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INTELLIGENT SYSTEMS AND THEIR IMPLICATIONS FOR THE INDUSTRIES

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ABSTRACT

In this dynamic and turbulent business environment, technology plays a pivotal role in the success of a business concern that cannot be ruled out. Thus, with the development of the technology for the business concerns has changed the face of the business. The family of intelligent systems so developed by the organizations like SAP, IBM, and GS1 etc has made the businesses more efficient and processes more effective. Intelligent systems in the business can not only provide a seamless shopping experience to the consumer, but can also help businesses streamline their operations so that they can meet the challenges of competition, shrinkage, supply chain management, inventory and store management by implementing new technologies. They can lend cutting-edge technology to industries and it only gets better with newer processes and softwares coming into the market. Industries need to shake up their feathers and fully realize the potential of intelligent systems and incorporate them in their business.

RADIO FREQUENCY IDENTITY TAGS

Radio frequency identity tags (RFIDs) are microprocessors that respond to radio frequency signals and can provide data regarding not only the RFID itself but also information stored on the microchip. This technology will not have an immediate and direct impact on the Shared Technology industries but it will result in changes to the way that work processes are undertaken in the future.

RFIDs work in a similar way to a printed bar code but provide for much more information to be transmitted. A bar code is printed with a number that only identifies the manufacturer and the product. As it is included in the label, there is very little cost to the manufacture and it is a 'dumb' number that is not able to identify anything else. An item-specific bar code is able to be attached that would be able to provide for a unique reference to a database.

One major difference between an RFID and a bar code is that the RFID does not need to be visible for the data to be communicated to the reader. As the RFID works on a radio frequency, an RFID reader sends a radio frequency out to the tag which responds and sends a signal back

with the stored data. This data may be a unique number that is matched to a database or it can send data that is only stored on the RFID.

This technology is not new but does have the ability to transform work processes. It will also allow technicians to quickly interrogate parts or components to determine age, batch numbers and shipping date, order processing, warehouse receipt and even location. The future applications of this technology are very broad.

RFIDs are currently used to provide a data sequence to a reader in situations such as security access, public transport fare collection and motor vehicle toll way collections. These tags are also injected into livestock to allow for commercial tracking and unique identification or into pet animals for a similar purpose. RFIDs are used to automate custom manufacturing processes by identifying the planned component combination through this tagging. The most prolific application is expected to be in tracking the movement of products through the distribution process.

Technology overview

The main function of the RFID is to provide a record of the data contained on the microchip. Contained within a radio signal is a small but useable amount of energy. When this radio signal hits the RFID it responds with the stream of data.

This process is known as induction. The frequencies used for RFIDs can be between 50 KHz through to 2.5GHz. At the higher end of the range, is industrial scientific medical (ISM) frequency and the use of tag readers at this frequency can interfere with many of the wireless technologies also planned and in use. Additionally, it is unlikely that all manufacturers will use the same frequency so a range of readers may need to be available for various industries.

The basic components of any RFID system include:

Tags

Also called transponders, these can be either *active,* with their own means of sending a signal, or *passive,* relying upon the tag reader to provide the power necessary to generate the response signal. The signal could be a simple identification number stored in a read-only tag, or a complex data stream that includes additional data stored within the tag's memory. These more complex tags could contain such data items as manufacture date, lot number, serial number, or even built-in sensors to track average storage temperatures or other data.

