

IRTEZ
Technology 2000

GARY ERTEL

VEHICLE LOCATION METHODS;
APPLICATIONS AND CHALLENGES

Vehicle Location Methods.

Applications and Challenges.

Presented by

Gary Ertel
Wireless Data Services Limited

Man has always wanted to know where someone is!

For example, in early wars, scouts were sent out to find the enemy.

Juliet asked Romeo, "Wherefore art thou Romeo?"

With a location system she would of known he was under the balcony and could have saved her voice.

Vehicle Location Technology Developments

With the advent of radar, the first electronic means of tracking vehicles such as planes, ships and tanks became available. But this proved to be cumbersome and difficult to track small vehicles, range was limited and only one target could be tracked at a time.

The military were always spending money researching better ways of finding the enemy.

When the first satellite was launched it was soon realised that this was a good method of being able to see the earth and every thing on it.

During this period there were already several navigation systems being installed around the earth such as Loran and other systems which provided radio signals allowing ships and other devices (such as missiles) to be able to calculate where they were in relation to either land, hazards and/or targets. These however were mainly in the Northern Hemisphere.

In the early 1970's SAT NAV was used to provide navigational aid to ships and planes by using a signal from the satellite which was transmitted at regular intervals. On the ship or vehicle a very accurate clock was synchronised so that the time delay on receiving the signal could be calculated and therefore the position calculated. In the early stages fixes could only be made when the orbit of the satellite allowed a signal to be received. Some times the delay between fixes was up to 20 minutes in the Southern

Hemisphere. As more satellites were launched this delay became less, resulting in no delays today.

As the satellite was in a fixed known position, the signal received by the vessel from the satellite would provide the distance from the satellite. Given that radio waves travel at 300,000,000 metres/sec, if the time of the transmission is known then the distance from that satellite can be calculated.

Therefore if you have three or more satellites through triangulation you know where you are on the earth's surface. With four satellite positions altitude can be determined. This equipment was expensive and required specialised knowledgw to operate.

The late 1980's and early 1990's allowed the GPS receivers to become smaller and smaller by more advanced technology. This in turn lead to the product (receivers and microprocessors) being able to fit into smaller units and manufactured in mass production for the general public. This also greatly reduced the cost per unit. Now there are hand held GPS units which are great as you can determine where you are on the earth and any given time.

BUT THERE IS THE PROBLEM.

You know where you are, but no-one else does!!!!

This has recently been improved by the addition of a transmitting device that allows the positional data to be sent to a receiving station that can then act on the information.

This for example is an EPIRB, which is used for search and rescue, which transmits the location (latitude and longitude), for passing ships or planes to receive. The signal transmitted is not very strong but is on an internationally monitored distress frequency.

In New Zealand commercially available radio networks such as Fleetlink or Team Talk allow users with the correct equipment to pass the location of the vehicle back to an office or monitoring location where the location of the vehicle is plotted onto a map. This then allows the operator to see very quickly where the vehicle is and can also determine the speed and direction of the vehicle.

Currently this option is not available over Cellular networks although each network operator is trying to provide this facility.

So is all the hype about GPS and vehicle location systems and the benefits real or imaginary?

Some applications where the GPS can provide benefits are:

1. Location of certain assets or stations. An example is a company where we have placed a GPS receiver in a vehicle connected to a data-gathering device. When the operator reaches a certain station he enters the customer number and the unit collects the latitude and longitude and the distance traveled from the last station. This allows the company to ascertain correctly distance between stations and therefore work out the most effective means of route planning.
2. Historical data of vehicle movements. We currently have vehicles travelling in both the North and South Islands, which every five minutes send their information such as speed and location back to our office. From this information we can provide a playback of where the vehicle was and the speed it was travelling at that time. This is not to replace a vehicle management system but does provide location information at a later date. Again the company involved will be using this information to determine more effective route planning or determine better time scheduling for their customers.
3. Occupational Safety and Health. In this instance we use the system to allow the vehicle operator to "tell" the office when they feel threatened or perhaps just to let them know for their own comfort.
4. Automatically tell the office where the vehicle/plant is. In this instance we use a unit called the Zevo which has some intelligence in the unit. When the vehicle is started the location from the GPS is noted. Compelling events, such as door open, engine stopped, etc, will trigger the capture of the data collection.

