



:AeroMap  
:P.O.Box 22751 :Tel:+97317530100 :info@aeromapss.com  
:Kingdom of Bahrain :Fax:+97317533513 :www.aeromapss.com

# VEHICLE TRACKING SYSTEM (VTS)

**Aeromaps Technology Systems**



**AND**

**Digital Planning Information Technology Solutions,  
DPITS**



## Content

- 1- What is AVL or VTS?
- 2- Components of AVL
  - 2.1 GPS Satellite
  - 2.2 Mobile GPS Unit
    - 2.2.1 ENFORA MTG/MTGL GSM Unit
    - 2.2.2 Quake Q5500D+ Satellite Unit
    - 2.2.3 SkyWave DMR 200 Satellite Unit
    - 2.2.4 SureLinx8100 Satellite Unit
  - 2.3 Communication Network
    - 2.3.1 GSM Network
    - 2.3.2 Satellite Network (INMARSAT D+)
  - 2.4 Application
    - 2.4.1 Software
    - 2.4.2 Maps
    - 2.4.3 Real Time Events
- 3- Different Types of implementation
  - 3.1 Stand alone Station
  - 3.2 Stand alone Server
  - 3.3 Through Our Server
  - 3.4 Web Base AVL

## 1- What is AVL?

**AVL** stands for **Automatic Vehicle Location** which is a term used for naming the system able to track vehicles, vessels, and mobile assets such as trailers, containers, and equipment, plot their coordinates into one or more computer generated maps and be able to interact with them in several ways.

In AVL business, all vehicles in a fleet must have a unit, or **GPS Vehicle Unit** which can report its position to the **Base Station** over a cellular communications network or Satellite Network (AMPS, TDMA, CDMA, GSM, INMARSAT, etc).

With **Base Station** you can monitor a virtually **unlimited number of vehicles**, so you can raise your number of customers without any trouble using our turnkey solution.

All Vehicles can now be secured and monitored 24 hours a day by his owner with Vehicle Tracking System



## 2- Components of AVL:

AVL or VTS consist of four major components which are:

- 2.1 **GPS Satellite:** The **Global Positioning System (GPS)** is a precise satellite-based navigation system providing **three dimensional positioning, velocity and time** information all on a twenty four hour basis. GPS can be used in all types of weather, any place in the world. It offers better **performance** than any other navigation system available now or in the foreseeable future.
- 2.2 **Mobile GPS Unit:** is the hardware which is installed within the vehicle and capture the data received from GPS satellite as well as vehicle status and send it to the base station (tracking station) through GSM towers or Satellite. We are providing many types of devices, some works with GSM only, some works with Satellite only using INMARSAT D+ protocol, others works with booth GSM and Satellite networks, which are:

### 2.2.1 ENFORA MTG/MTGL GSM Unit



Spider MT-GL



Spider MT-G

Our GSM-Based devices manufactured by Enfora L.P. one of the world's leaders in enabling GSM/GPRS technologies. Enfora commit to the highest international standards in term of quality and reliability. All GSM-Based modem has the following common features:

- High quality product (E-mark, CE-mark certified).
- Time/Distance reporting.
- Voice Communication.
- OTA programming.
- In-vehicle internet access.
- GPS data available locally for in-car navigation systems.
- Virtual odometer and GPS odometer.
- Packet assembler/de-assembler(PAD).



## WE offer two models of Enfora's AVL devices:

1. **Enfora Mobile Tracker (MT-GL):** Get all the standard AVL features in high quality device with affordable price.
2. **Enfora Mobile Tracker (MT-G):** for the customers who require advanced telemetry options like: temperature and fuel level sensing or an AVL application with a lot of features.

The most economical and powerful wireless IP (GPRS/GSM) ruggedized mobile tracking device available today. The Spider™ MT-G is the premier solution for your AVL Applications.

- The MT-G includes built in TCP/IP and UDP capability that allows for complete flexibility for a user in customizing a mobile tracker application.
- GPS data is made available on-board the MTG for transmission to a centralized operations center or web page or to a localized computer or MDT.
- The wireless data and voice port are also available for the localized user for e-mail or voice communication.