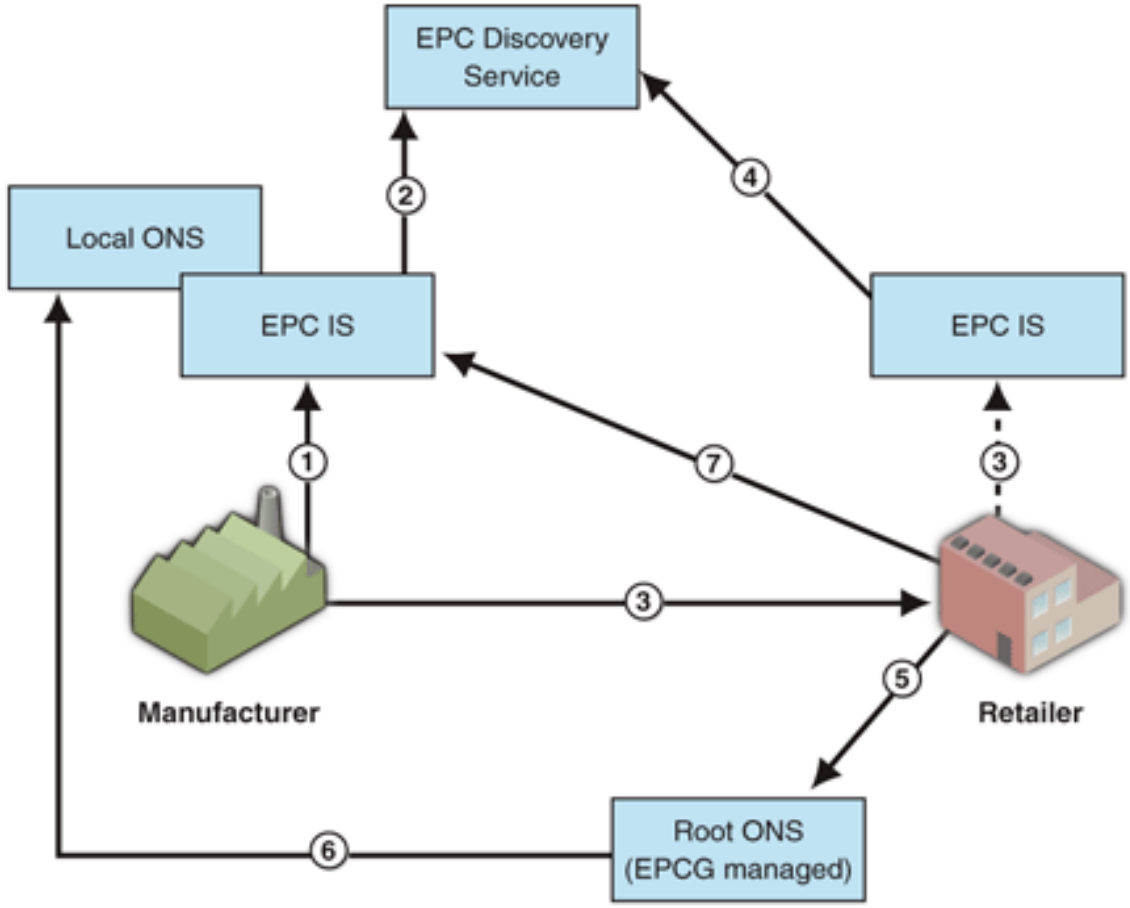
Readers

Also called *interrogators*, these come in various configurations depending on the location, environment, and scanning area coverage required. A reader is used to identify all tags within its reception coverage area. Readers require some intelligence for aggregating and smoothing the tag data.

