GREENWAVE LINKING SYSTEM

Promotes Smooth Vehicle Flow Through Signalised Traffic Junctions

PPK Technology implements greenwave linking using wireless RF module for VA operations and GPS multiplan synchronisation for non-VA operations.The development was initiated because of the need to synchronise the flow of vehicles traveling from one junction to another in order to minimise travel delays caused by frequent stopping and waiting. Wired greenwave systems were previously used and were found to be costly because of the requirement to do underground cabling and ducting which can span long distances. Using the wireless RF module, PPK has managed to address this issue effectively. Cascading controllers can be connected to each other to provide a greenwave flow while the traffic controllers are still operating in vehicle actuated modes.

• Features

The wireless RF module is connected to the MATC 4000 controller using general purpose input outputs via the Intelligent Lamp Control (ILC) card. The ILC card has a facility to receive inputs and provide outputs to the RF module based on the commands received from the Advanced Processing Unit (APU) card. The wireless RF module sends and receive signals using the ISM band at a frequency of 2.4GHz. The range of the RF module is up to 2km outdoor line of sight. Using a high gain antenna, extended range higher than 2km can be obtained. The RF module has an incredible receiver sensitivity at -110 dBm and uses 7 frequency hopping channels, each with a 65K available address.

For GPS based synchronisation, the MATC controller uses a GPS 4000 module which synchronises the time of nearby controllers and activates linking based on a pre-set Multiplan time. For customers with complex vehicle volume patterns, a combination of RF module and GPS synchronisation can be used.

• Linking algorithms

PPK conducts traffic studies at both junctions before implementing a wireless greenwave system. In this study, we analyse the arterial flows of vehicles and the demand of vehicles at various peak hours throughout the day and based on the customer input. According to the analysis, we recommend suitable linking algorithms. These algorithms have been generalised and embedded into the MATC4000-Set software which is used to program the traffic controller.

The parameters which can be configured include:

- Link enable time
- Distance between junctions
- Link offset time
- Link hold time
- Cycle time extension
- Phase splits

These parameters can be configured and customised according to the customer needs.

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The greenwave linked controller system can be connected to the MATC Intelligent Traffic System (MITS) software via GPRS/EDGE, 3G/4G, PSTN modem, Wifi, fiber optic or leased line. MITS can also provide greenwave linking by control center commands to the traffic controller. In case of communication failure between RF modules, MITS can take over greenwave coordination if both junctions are connected to the control center.

• Key Features:

- Compatible with MATC 4000 traffic controller
- Vehicle detection via inductive loop and wireless infrared/radar
- Flexible control centre communication link supported i.e. IP-based, GPRS/EDGE, 3G/4G, fiber optic, leased line
- Greenwave priority links using wireless RF module (for VA operation) and GPS clock synchronisation (for non-VA/Multiplan operation)
- SMS alerts and prompt controller status checks
- Controller digital identification number
- Remote controller firmware updating
- Fully customised to integrate with other Intelligent Transportation Systems (ITS) i.e. variable message signs (VMS), flood warning system, video detection system, CCTV, red light camera, speed detection
- Incorporated with Anti Theft Technology

• Benefits

- Incorporates advanced local intelligence
- Highly adaptable phase succession
- Employs distributed control strategy
- Compliance of safety standards with lamp conflict detection
- Designed with a modular architecture
- Cost efficient

• Operational Specifications:

Item	Specifications
Microprocessor	8 bit
Wireless Greenwave RF Module	• 2.4 GHz, license-free ISM band, 19200 bps date rate, line of sight - 110 dBm receiver sensitivity - 150 mA transmit / 50 mA receive, power down current < 26 uA • Each RF transceiver has 4 port IDs Set - 4 inputs (opto-isolator coupling) and outputs (active high trigger) - Range up to 2 km - Module casing: L x H x W = 254mm x 198mm x 71mm - Screw mount onto MATC 4000 controller casing. Also mounted on pole/outdoor location depending on line of sight requirements.
GPS Greenwave synchronisation module	Industrial 32 bits CPU - Embedded Real Time Clock(RTC) circuit which can realize scheduled online/offline function RS232/RS485/RS422 port: 15KV ESD protection - Provide management software for remote management - Support TCP server and support multi TCP client connection - Multiplan based timing
MITS Greenwave synchronisation	• Receives commands from control center MITS software in case of RF module or GPS module failure • Replaces local greenwave synchronisation if larger network of traffic controllers need to be synchronised (for complex flows)
Programming / Configuration	Uses MATC Set software for controller configuration
Control center compatibility	Compatible with MATC Intelligent Traffic System (MITS) software
Logging Data and Events	Logs and stores data for any event occurring affecting greenwave linking functions
Vehicle Priority / Preemption	Can over ride greenwave linking settings

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