## Spider MT-G/ MT-GL Features:

1. **Over The Air Connection:** The Spider MT-G allows a user to configure/setup the system parameters Over The Air (OTA). OTA configuration data is sent with UDP-API header. In case the GPRS network not available the commands can be sent by SMS.
2. **Serial Connection:** A RS232 9-pin serial port is provided on the Spider MT-G for the user to read, write, or modify the data parameters, surf the internet, or make SMS or voice call.
3. **Input/Output Setup:** The Spider MT-G supports **five (two in MT-GL)** General Purpose Input/Output (GPIO) lines and **two** analog to digital input lines. The GPIO lines can be configured for input or output. A Dynamic Input/Output (DIO) system is created to provide a flexible way for the user to configure the IO lines.

For example: a GPIO line configured for input can be configured to send a GPS message or an IO message to a remote host when the current state of that IO line changes. The user can pick and choose the header and message associated with the individual IO line.

**The IO lines can be implemented to achieve the following feature:**

- a. **Panic button:** when the driver pushes this button the device will send an alert to the control center. In addition to the ability to call predefined emergency number.
- b. **Engine Shutdown feature:** the control center has the privilege to remotely turn the engine on or off.
- c. **Door open/close notification:** the device has the capability to send notification to the control center or to fleet supervisor (by SMS) when the trailer door has been opened or closed.
- d. **Others:** like air-conditioner status, oil pressure indicator, engine temperature indicator, remote security system arm/disarm, remote central lock activate/deactivate ...etc.

In general, the IO line can be implemented to monitor any event/equipment on the vehicle or to control any event/equipment on the vehicle.

The ADCs of the MT-G are 10-bit resolution. The customer can hook any type of analog sensor/transducer to one of them. We already designed sensors to meet most customers' requirements like temperature sensor, fuel gauge...etc.

4. **Maximum Speed Exceeded:** The Spider MT-G allows a user to configure sending of GPS message over the air to a remote user when a set speed is exceeded.
5. **Geo-Fencing:** The Spider MT-G allows a user to configure maximum of 25 circular shape geo-fences. GPS message will be sent to a remote user whenever a device enters or exits a geo-fenced area.
6. **GPS Odometer:** The Spider MT-G maintains GPS Odometer (distance been traveled) history for four days starting with the current day. Distance is displayed in hundreds of meter per hour. Distance traveled is updated continuously but is saved on top of every hour or during an Ignition Off event – given the power save mode (section 5.9) is configured. Saved distance history is maintained through a power cycle (removal of car's battery).
7. **Time and/or Distance updating:** The Spider MT-G sends GPS messages OTA to a remote user when time or distance settings are violated.
8. **GPS Read:** The Spider MT-G allows a user to read the device's current GPS position (NMEA messages only).
9. **Power Save Mode:** The Spider MT-G allows a user to configure the device for low power mode when auxiliary power is removed (i.e. when the engine turned off).
10. **Store GPS Messages:** This feature provides the user with the capability of storing GPS messages and retransmitting it later when the Spider MT-G is out of GSM/GPRS coverage area, voice call is in progress, SMS messaging is in progress, or circuit switched data transfer is in progress. The Spider MT-G can store up to 40 Kbytes of GPS data.
11. **UDP PAD:** The Spider MT-G allows a user to initiate UDP PAD data session.

12. **Remote Server Reporting:** The Spider MT-G has the ability to report GPS messages and events via UDP/IP packets to remote servers. The MT-G can report messages to a maximum of 10 server IP addresses. Event messages can be acknowledged via a UDP command sent to the MT-G to stop sending of the same message.
13. **Sending GPS data over SMS:** The Spider MT-G allows a user to configure maximum of 5 destination addresses where GPS data can be sent. Destination address can be a phone number or an email address.
14. **GPS Idle Trigger:** The Spider MT-G maintains GPS Idle count. The Idle count is incremented every second that the unit has not moved and is stationary in one position. The user can elect to receive a GPS message when the idle count exceeds. Idle count is measured in seconds.
15. **GPS Invisible Trigger:** The Spider MT-G maintains GPS Invisible count. The Invisible count is incremented every second when the unit does not have valid GPS data. The user can elect to receive a message when the Invisible count exceeds a set period. Invisible count is measured in seconds.