Electronic Product Code

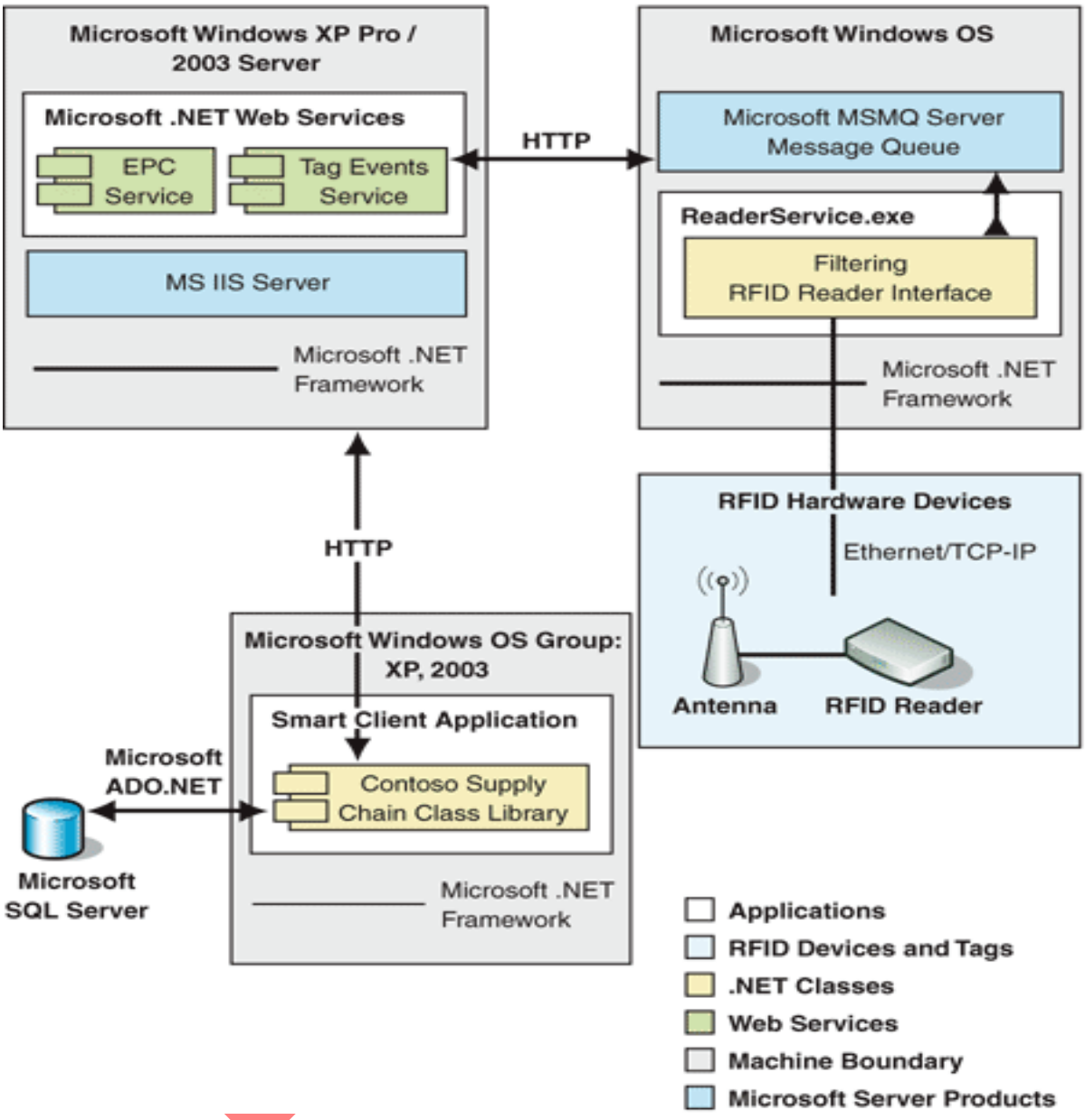
An Electronic Product Code (EPC) that acts as a license plate, pointing to more information of the tagged item stored in a data base. This makes the tag simple, improving the read rates. Essentially, the EPC is the electronic equivalent of the UPC barcode. It is a string of characters that uniquely identifies any tagged item. However, instead of referring to a *class* of products, like UPCs do today, the EPC refers to a specific *instance* of product. In essence the EPC is a single ID built upon smaller IDs that represent the manufacturer, product identification (or model), and a serial number for that particular item.

The EPC is embedded in a RFID tag, primarily a low cost passive read-only tag on individual products or cases. When a reader scans each tag, it will transmit back its unique EPC code. This is done with little to no manual effort required compared to the work required to open boxes and align a barcode with its visual scanner. The EPC tag standard does not preclude other tags with read-write functionality or even more advanced capabilities.



Source: *http://msdn.microsoft.com*

EPC Routing



Source: *http://msdn.microsoft.com*

RFID-Enabled Supply Chain Architecture

Future Applications

The possible applications in which RFIDs may be used are very broad. These devices will be used to identify a single item, monitor the status of an item or determine the location an item. For the Shared Technology industries, this can mean the ability to quickly identify the specific individual part that requires replacement. As these devices can be read without being visible, individuals can check to see if all the items for a maintenance plan are contained in a shipment of parts prior to setting off to the site.

Much of the activity for RFIDs will be in the monitoring of retail products. This will include applications in shoplifting prevention, proof of purchase and use-by dates for food products. For example, an RFID included within a garment will signal an alarm if it is stolen (but not discovered) from the store. Additionally, if it is removed and presented for refund, the system will signal that the particular garment was never sold.

Privacy Concerns

In a world connected by recording devices it is possible to imagine the collation of databases that will provide for a detailed analysis of the behaviour of individuals. For example, if an empty drink container is found at a crime scene, the RFID data may be able to track the exact time at which the product was purchased. If a bank-linked transaction card is used, the purchaser may be able to be identified.

