of monitoring the movement of vehicles at an affordable cost.

1.1.1 Vehicle tracking, the essence of fleet management

Management of a bus fleet essentially involves ensuring timely arrival and dispatch of buses. To go a step further it also involves ensuring that the bus touches the enrooted points as per schedule. Simple though this may sound, the magnitude of this can be gauged from the fact an Urban Transport Corporation in a city like Bangalore has 2300 buses and about 33000 trips, and these trips pass through repeatedly about 1000 bus stops in the city. In the conventional system some sort of vehicle tracking is carried out manually by posting traffic controllers/timekeepers at some important points. This manual tracking doesn't give 100% coverage, it totally depends on human alertness and is thus prone to errors, it is very expensive, it is not tamper-proof, and the data generated in the form of entries in the registers do not lend themselves easily for computer processing. A vehicle tracking system can thus be defined as a system, which enables the fleet operator to find out the location of the vehicle throughout the journey of the vehicle, against time. Apart from utilizing the data generated by the vehicle tracking system for Vehicle Tracking, the essence of Fleet Management enforcing the schedule of the bus, this data also provides important inputs for decision making. The system facilitates computation of exact distance traveled in a given time span, computation of the speed of the bus at a given location, analysis of the time taken by the bus to cover certain distance and so on. It becomes a very powerful tool in case the Transport Corporations are hiring private buses, as computation of the distance traveled, based on which payments are made becomes totally objective.In this project, the main objective is to find a simple and practical solution to provide up to date location information for emergency vehicle, delivery trucks, freight trucks, service vehicles, private use, etc.

In turn this,

- Improves schedule adherence and transfer coordination.
- Helps control vehicle operation.
- Reduces overall labor.
- Effective tracking of off-route buses as well as para transit vehicles and drivers.
- Improves communication between supervisors, dispatchers, and operators.

Establishing a full duplex communication systems between a GPS system fitted in a vehicle and PC based tracking software which when paired with GSM MODULE can give a limitless range of communication.

- The GPS system in the vehicle transmits its information regarding the location to a microcontroller, which processes the data.
- The GSM module of the combine module is interfaced with the microcontroller at the transmission end, which sends the information to a web server via GPRS.

- The information is received by the web server which is then recorded into the database and display on the map.

1.1.2 Who can use GPS based vehicle tracking technology?

Any organization that maintains a large fleet of vehicles and wants accurate real-time information about vehicle position can use this technology.

This includes:

- Transport companies
- Car rental agencies
- Law enforcement agencies
- Sea-port authorities

There are numerous examples of GPS based tracking systems in use all over the world. Some of them are:

The Bangalore Metropolitan Transport Corporation (BMTC) uses this technology to track its fleet of buses. In Alaska, this technology is being used to enhance monitoring of fishery activities, enforcement of fishery management regulations, and to further the conservation goals and objectives of the National Marine Fisheries Service

Who can use GPS based Vehicle Tracking technology?

It is being explored as an alternative to human observer coverage of positions, of vessels participating in the Pollock fishery. The areas in which these fisheries operate are remote, and the weather is frequently poor. Traditional methods of enforcement, such as aerial surveillance, are difficult and costly. The Alaska Enforcement Division (AED) of the National Marine Fisheries Service (NMFS) is making use of this technology for the ground fish fishery in Alaska. The purpose is to assist NMFS in the implementation and management of its enforcement efforts and to monitor fishing vessel compliance with

NMFS' rules and regulations. NMFS wishes to monitor vessels fishing inside, and in proximity to, areas designated as Stellar sea lion critical habitat.

- Shanghai Port, China uses this technology for navigation and monitoring of ships. Aside from tracking ships, this can also find use in other applications, such as navigating taxis.

1.1.3 Application of GPS based vehicle tracking technology

- Covert GPS tracking and law enforcement.
- Stolen asset recovery and theft prevention.
- Hire car monitoring, over speed detection and theft recovery.
- Commercial vehicle monitoring and driver performance monitoring.
- Bus and passenger vehicle timetable validation and breakdown monitoring.
- Preparation of efficient transport schedules.

2. SYSTEM OVERVIEW:

2.1 **Overview of global positioning system (GPS)**

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2.1.1 GPS is a satellite navigation system

- GPS is funded by and controlled by the U. S. Department of Defense (DOD). While there are many thousands of civil users of GPS world-wide, the system was designed for and is operated by the U. S. military.
- GPS provides specially coded satellite signals that can be processed in a GPS receiver, enabling the receiver to compute position, velocity and time.
- Four GPS satellite signals are used to compute positions in three dimensions.

