

## INTELLIGENT INDUSTRIAL WIRELESS NETWORK

### Personnel & Asset Monitoring System (PAMS)

PAMS is a solution used for personnel / asset monitoring which includes personnel safety features based on the following capabilities:

- Location tracking for personnel, equipment and other assets
- Man-down detection and alarming
- Hazardous area alerts
- Proximity detection
- Messaging and communications
- Video, audio and image capture and surveillance

These are achieved using a combination of the listed functions available in different levels of requirement:

- Proximity Detection
- Personnel Safety / Monitoring
- Vehicle Monitoring and Proximity Detection

#### Proximity Detection

- The lowest level is a basic proximity detection system provided via active wireless RF tag.
- These tags can be carried by users, allowing them to be detected by vehicles and other machinery, or they can be fixed to infrastructure allowing vehicles to interact and adapt to the environment (eg. to enable advanced vehicle automation) or to alert operators when they are near specific locations.
- The tag detection and reporting is integrated into the Nexis hardware platform.

#### Personnel Safety / Monitoring

- The next level provides for advanced personnel safety via GPS tracking, motion sensing and wireless connectivity.
- This level is provided using a combination of a software application and a suitable mobile device, such as the Nokia N95 mobile phone.
- The application utilises various motion sensors based on an accelerometer and GPS features to monitor the users activity; i.e.
  - If the user stops moving, it generates a warning tone and vibration. If the user does not acknowledge the alert, it automatically uses any available network (NextG/GSM or WiFi WLAN) to raise an alarm with a central monitoring system.
- The system periodically logs the users position and status to the central monitoring system for reporting and auditing purposes
- The application also provides the ability to support geo-referenced areas configure to identify safe or hazardous zones;
  - In a safe area (eg. offices), no alarms are generated.
  - If the user enters a hazardous area, it immediately generates an alarm and notifies the user.
- A future upgrade can be added to support streaming live video / audio from the phone, and capturing photos such



as for incident reporting. The video/audio will be able to be remotely activated to provide a surveillance mode in the event of an emergency, or to aid an injured user via live video/audio support.

- The devices can also be used to make and receive calls, access web-based applications, make VoIP calls (via the integrated VoIP features within the new Nexis products, or via a central VoIP server) and many other features.

#### Vehicle Monitoring and Proximity Detection

- Vehicle-to-vehicle proximity detection is provided using a fault-tolerant hardware platform based around the Nexis XS1.
- The system uses a combination of GPS (and / or GPS-augmentation systems) and special range sensors to accurately determine the position of other vehicles, and to then warn the operator.
- The XS1 utilises innovative techniques to ensure the dynamic location information is received by every other PAMS-capable device. These techniques eliminate the complex and error-prone handshaking and detection mechanisms used by other proximity systems based on standard WiFi connections and/or RFID. This feature is the direct result of numerous customer requests for a way to overcome several of the major safety limitations present in other solutions.
- To ensure the system continues to operate during periods when no GPS is available, a secondary network of dedicated range sensors can be added to the solution. This network utilises pairs of sensors to detect the presence of neighbouring vehicles (up to 100m away), as well as to perform continuous self-test / fault detection between sensor pairs. Unlike other proximity solutions that cannot detect a failure in the onboard detection system, the range sensors will immediately notify the vehicle operator if any of the detection system components fail.
- Video surveillance (eg. reversing / turning cameras) and other sensor inputs can also be incorporated into the solution.

#### PAMS

The unique capabilities of the PAMS platform, allow it to play a role in delivering advanced vehicle automation solutions coupled with end-to-end safety.

There has been significant interest from a wide variety of organisations, including existing and new mine sites, research organisations, equipment / vehicle manufacturers and solution providers. Site trials with several organisations are currently being discussed.

Many of these discussions may result in some or all of the PAMS components being integrated into the next generation products from these organisations.