The printed bar code with the Universal Product Code (UPC) was also imagined to be able to accomplish similar privacy infringements. But when a technology offers power, simplicity, flexibility and affordability, consumer acceptance tends to catch up.

IMPLICATIONS FOR THE SHARED TECHNOLOGY INDUSTRIES

Automotive

This technology is already in use in manufacturing to define the range of components to be included in the vehicle as well as in automated toll way collection. The use of this technology in parts management and order confirmation will have significant benefits in reducing cost of warehousing and inventory management.

Building and Construction

This technology will assist in asset management where the details regarding a particular device will be available through a reader/display device that is linked wirelessly to the network.

Electrical

There is limited application in the activities within this industry. Obviously devices that are installed will be able to be interrogated with a reader/display to provide for historical records regarding the composition of the device and the installation/maintenance history.

Electronics

Further development of this technology will see the integration of other microprocessors. New applications will continued to be developed that utilise this identity system.

Engineering

The application of this technology in process and manufacturing automation will require the coordination of the product with the identification tag. The collection of this data will be critical for the distribution stream and marketing functions.

Information Technology

The data collected through the use of this technology will need to be managed. The data will also be required by various other enterprises for product improvement and customer relationship management. These applications will involve expansion of database applications and web services.

Telecommunications

This technology will assist in asset management where the details regarding a particular device will be available through a reader/display device that is linked wirelessly to the network. Other applications will be developed.

GEOGRAPHIC INFORMATION AND LOCATION SENSING

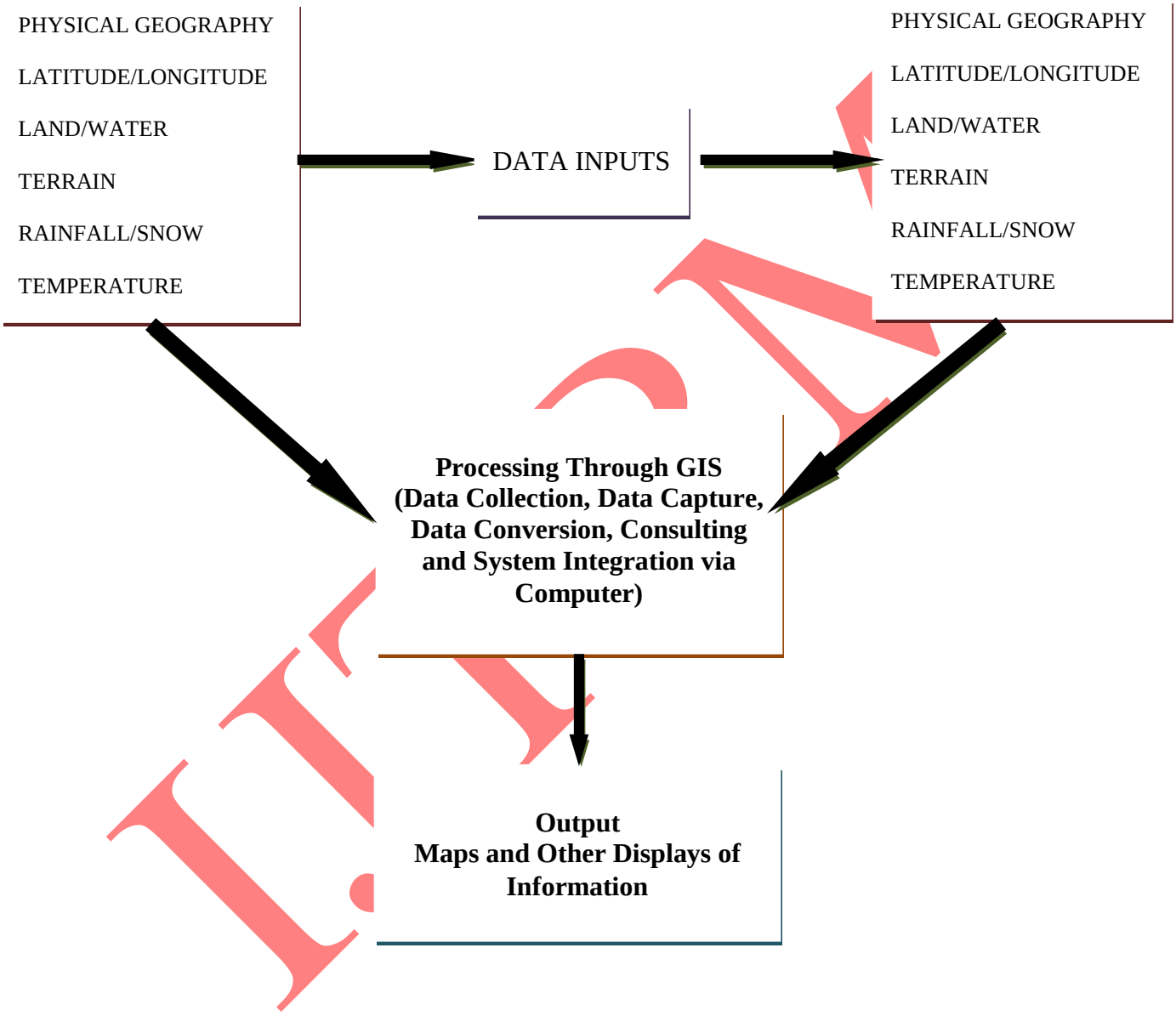
As the world moves from a paper-based and dial-up Internet connection to an always-on mobile work process and lifestyle, new ways of relating to our surroundings will be necessary. The focus will be on gathering information about our surroundings not from interacting with it but from data stored and delivered electronically.