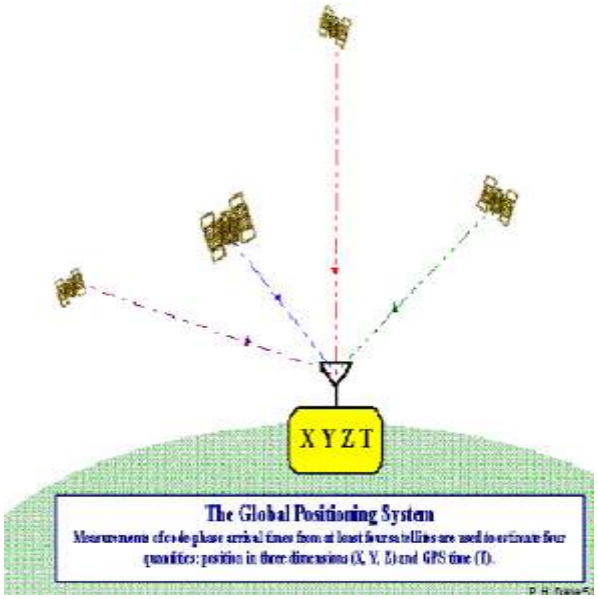

Figure 1.1: GPS Coordinates

2.1.2 Space segment

- The Space Segment of the system consists of the GPS satellites. These space vehicles (SVs) send radio signals from space.
- The nominal GPS Operational Constellation consists of 24 satellites that orbit the earth in 12 hours. There are often more than 24 operational satellites as new ones are launched to replace older satellites. The satellite orbits repeat almost the same.
- Ground track (as the earth turns beneath them) once each day. The orbit altitude is such that the satellites repeat the same track and configuration over any point approximately each 24 hours (4 minutes earlier each day). There are six orbital planes (with nominally four SVs in each), equally spaced (60 degrees apart), and inclined at about fifty five degrees with respect to the equatorial plane. This constellation provides the user with five and eight SVs visible from any point on the earth.

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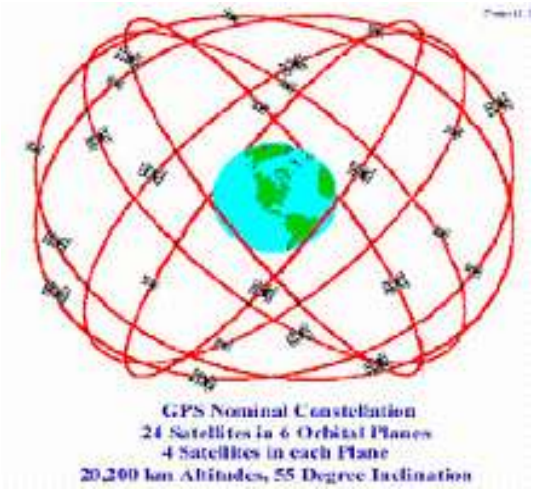

Figure 1.2: GPS Nominal Constellation

Figure 1.3: GPS Network

3. PROJECT DETAIL

3.1 Specifications

3.1.1 Vehicle tracking system specifications

- Tracking Accuracy: 15 m.
- Communication Link: 900/1800 MHz GSM modem.
- Position Update Rate: User Programmable (15 sec. to 24 hrs.)

3.1.2 Hardware specifications

- Operating Voltage: 12V – 28V DC. Standard 12V automotive battery ideally suited.
- Power consumption: Peak Power Consumption: 3W.
- Standby Power Consumption: Less than 250mW.
- Operating Temperature range: -10 to +55 degrees C.

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3.2 System description: The building blocks of the vehicle location (Tracking) System

The system consists of two parts:

1.Vehicle Location System:

This is the mobile part of the entire tracking system that I have developed. This consists of the GSM-GPS card, the GSM antenna & the GPS antenna that is fitted on the vehicle. The AVL system communicates with the Control Station via SMS using an existing GSM network.

2.Monitoring Station:

This is the stationary part of the system. It consists of GSM card. This part of the system is the central monitoring station.

3.3 Block Diagram Description

3.3.1 VL system

- GPS Receiver: Receives signals from satellite and calculates the latitude, longitude and altitude of the vehicle**.**
- MCU: The MCU or micro-controller is responsible for communication between the GPS receiver and the GSM modem.
- GSM Modem**:** Responsible for establishing communication between control station and AVL system.
- Vehicle Interface**:** Consists of hardware that can be used to monitor various parameters of the vehicle.

3.3.2Monitoring station

- GSM Network: The cellular operator's network. This is the medium that links the AVL system to the Control Station.
- GSM Modem**:** Responsible for establishing communication between control station and AVL system**.**

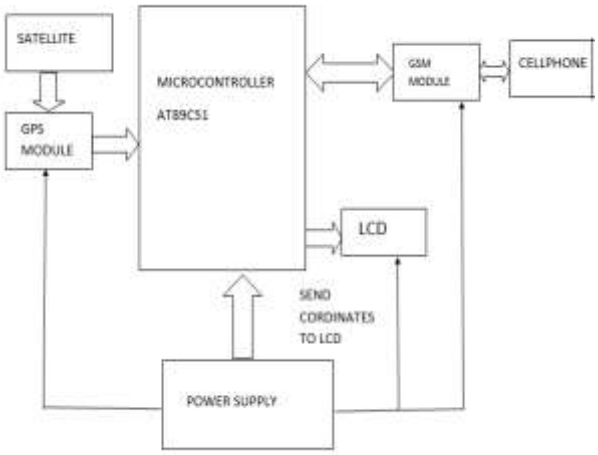

Figure 1.4 : block diagram of gps tracking vehicle system

4. Advantages:

1. Improves schedule adherence and transfer coordination.
2. Helps control vehicle operation.
3. Reduces overall labor.
4. Effective tracking of off-route buses as well as para transit vehicles and drivers.
5. Improves communication between supervisors, dispatchers, and operators.

5. Disadvantages

1. GPS Location can be inaccurate sometimes.
2. Battery might drain out.
3. Employees might feel offended.
4. Environmental conditions.
5. Monitoring travel data might consume time and labour.

6. Applications

1. Asset Tracking.
2. Trailer Tracking and Surveillance.
3. Tracking your possessions and near ones.
4. Ambulance Tracking and Emergency Medical Services Fleet.

7.Conclusion:

1. Covert GPS tracking and law enforcement.
2. Stolen asset recovery and theft prevention.
3. Hire car monitoring, over speed detection and theft recovery.
4. Commercial vehicle monitoring and driver performance monitoring.
5. Bus and passenger vehicle timetable validation and breakdown monitoring.
6. Preparation of efficient transport schedules.

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