5. Using the Zevo we can be monitoring the speed of the vehicle and if certain speeds are exceeded for a finite length of time the position and the speed are collected for analysis at a later date. For one customer who uses the trunk radio network we send the information directly back to him so they can contact the company and alert them to the fact.

What are some of the problems using the System?

One of the biggest challenges facing companies who have the system fitted is of driver resistance as they think it is a "Big Brother" system. The driver assumes the management wants to know where they are and what they are doing all of the time. However most of the companies where it has been fitted are looking for better vehicle efficiency, utilisation and vehicle safety. Often the vehicle loaded with the freight is worth \$300,000-400,000, and the owner just wants to know his truck and freight are safe.

As the GPS needs to see satellites to function it is easy to thwart the system by placing a metal (tin foil) cover over the antenna to reduce the chance of the system providing location information. It is becoming a requirement now for information to be supplied when there is no GPS coverage for longer than a specified length of time.

The accuracy of the positional data from the GPS unit can cause problems. Several factors can affect the performance of the GPS receiver. Some of these are:

- Atmospheric conditions. As the signal from the satellite has to enter the earth's atmosphere it has to pass through the ionosphere and troposphere. The position and conditions of these layers can attenuate the signal or can even cause small delays in receiving the signal. As the operation depends on timed information small variations in the time of reception can lead to variations in locations.

- Until recently the American Defense force placed a "dither" on the B signal which was available to Commercial operators. This "dither" was used to provide an offset so as not to allow opponents to be able to use the GPS for nefarious purposes. This "dither" has been removed which is allowing the accuracy to be reduced from +/- 50 meters to +/- 5 meters. Some companies want a better resolution than this, which involves the use of differential GPS. (D-GPS). This system is used for very accurate fixing such as surveying and other applications.
- Access to the satellites. With the advent of smaller and smaller GPS units, telephone companies are considering putting GPS receivers into cell phones. Which is great but how do they see the satellites when inside the buildings or even the cars. Although to be fair the cell phone can operate in the vehicle and already some cars come pre fitted with GPS antenna, Cellular antenna, and Commercial radio antenna all in one housing.

So what's in the future?

The desire for information on where people are, where assets are, and where am I?, will continue to see new ideas being challenged. Currently available in the USA are rental cars that can tell you where you are and what roads to take to get you to where you want to be.

Car security is very high but there are still problems to overcome with respect to who is going to monitor the vehicle and how to know where the vehicle is if the vehicle has been stolen and the GPS disabled.

As the location accuracy gets better and better through improved receivers, it may then be used to collect information from road maintenance crew, who can accurately plot where holes are and what maintenance needs to be done. With the GPS system fitted to the road repair equipment then only the portion of the road which requires repairing will be done without over runs.

With vehicle systems such the Zevo vehicles will be able to be monitored during loading for weight, to ensure overloading does

not occur. It may also be possible to measure the sway factor of the vehicle if it is cornering at excessive speeds or perhaps measure the camber of the corner.

For more ideas and concepts please feel free to call our company at:

Wireless Data Services Limited (wirelessdata)

Bus: 09 379 4710

Fax: 09 379 7360

E-mail: Sales@wirelessdatanz.com

Our team is:

Boris Bruges, Managing Director

Gary Ertel, Sales Manager

Keith Swasbrook, Account/Product Manager

Kerry Gupwell, Marketing Manager

Ainsley Thwaites, Software Development Manager

Plus 15 software engineers

And three Administration Staff (to keep us in check)

Wirelessdata have successfully completed projects in mobile location projects with Tapper Transport, Wymers (the A Team), Foodstuffs, plus others we cannot mention here due to customer competition/confidentiality.

Wirelessdata have also successfully completed 45 mobile data projects with trunk radio, cellular, e-mail, 025, spread spectrum, conventional radio, and are always looking at new network technologies developing such as WAP, GPRS, Tetra, and CDMA.

Not bad for a company three years old Huh!! To the best of our knowledge no other company in New Zealand has such a track record in mobile data.