The remote future

Peter Cattell of Clearview Traffic analyses different wireless communications methods and explains how these are changing the face of vehicle detection

With the continued expansion of traffic data collection solutions, providing a robust, reliable, scalable and secure method of collecting information becomes increasingly important. Over many years, various mobile wireless technologies have been utilised to make the remote collection of data a reality but recent developments are changing the way that this will take place in the future.

Flexibility

The main technologies currently in use for data collection by those involved in traffic management are GSM, GPRS and 3G. All these methods are effectively based on the cellular telephone networks.

GSM is the simplest of these technologies and can be seen as being similar to the traditional dial-up modem functionality that was prevalent 10-15 years ago. The costs associated with GSM are based on the duration of the call; that is, the longer you are connected, the more it costs. GSM is a reliable and simple solution but does not scale very well as the more data you need to transfer, the longer the call takes. This means that with a large number of devices creating large amounts of data, it becomes a challenge calling up each device in turn and finishing in time to start again. More modems can be added, but that in itself can lead to added complexity and problems including modem contention, scheduling and availability.

"Traffic managers will be able to spend greater time focusing on the value and application of data"

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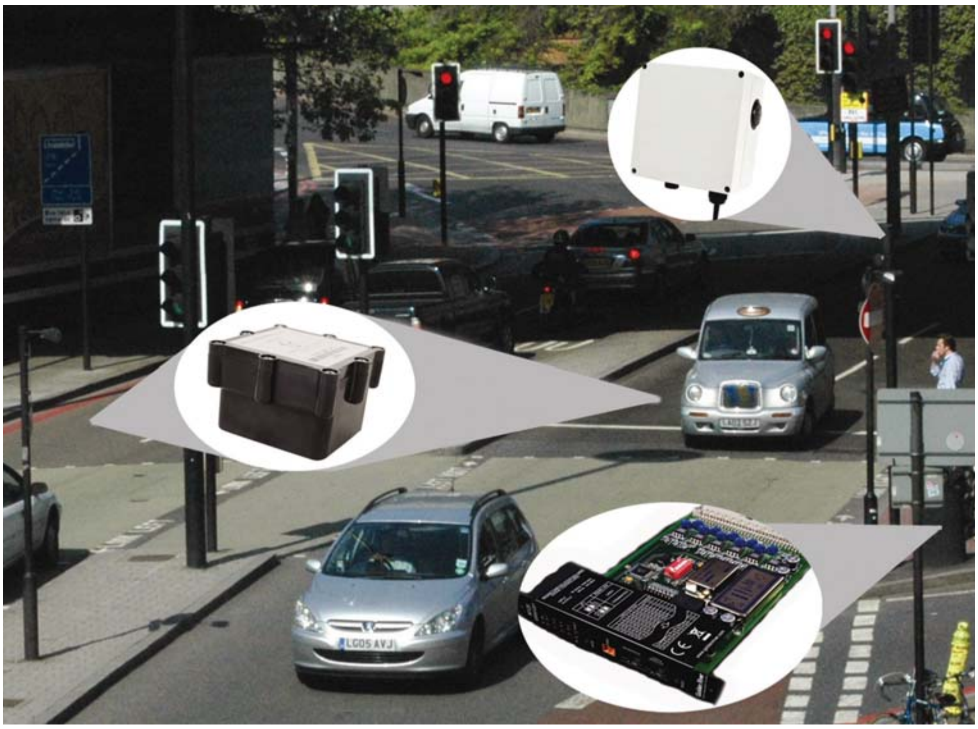
GPRS communication on the other hand is more akin to typical broadband data services as it is always on, with all the data being sent automatically with no user intervention and the charges based on the volume of data rather than connection times. Because of its 'connection free/always on' functionality, scalability is intrinsically easier to deal with and communication/connectivity errors can be spotted immediately.

3G connectivity is on the surface very similar to GPRS, with the key difference being the bandwidth and data throughput speed and so, for the majority of traffic data solutions, 3G is not used. However, it can be very useful when large amounts of data need to be sent back to a central point, for example when overview images from automatic number plate recognition cameras are frequently needed.



The M100 magnetometer-based vehicle detector communicates with a roadside access point via a secure, two-way wireless protocol based on the IEEE 802.15.4 PHY protocol

Urban environment

Whilst these networks can be effective for collecting data from disparate remote locations, they are not necessarily suited to the challenges faced within an urban environment and for such applications there are several other solutions which may be more suitable.

Many city centres now have fairly comprehensive WiFi networks that may be able to be utilised for this purpose but due to the widespread adoption of WiFi there may be some problems due to congestion and interference from other networks.