At present much of the information about the geographic world is stored on databases that use proprietary software. These systems are known as geographic information systems (GIS) and a number of vendors sell these systems. Many utilities and government organisations use these software applications to keep an asset register of infrastructure.

As has been demonstrated in other chapters of this report, there is a move to enable these separate systems to be more communicative. This move in geographic sensing is being driven by the OpenGIS Consortium (OGC) towards an open system that relies upon the use of a web services model. This consortium includes the Australian Department of Defense.

One of the more interesting developments from this project is that the open system will allow for users to define the information that is required rather than view unnecessary data. Additionally, if a location sensing system is used, it will be possible for a person to load data onto their mobile computer that relates only to his or her physical location.

These developments have the ability to change the way that we will live and work in the future.



Process of Geographic Information System

Current Geographic Information Systems

Geographic Information Systems (GIS) is a mature technology with a number of vendors providing this market with a range of application software. Nearly every organisation that needs to relate to geographic information has some type of system established to collect data and re-present this data at a later stage.

These systems are in use a wide range of applications. For example, government land administration, utility infrastructure mapping, real estate industry, health management and traffic management are a few obvious examples. Unfortunately, much of the data is unable to be shared across vendor software due the separate development of these applications. The issues of incompatible data sets require either the purchase of that vendor's software to read the data or a lengthy and expensive process of re-entering the data into the system.

Open GIS

The Open GIS Consortium is seeking to have geo-spatial data more compatible with other systems. The goal is to allow more individuals access to data stored by governments and enterprises to provide for improvements in economic productivity, decision making and service delivery.

As the world becomes more mobile, there needs to be access to physical and geospatial data through mobile computers. This vision requires a number of systems to be put into place. These are:

- Integrated geographic information systems that share data accurately and resolve conflicts;
- Reduced data sets that meet the needs of the user without additional information;
- Economic distribution of the data to the mobile user;
- User-friendly software applications for ease of interaction with the data.

The Open GIS is working towards these goals using a range of Internet-standard software. The programming languages to be used are based around web services protocols such as the extensible Markup Language (XML).

The value of metadata which could be created by such a network is that it will help to build a strong spatial data infrastructure rather than having enterprises and governments rely on their data alone. This integration requires each database manager to put into place the ability to not only have others within the organisations be able to read the data but to also have this data available to the Internet. This will require databases to move to open systems.

It is recognised that the cost of developing and maintaining databases is expensive and free access is something that is unlikely to be given. Therefore billing arrangements will need to be put into place before much of this information is available. Additionally these organisations will need to establish a web services infrastructure to be able to provide this service.

Geographic Data Display

At the beginning of this chapter there was a mention of a focus on mobile computing and geo-spatial information systems. What is demonstrated through Open GIS is that attention is being paid to enabling this geographic data to be available through the Internet. Many current systems can be displayed through an Internet web browser using application software from the vendor.