### 2.2.2 Quake Q5500D+ Satellite Unit



If your vehicles spend more than 70 percent of their time out of GSM network coverage and you need to track them in real time, the satellite-based devices are your best choice. We offer satellite modems manufactured by Quake global, a world leader in satellite terminals making that designed specially for the harsh environment of the remote areas. Typical application would be in oil & gas industries, security applications, lone workers safety. we adapts Inmarsat D+ satellite network, operated by Satamatics, the best choice for AVL applications.

The Q5500D+ is specially designed for applications operating over the INMARSAT Satellite network. The system provides two-way global data communications.

The Q5500D+ module has been designed to ensure reliable operation in remote and severe environments, including marine applications and asset tracking.

User programmability is a key feature of this unit. The Q5500D+ can be programmed. Individual inputs can be specifically configured to continuously monitor sensors and report at selected intervals. Alarm conditions preprogrammed so the unit reports the condition automatically and immediately. Reports can be generated on a regular schedule, by exception only reporting, or a combination of both.

### 2.2.3 SkyWave DMR 200 Satellite Unit



The DMR-200 series Inmarsat D+ terminals set the industry standard for reliable burst-messaging satellite communications with low total cost of ownership. The D+ network operates over Inmarsat's high quality international satellite constellation, and is the choice for mobile and stationary asset security and management applications deployed anywhere in the world.

The DMR-200D provides flexibility and integration in a compact form factor. Burst messaging capabilities combined with a flexible API enable the DMR-200D to be quickly deployed in a wide range of asset security and management applications on land, at sea, or in the air. Four configurable I/O lines provide monitoring and control capabilities, eliminating in many cases the requirement for additional controller devices by utilizing the DMR-200D as a complete remote monitoring and control solution. Variants with and without GPS cost-optimize deployment in both mobile and fixed applications. Complementing its hardware versatility, advanced software features such as geo-fencing, in conjunction with a powerful scripting language, significantly increase the range of uses for the DMR-200D.

#### Key Benefits

- Reliable global coverage
- Low total lifecycle cost
- Easy to install
- Painless integration with application software
- Feature options balance capital and functional Needs

#### KEY FEATURES

- Compact & Inconspicuous
- Prioritized communications
- Exception-based reports
- Over-air programming
- Integrated input/output
- Multiple geo-fences
- High-speed GPS correction
- Data logging
- Low power modes
- Inmarsat type approved
- Ruggedized, environmentally sealed packaging
- Data logging
- Highly reliable network

## APPLICATIONS

- GPS reporting for asset tracking of vehicles, equipment or containers
- Ability to monitor sensors and actuators for conditions and perform report actions such as automatic door or engine locking
- Vessel monitoring or ship security alert systems to meet international legal and safety requirements
- Commercial fishing, navigational or environmental weather buoy applications
- Logistics applications for ensuring efficient route planning, fuel consumption, vehicle adherence to regulations
- SCADA, telemetry and remote monitoring for cathodic protection and field equipment monitoring such as storage tanks, pipelines, compressors or agricultural equipment

### 2.2.4 SureLinx8100 Satellite Unite



The SkyWave SureLinx 8100 from Network Innovations is the world's first D+/GPRS integrated mobile device. It sets the standard for reliable asset tracking and management systems at low total cost. The 8100 ensures that your applications are delivered with lowest cost routing using GPRS, and when your assets are out of cellular coverage, automatically switches to Inmarsat D+ satellite service, maintaining a critical life-line link to your assets. Assets moving anywhere in the world are visible and reachable at all times by your business operations.

The SureLinx 8100 is a highly integrated, compact device with quad-band GPRS and Inmarsat D+ satellite transceivers, GPS, discrete input/output feeds, a programmable controller and integrated data logger. Program the device to report by time, distance, geofence or any other criteria to meet your specific application needs. A single device and interface for both GPRS and D+ eliminates many additional components and integration issues, to save you time and money and build robust solutions.