Within the urban environment WiMAX is continuing to be deployed, and offers a possible high-bandwidth, high-throughput service for internet access (similar to wireless broadband). WiMAX has many benefits above and beyond those found with WiFi. For instance, it operates on a regulated band and so should suffer from much less interference, and due to the use of MIMO technology, can cope with up to 10ms path signal delays (unlike WiFi that needs sub-1ms delays to work reliably). The main issue facing WiMAX is whether it will become a widely adopted service that has a secure financial viability in the long term. Adoption rates are currently lower than originally anticipated but interest is growing as it provides a real alternative to 3G services within an urban environment.

Power

Wireless data communications are often important when the equipment is in a remote location, and in order to be

The MtPole has a 30W solar panel that can be positioned to collect as much sunlight as possible and a high-mounted GPRS antenna

successful, it needs to consume very little power as the cost of providing mains power infrastructure can be prohibitive. All of the well-established wireless communications infrastructures (GSM, GPRS and 3G) are suitable for this type of solution, meaning that both the monitoring equipment and wireless modem can successfully be powered by a solar panel. However in this type of application it is important that the solar panel is able to collect enough power to run the device when the sun is shining, as well as to charge a battery for when there is insufficient sun. Obviously this is fine in regions where there is a lot of sun. At higher latitudes or in areas which suffer from poor weather it is more of an issue. Nevertheless, this less intrusive technology is becoming increasingly visible at roadsides. A good example is the MtPole traffic counter, 2,000 of which have been deployed around the UK by Golden River to support Serco as part of the National Traffic Control Centre project.

The MtPole has a 30W solar panel that can be positioned to point towards the south to collect as much sunlight as possible. A GPRS antenna for wireless communications sits behind the solar panel. The power consumption from GSM/GPRS is heavily dependant on the signal strength being received. Raising the antenna as high as possible helps to ensure that the GPRS modem has the strongest signal strength possible in any given location and this in turn ensures that the amount of energy used to power the device is minimised.

Local area communications

Bluetooth communications was anticipated to become a key technology for local area communications, but as any of the over 1 billion users of a mobile phone with Bluetooth capabilities will know, turning on the Bluetooth feature is a sure way of draining the device's battery.

In April this year the Bluetooth Special Interest Group (SIG) presented an extension to the existing Bluetooth specification, 'Bluetooth low energy'. This will be compatible with other existing Bluetooth protocol stacks and we are sure to see traffic recording devices using this technology appearing within the next few months.

Short-range protocols can be particularly useful at removing the need for cables when working at the side of the road. This means it is often now possible to use short-range communications as a method of connecting with roadside equipment providing the added benefit of allowing the user to position themselves safely, away from traffic-related hazards.

Wireless vehicle detection

As the number of technologies enabling communications to traffic management staff increases so does the development of using wireless technology within systems themselves. With the advent of technologies such as radar, infrared and laser there is a new set of challenges to overcome in terms of security, battery power and interference. An example is the Golden River M100 magnetometer-based vehicle detector, which communicates with a roadside access point via a secure, two-way wireless protocol based on the IEEE 802.15.4 PHY protocol. This is a short-range, secure radio signal (up to around 100m) but is extremely low power, which is vitally important when dealing with battery-powered devices. As the communications to and from the in-road device are so critical, immunity from other spurious radio transmissions is a key reason for the choice in communications technology.

As the wireless protocol is two-way, it means that the transmissions between the vehicle detector and the access point can be acknowledged and thus help to ensure the resiliency of the messages, but it also allows configuration changes (including firmware updates) to be made to the vehicle detector, which is embedded in the road surface, without having to gain physical access to the device.

Future direction

Wireless communications are becoming increasingly important in the field of vehicle detection as the scope and complexity of network-wide, integrated transport solutions grows. This is required to deliver the ultimate flexibility demanded by today's users. As previously discussed the reasons are numerous and diverse and include: improving the safety of those working on roadside equipment; improving the flexibility of the solution (vehicle count and classification equipment can be installed in very remote locations that would not have been possible before); and allowing innovative vehicle detection technology to be used in situations where cables (including loops) would be unsuitable

It can be assumed that this growth will continue with even more vigour as intelligent vehicle-to-vehicle and vehicle-to-infrastructure solutions start to become a reality. This combined with the increased efficiencies provided, will equip traffic managers with even greater information availability and drive the adoption of these technologies within the market. Traffic managers will therefore be able to spend greater time focusing on the value and application of the data instead of spending significant periods of time travelling to site in order to collect information. ■

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