This Intranet or Internet presentation of data is usually for intra-enterprise display. This means that individuals within the organisation are able to view the data very easily. However, when the data needs to be presented to individuals outside the organisation, this may present difficulties with interoperability issues.

Currently there are a number of service providers that can provide web-based geographic displays on a demand basis. The Yellow Pages or City Search has such a facility for locating specific geo-spatial locations and allow for a zoom-in or zoom-out facility. However, it is not possible to minimise the data that is presented on the screen and the entire data set (or graphic) must be viewed.

For distribution to a mobile computer, the amount of data needs to be minimized as the user will need to pay for all of the data sent rather than just the data that is required. For example, if a person only wishes to know the street layout and the nearest bus stop for a particular bus, this is the only data that will need to be downloaded to satisfy the user. In this case, a method of displaying selected data is required.

The Geography Markup Language (GML) will provide for the economic use of mobile Internet data. In software application similar to a web browser the user can select which data is presented. This data is loaded in the form of text similar to a web page that uses Hyper Text Markup Language (HTML) to display text and colour. This then provides the user with a faster and less expensive method of gaining geo-spatial information.

Location Sensing

The ability to have a device located remotely provides for a number of benefits. Firstly, this capability allows those who are in an emergency situation to accurately describe where they are. This speeds emergency services to the correct location.

The second benefit is that if data is requested by a user for his or her immediate location, this data can be sent based upon the location of the mobile computer. One way of doing this is to use a global positioning system (GPS) transponder. This technology is very mature within transport and marine applications. A GPS transponder is also able to be included as an add-on to personal digital assistants (PDAs) and in notebook computers. When combined with a mapping system, the individual knows where he or she is to within a few metres.

The GPS transponder works well in a vehicle as the size of the equipment can suit the application and does not need to be physically carried by the user. Additionally, a power source is available from within the vehicle. For mobile computing, the user will need to physically carry this equipment and have access to a mobile power source. Battery technology has not overcome the problems encountered with an 'always on' society that requires longer-lasting batteries.

One way of being able to locate a mobile computing device is to use the mobile telephone network infrastructure. This is done by using the cellular network towers as measuring devices. As it takes time for a radio signal to travel through space, a signal can be timed from the point of origin to the point of reception. If three reception points are established, it is possible to triangulate the signal and determine geo-spatial origin of the signal.

The process of location sensing is accomplished by knowing the time of arrival of the signal at each of the three locations and the physical location of the points of reception. The network provider will make the various calculations and by using this method the location of the device can be estimated to around 31 metres. While this is less than the one to three metres for a GPS system, the process does not require the mobile device to do the calculations nor support a GPS transponder.

This eliminates the cost of the transponder and additional power requirements.

IMPLICATIONS FOR THE SHARED TECHNOLOGY INDUSTRIES

Automotive

Manufacturers provide CD-ROMs or DVDs to clients of roadmaps for cities around the world. When a client visits a new city, he or she will need to obtain a CD for that location (inexpensive option) or download the information from the Internet (very expensive option). A GPS system will be able to integrate with the geo-spatial data to provide for navigation.

The CD is a static database and is not able to be updated. The use of targeted information regarding temporal events through the GIS systems and linking this with an existing road map can provide for much greater functionality for these navigation systems.

Building and Construction

These technologies can provide for much more efficient asset management and maintenance activities. By providing a remote worker with specific information and location of the activity to be performed, work processes can be more efficiently planned.

Electrical

These technologies can provide for much more work processes and maintenance activities. By providing a remote worker with specific information and location of the activity to be performed, work processes can be more efficiently planned.

Electronics

These technologies can increase the number of devices to be used by individuals. The repair and maintenance of these devices would be an ongoing requirement within this industry.

Engineering

These technologies can provide for much more efficient asset management and maintenance activities especially in large, geographically diverse sites.

By providing a remote worker with specific information and location of the activity to be performed, work processes can be more efficiently planned.

Information Technology

These technologies require an increase in the development of existing databases and infrastructure. New applications will need to be developed to support the requests by users as well as an increase in content management for commercial and retail involvement.

Telecommunications

While likely to be mainly contained at a network level, this industry will see a greater utilisation of existing and planned infrastructure as a result of the introduction of these services.

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