#### Key Benefits

- Reliable global coverage
- Eliminates excess hardware component costs
- Fewer components increases reliability
- Reduces integration and support costs
- Reduces networking costs



## **KEY FEATURES**

- Compact & Inconspicuous
- Quad-band GSM/GPRS
- Inmarsat D+ satellite
- Global roaming
- Least-cost message routing
- Optional message priorities
- Common exception reports
- GPRS-only long messages
- Exception-based reports
- Over-the-Air Programming
- Expandable inputs/outputs
- Geofence capability
- Data logging

## **APPLICATIONS**

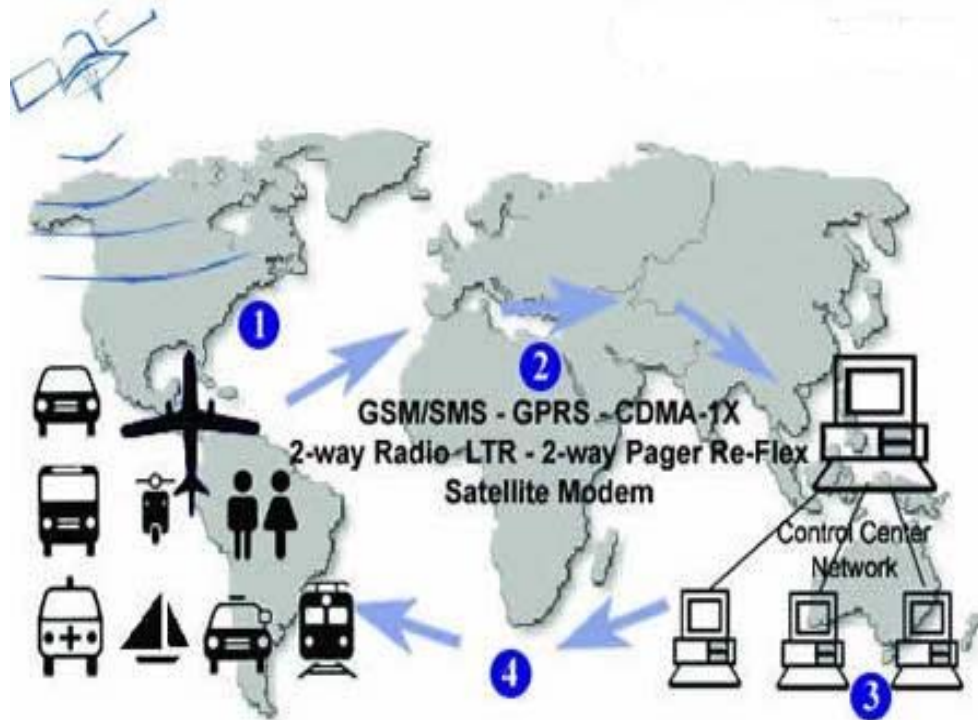
GPS reporting enables asset tracking for fleet management and security. With its low profile design, the 8100 is compact and inconspicuous for covert installations. Combined with built-in alert capabilities, your assets will operate more efficiently and at lower risk. This means significant improvement to your bottom line. Trucks and containers moving across the country move in and out of cellular coverage. Ships enter and leave port and the coastline. In-land vessels follow rivers along borders and through valleys. But the 8100 keeps you covered no matter where your assets are with global, seamless network services. When in cellular coverage, your application can send frequent updates cost-effectively using GPRS. But when outside of cellular range, the 8100 automatically switches to D+ exception mode, sending critical updates only when necessary. The optional on-board data logger can be used to store less-critical information and can be transmitted via GPRS when the asset returns to cellular coverage.

## 2.3 Communication Network

The AVL tracking system consists of a GPS receiver inside the vehicle and a communications link between the vehicle and the control Center as well as pc-based tracking software for dispatch. The communication system is usually a cellular network similar to the one used by your cellular phone or satellite network. Currently all kind of communications networks permit Real-Time Tracking for mobile assets. Communications used for Vehicle Tracking Systems:

- Over GSM SMS/GPRS
- Over Satellite INMARSAT D+ protocol.

The diagram below illustrates the basic AVL system. It shows the GPS signal arriving from satellite to vehicle. The vehicle location is communicated to the PC (Control Center) via wireless network. That's all there is in a basic AVL set-up.



