tern systems ltd

What is TERN? September 2011

TERN is a simple processor-based aid for Train Controllers.
The system comprises a Control Unit and Train Units which can be in-cab or portable, supported by a System Server.

The TERN sequences confirm verbal train movement instructions and reinforce them with the secure transmission of visible authorities linked to an intuitive user interface.

The system has been designed with minor railways in mind - although it could work for other applications as well.

Background.

TERN (which is an acronym for Token Exchange using Random Numbers) was first developed in BR about 25 years ago as a simple means of allocating possession tokens to remote track maintenance gangs. Over the years, the huge advances in technology have enabled TERN to become akin to a signalling system but it still retains the original ethos of being very simple.

Because the security of the system is built into the individual units there is no need for communications links to be secure. Safety critical information is lightly encrypted for transmission, but no authorities are issued or rescinded on receipt of these transmissions alone. Further exchanges of checksums are required before there are any changes to indicated authorities.

TERN will work well if GPRS coverage exists or if a digital back-to-back radio system is available. The present form of TERN uses IP technology and instant messaging software to transmit data.

There is an audio version of TERN that uses analogue radio, although this is perhaps more suitable for simple applications.

What can TERN do?

It can control multiple train movements on simple rail layouts so increasing line capacity and, potentially, revenue.

It can be a low-cost control option for railways that are planning to extend their layouts but for whom conventional signalling would be too costly or impractical.

Because TERN uses a powerful computer 'illusion' it can even:

- Lock out a ground frame by the physical capture of an Annetts key. This isolation of a ground frame can be written into the 'rules' of the user interface so dictating what train movements are permissible.

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- Substitute for a physical link between conventional key token machines. This option can have the advantage of allowing a railway to operate with traditional tokens without requiring any in-cab equipment whilst still preserving its 'heritage' character. TERN can use either the internet or conventional phone lines. Issues of security are bypassed because of the underlying TERN principles.

- Be a portable control system for railways that have only the occasional need for complex movements.

There are likely to be other uses of TERN!.....such as linking it with GPS to give added confirmation of train whereabouts and to simulate an AWS facility.

Why is TERN useful? What are the advantages?

It does not require any fixed infrastructure. That is, it doesn't need cabling or technical equipment that is exposed to vandalism. Signage is required to demarcate operating sections and it also needs a communications link between the Controller and the trains.

But it does not require a *secure* communications link as the security for token transmission is contained within each of the units.

It requires the very minimum of physical input from a train driver. It is recognised that drivers need their attention on the railway ahead and that steam cabs in particular are hostile environments for delicate electronic equipment. Drivers wearing heavy gloves are not best suited to using small and complicated controls. The TERN driver unit requires just one large button to be pressed – nothing else.

The in-cab unit gives a visible confirmation of movement authority to a driver. This indication cannot appear until the Control unit first shows the appropriate authority. Likewise a section cancellation cannot appear on the Control unit before it goes from a train unit.

It has a system architecture that recognises that it is based on 'SOUP'. (Software of Unknown Provenance) and so uses various stratagems to mitigate against any software anomalies.

The control unit is always in control – sequences cannot get out of phase even if communications links are broken and the system cannot be paralysed by a failed slave unit in mid transaction.

And the Controller is always in control. The railway is run using verbal instructions between controller and train driver. TERN provides a technological means of ensuring that these messages are correct and logical especially at times of operating stress.

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Technical matters:

There are three elements to consider: the control unit, the train units and the system server. (The analogue version does not require a server.)

The Control Unit
The control unit user interface will be custom built to suit the layout of the railway – although there are many common features on railways throughout the UK.
The 'rules' of the route have to be agreed with the railway operators before the interface is built.

The hardware/software involved
- Conventional Windows PC/laptop
- Operating system – XP/W7
- Required software – Net Framework 3.0
  - TERN instant messaging software
  - TERN token exchange system
- System recovery incorporated along with real-time logging.

The System Server:
The server does not need to be configured for a particular railway. It just does what it is told and that is to relay data between units.
There are two options:
The railway can use a rented server facility, or use its own in which case it should run Windows Server 2005/2008/2008r2.
The former gives a very high reliability as it is unlikely that local staff will be able to maintain or troubleshoot a Windows server!
The latter option has advantages if linked to a sealed digital radio network because such an overall radio system would eliminate any 'message-lag' that can be encountered when using the internet.

The Train Units:
These run on Windows Embedded in custom-made enclosures with the display integral with the main box or separate in a smaller enclosure via an umbilical cable. Mounting will be custom made to suit site conditions. Mag-mount is an option for some difficult cabs. A 12v supply is required. For portable units this will be within the unit and will need to be charged every day.
GPRS modems can be within the unit or separately plumbed within the cab.

If you have any queries then just get in touch via the phone or email contacts below.

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