- 1 - GPS receivers in each mobile asset receive signals from a network of overhead satellites.
- 2 - Transmit the data to the communications center via different networks.
- 3 - The control center receive and process this data and shows real-time pinpoint information over maps.
- 4 - The Control center is able to send commands to each unit (trigger alarms, stop engines, change direction, personal messages, etc.)

## 2.4 Application

Consist of two components:

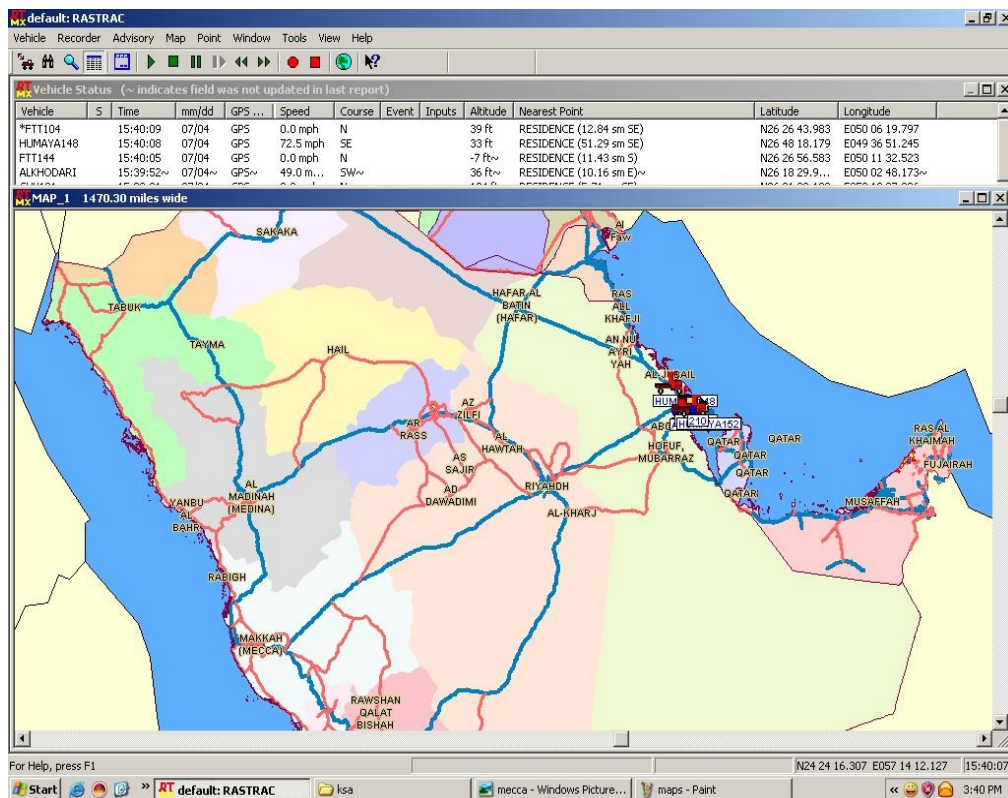
### 2.4.1 AVL Software



Are you looking for AVL software that can be adapted to your business rather than you adapt your business to the software? AVL software that let you know where your vehicles are and what they are doing without a lot of hassle?

Welcome to RASTRAC the industry standard AVL software. RASTRAC was built with you as user in mind from the beginning. You will feel the powerful design of RASTRAC from the first time you fire the program.

RASTRAC will help you to do your job much easier than ever. Any information you need to know is just few clicks away. You have the total control of what to be displayed on screen and how to be represented. In addition, you can customize RASTRAC to your personal preferences.





## ***RASTRAC® Features***

**RASTRAC®** offers powerful business tools enabling vehicle owners to monitor their mobile assets.

**RASTRAC®** products will allow you to more efficiently manage your business, enhance your service and raise profitability.

### **Communication and Vehicle Control**

- o One button manual position query.
- o Type & click "chat" messaging.
- o Point & click remote onboard equipment control.
- o Custom formats can be easily added.
- o Simultaneous tracking of different communications technologies (GSM/Satellite/RF.) on the same work station.

### **Vehicle Features**

- o New enhanced vehicle database packs more data into less memory.
- o You can show/hide any vehicle from the map.
- o You can set vehicle icon text to any font size or typeface.
- o Vehicle icon crosshair visually shows speed & direction, in its own color.
- o Each vehicle can be represented by a unique user-defined icon, such as a "mug shot" driver photo.
- o Each vehicle can have its own track history "tail" that follows it dynamically.
- o Auto-track your chosen priority vehicle.
- o You can instantly "find" any vehicle on any or all open maps.
- o Vehicle icons can change color when they don't report often enough (or get out of range).
- o Recorded vehicle tracks can be translated to ASCII format for direct use with various off-the-shelf database, spreadsheet, and analysis software packages.

### **Analyze driver performance**

- o Automatic recording of all vehicles' actions and travels.
- o Recorded vehicle files can be directly imported into your financial, accounting, and spreadsheet software applications.
- o Recorder files can be set to automatically cycle (start new recordings) at shift change times.
- o Automatic reports can be generated for each vehicle every day.



### **RASTRAC Allows You to Be More Productive**

- o Personalized operator settings for each dispatcher.
- o Viewers can operate over the Internet (remote fleet viewing from any telephone jack).
- o Easy-to-use toolbars for common functions.
- o On-line documentation supplies operational help at a click of a button.
- o Balloon help for all functions.
- o Mouse can be used as a "driving" vehicle (for route generation/ pre-dispatch/ driver training).
- o Integrated text "chat" with any driver.

### **Mapping Feature**

- o Maps stay in the same position, size and magnification when you close and re-open RASTRAC®.
- o Any area on the map can be "zoomed" simply by outlining the area with the mouse.
- o Layered (vector) map names can now be easily renamed using the "Change Name" function.
- o A detailed street-level map for the entire GCC is available.
- o Supports standard imaging formats (GIF, JPEG, TIFF, TARGA, PCX, BMP, and BSB/NOAA maritime charts). This means you can scan your own maps.
- o Supports most major raster and layered vector image formats (ESRI Shape®, MapInfo®, and ArcView Shape file).
- o Floating pop-up menu gives you quick access to all common map functions.
- o Driver's "alias" name is displayed next to vehicle on all maps.
- o Your special "points of interest" are automatically displayed.
- o Latitude/Longitude is conveniently displayed in the status bar.
- o New maps can be defined in minutes.
- o Up to 25 different maps can be displayed simultaneously.

### **Playback Features**

- o Automatic recording of all vehicles' actions and travels.
- o Playback uses real-world timing (just like it happened), not just position "dumps".
- o Playback unlimited number of recorded vehicle tracks simultaneously.
- o Playback (fast-forward) at up to 1000 times the recorded rate.
- o Instantly draw a recorded route on a map.
- o Instantly "jump" to any recorded time of day.
- o Playback loop (up to 5 minutes) for detailed analysis.
- o Reconstruct entire fleet's composite performance by playing all vehicles back in simultaneous time-sync.
- o All vehicle log files can be replayed individually or auto-synchronized with each other to allow the viewer to realistically recreate a given situation or time period.
- o Recorded vehicle tracks can be translated to text format for direct use with various off-the-shelf database, spreadsheet, and analysis software packages.

## **RASTRAC is MORE than just maps and vehicles**

- Automatic work order/special instruction display when vehicle arrives at specified a location.
- Automatic multimedia alarm when:
  - Vehicle enters or exits a predefined area.
  - Vehicle leaves its pre defined route.
  - Driver presses emergency/panic button.
  - Vehicle is started.
  - Vehicle stays motionless for too long.
  - Vehicle drives too fast.
- Occurrence of any event.

### ***Powerful reporting module:***

Your RASTRAC software comes with powerful reporting module that enables you to get exactly the information you are looking for with few clicks on your computer. Here is a short list of the reports RASTRAC can provide:

- 1- **Advisory report:** mark the areas you are interested in. The report generator will tell you how long your vehicle stayed in each area at what time.
- 2- **After-hour report:** find out if some one is using your vehicles outside regular working hours.
- 3- **Compact-report:** get useful information like number of trips each vehicle had made, distance of the trips, average trip time, average trip distance. In addition to each stop your vehicle made and duration of it.
- 4- **Message report:** get all message sent to or received from your vehicle in case you install MDT in it.
- 5- **Mileage report:** distance traveled by your vehicles between any date/time of your choice.
- 6- **Stop report:** get all the stops your vehicle had made and the location, duration of each stop.
- 7- **Speed report:** see all events of over speeding.
- 8- **Idle-time report:** get the idle time where the engine was running and the vehicle was not moving.
- 9- **Event report:** see all the events that happened in your vehicle.
- 10- **Complete report:** all the information sent by your vehicles.
- 11- **Custom report:** looking for certain information the standard reports don't provide? Go ahead and define your own reports.

## 2.4.2 Digital Maps

Our digital map database is like no other, because it's built on the roads of the world with precision. It builds a database from a driver's view. And it's built to a single global standard.



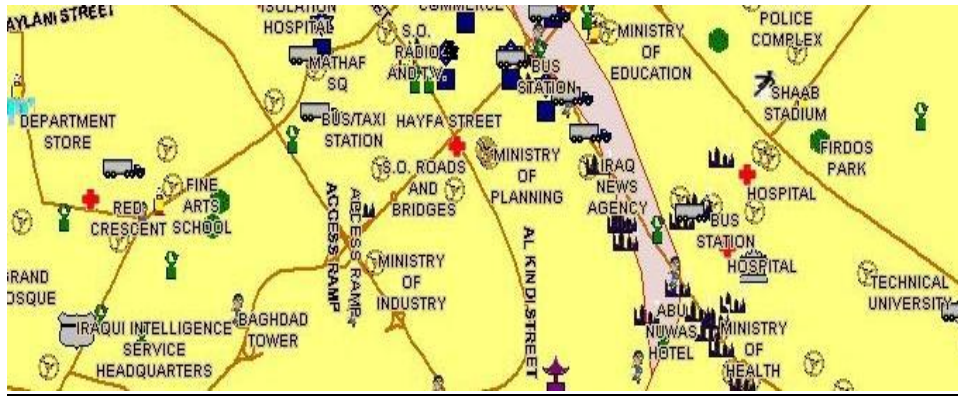
- o Our digital map created from QuickBird satellite Imagery (finest in the world) with .6m resolution. The quality is capable of showing asset on which side of the road.

- o Our digital map data doesn't just feature road geometry. It contains dozens of road attributes for every kilometer, everything from speed restrictions to lane configurations.

And it also offers users multiple Points of Interest, so it enables turn-by-turn directions to restaurants, fuel stations, shopping and more

Our regular digital map updates ensure the digital map data you're using reflects the world you're in today. We now offer digital map coverage in the major revenue generating Middle East countries - and counting. In 2005, expanded coverage highlights included the introduction of full coverage of KSA's entire road network, including all thirteen provinces. Though the objective of this project was not to develop GIS, but this digital base can be used for GIS development as well. Nevertheless, the vector data creation is by layers using MapInfo & ESRI software. There are softwares available in the market where similar work can be performed.

## PW\_Street Mapping Overview



PW\_Street is the RASTRAC street level map database. The PW\_Street map database contains information similar to the layered maps (cities, roads, rivers, etc...). The PW\_Street map database contains the MIDDLE EAST maps data that has been highly compressed (the entire MIDDLE EAST (available) maps database down to street level only requires 100 MB of disk space). This map database was created by merging multiple map data sources into a single map (including Provinces, cities, lakes, airports, railroads, roads, schools, hospitals, zip codes, etc...). Map properties can be enable/disable at selected zoom levels. Map attributes such as color and size of labels can also be modified. This produces a very aesthetically pleasing map that allows you to pinpoint your vehicles location at any given time. You can also use the PW\_Street map to search for a desired address (address lookup). The PW\_Street map can be zoomed out to show a large coverage area (the entire US) and then zoomed in to reveal the underlying detailed roads.



### 2.4.3 Real Time Events

All of our hardware can be programmed to send the exact information you want to know. They have enough processing power to analyze any situation and issue a control signal or send message depending on that situation.

With *Real-Time Events* you will know the event as it happened regardless what is your update rate. For example, if your update rate was a message every 15 minute and you have over speed event of 110 Km/h, each time your driver goes above 110 Km/h your modem will send a message to your tracking station right away even if the driver over speeds ten times in less than two minutes.

*Events Summary:*

**Here is some examples of the real time events that we can implement.**

- Geo-Fences.
- Engine On/Off status.
- Multiple Over-speed Alerts.
- Engine Idle alert.
- Door Open/Close notification.
- Panic button Alarm.
- Oil pressure alarm.
- Tow alarm.
- Reverse direction of the vehicle.
- Remote Engine Shutdown.
- Remote vehicle security system arm/disarm.
- Temperature sensing.
- Fuel gauge reading.

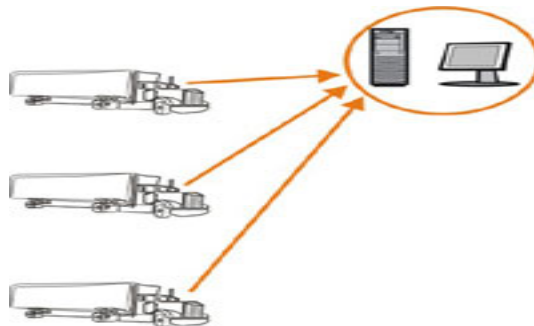
### 3- Different Types of implementation

DPITS offers a variety of AVL systems so you can choose the best solution that meets your requirement, fits your budget and adapts your financial policy.

#### 3.1 Stand alone station

Eliminate any third party dependency and running costs for your AVL solution except for STC bills or airtime usage of the satellite operator. Own your tracking station and digital maps.

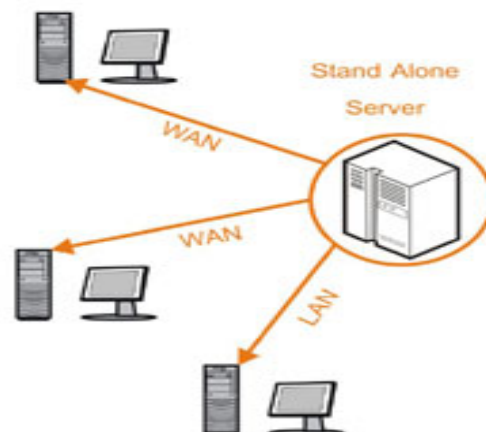
In this option the terminals will send the message directly to your tracking station which ensures your privacy. This option is recommended for customers who have between 1 to 100 vehicles. You can monitor your vehicle from more than one location and more than one computer.



#### 3.2 Stand alone server

For clients with large fleets who want to own their AVL solution. In this option, you will have server software that can take up to 1000 vehicles at the same time. Each division or sub-fleet in your company will monitor its fleet from “client’s” station or sub-fleet in your company. These can be anywhere in your LAN, WAN or in the internet. At the server side, you have total control of the clients' privilege. What vehicles to “see”, what information to access and what control signals to send.

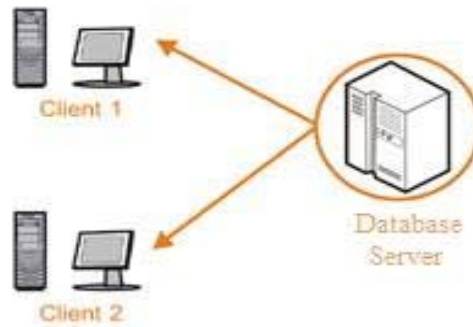
This solution is recommended for customers who have more than 100 vehicles.



### 3.3 Through Our server

Reduce your initial costs by monitoring your vehicle through our server and have database as backup for your vehicles.

In this option, you will pay reasonable monthly charges for us, depending on the message rate you have chosen. The AVL software will run locally on your machine giving you the flexibility to monitor your fleet in real time, navigate the maps fast, generate reports from your local database etc.



### 3.4 Web-based AVL

If you prefer to monitor your fleet through the World Wide Web (www) without having to install any software on your local machine then this solution is right for you.

No need for any IT infrastructure or technical background of any kind, just fire your web browser and enjoy our award winning RASTRAC AVL web-based service. All of your information will be secured on remote servers at a state of the art facility to host critical application like AVL

