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VisorTrac™
A Tracking System for Mining

SYSTEM APPLICATION

The VISORTRAC system was developed to allow tracking of mining personnel as well as mining vehicles. The VISORTRAC system provides an easy interface to any Ethernet based network and can be supplied with converters to a fiber optic backbone or RS-485 multi-drop systems.

SYSTEM COMPONENTS

The system consists of these basic components:

1. RFID encoded UHF transmitter to identify personnel. Unit is attached to the miner's belt and is known as a **PRIM** "**P**ortable **R**adio **I**dentification **M**odule".
2. A UHF transceiver and embedded controller used to collect data from **PRIM**'s and **Visor**'s. Units are placed at strategic points in the mine where personnel travel or work and are known as **RINC "R**adio **I**dentification **N**ode **C**ontroller".
3. A transceiver unit fitted to the vehicle to identify the type of vehicle and the operator and is known as a **VISOR** "**V**ehicle **I**dentification **S**ystem **O**n **R**adio".
4. Computer Server with SQL Software and tracking application software known as **VISORTRAC.**
5. **Optional Devices** - Alert horn(s) with a mute function, Remote Antenna, Strobe light, Traffic light may be added.

BASIC SYSTEM OPERATION

All personnel entering the mine are required to have a PRIM. The PRIM is powered by an internal battery with a lifetime of approximately 2 years and transmits a unique identification code. It has a transmission range of 5 to 100 meters in most mine entries. The transmission time is short and the RINC reader polling is fast enough to assure a minimum of signal collision.

The vehicle is fitted with a VISOR transceiver, antenna and optional alert horn. VISOR detects the presence of all RINC's within it's receive zone. The VISOR has a display that indicates to the operator the number of RINC's detected as well as any permission required.

The RINC unit is connected to the existing communications backbone in locations where monitoring of vehicles and personnel are desired. RINC's may be delivered with an optional built-in media converter to either single or multi-mode fiber-optic cables. Connection to RS-485 multi-drop cables and links to leaky-feeder radio are also possible. When a person wearing a PRIM is within range of a RINC the data packet transmitted by the PRIM is combined with other data from the RINC and is passed to the VISORTRAC Server located in the mine office. The packet contains information on status of the battery, alarm button and signal strength.

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PRIM DESCRIPTION

PRIM units are transmitters that may be used to identify personnel or machines. When used to identify personnel they are simply attached to the belt of the miner. The software identifies the individual by the unique code assigned to that unit. The PRIM units operate at low power (-100 mw) UHF.

PRIM units have the following features:

MARCO TAG MSHA APPROVAL
NO. 23-A060001-0

- MSHA Certified under CFR Part 23 as intrinsically safe
- Operate on UHF frequencies with specific identification code
- Small in size and light weight approximately 2 x 3 x .75 inch
- Self contained power source with battery life up to two years
- Specific identification codes provided by Marco
- Push button to signal alert or an alarm
- Normal expected range will be not more than 100 meters
- To achieve maximum battery life the PRIM is transmit only

RINC DESCRIPTION

The RINC units are transceivers that are connected direct to the communications port on any compatible network. They receive signals from the PRIM and VISOR units. The information is formed into packets and sent on to the VISORTRAC Server via the network connection. The PRIM data is time stamped with the RINC location and stored in the data base. The VISOR data is processed at the server and the results returned to the RINC. The RINC can send the resultant message to the VISOR as well as show the results on the optional traffic light.

RINC units have the following features:

- Identified by a programmable label in the VisorTrac software
- Interface directly to Ethernet, RS-485 or Leaky Feeder options are available
- Rugged construction for the mining environment
- Transceivers operating at UHF frequencies
- Small size permits the RINC to be lowered down a drill hole to receive the signal from any PRIM's which maybe in the area of the drill hole.
- Maybe located in dangerous area to alert the carrier of a PRIM that they are about to enter a restricted area. (Optional Strobe Indicator with RINC)
- Optional Battery operated RINC with transceiver communications to a wired RINC for use in areas where intrinsically safe devices are required
- X/P version is available for hazardous locations

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VISOR DESCRIPTION

The VISOR units are transceivers that maybe installed in the vehicle or can be used as a handheld tracking unit to location PRIM's. They have a keypad for entering the employee number and a LCD display. The units are connected to the vehicle electrical system for power and to detect when the engine is turned on or off. The LCD display will automatically indicate the following status:

- The VISOR, with a self-contained rechargeable battery can be placed with oxygen caches permitting text communications with a RINC lowered down a bore hole during an emergency
- The VISOR display will also show the signal strength and status of any PRIM's within range. Could be useful in locating lost or trapped miners
- Listening for a RINC Node
- Acknowledge RINC contact by sending ID packet
- Receive acknowledgement of logging by the RINC
- With interface to an AMS system, Visor can be used to control diesel traffic into a two-entry longwall system. Optionally the RINC can control a traffic light controlling entry by "*RED"* traffic light stays on and the VISOR display shows *"WAIT"*. When sufficient air is available the light will change to *"GREEN"* and the VISOR display shows *"ALLOWED"*.
- When a VISOR is located within receiving distance of a RINC, they will exchange information and the VISOR will display status accordingly. While parked at the working place the VISOR will display *"PARKED"* if the engine is switched to off. A button on the VISOR must be pushed to request permission to start.

VISORTRAC SOFTWARE DESCRIPTION

The VISORTRAC Server is a PC based computer with the following features:

- Collects and stores current RINC and VISOR data showing the location of Visor's and PRIM's with time stamp. "See screen view on page 4"
- Receives alarm signal from PRIM and broadcast a response
- Provides the mine with electronic TAG-IN / TAG-OUT of employees as well as any visitors.
- Alert if anyone travels into an area marked dangerous by the location of a RINC.
- Information transfer to other systems is available by special programming as required.
- The software can receive messages from RINC's and pass them to a VISOR on a vehicle or to an optional LED text display connected to the Ethernet or RS-485 multi-drop in the mining section.

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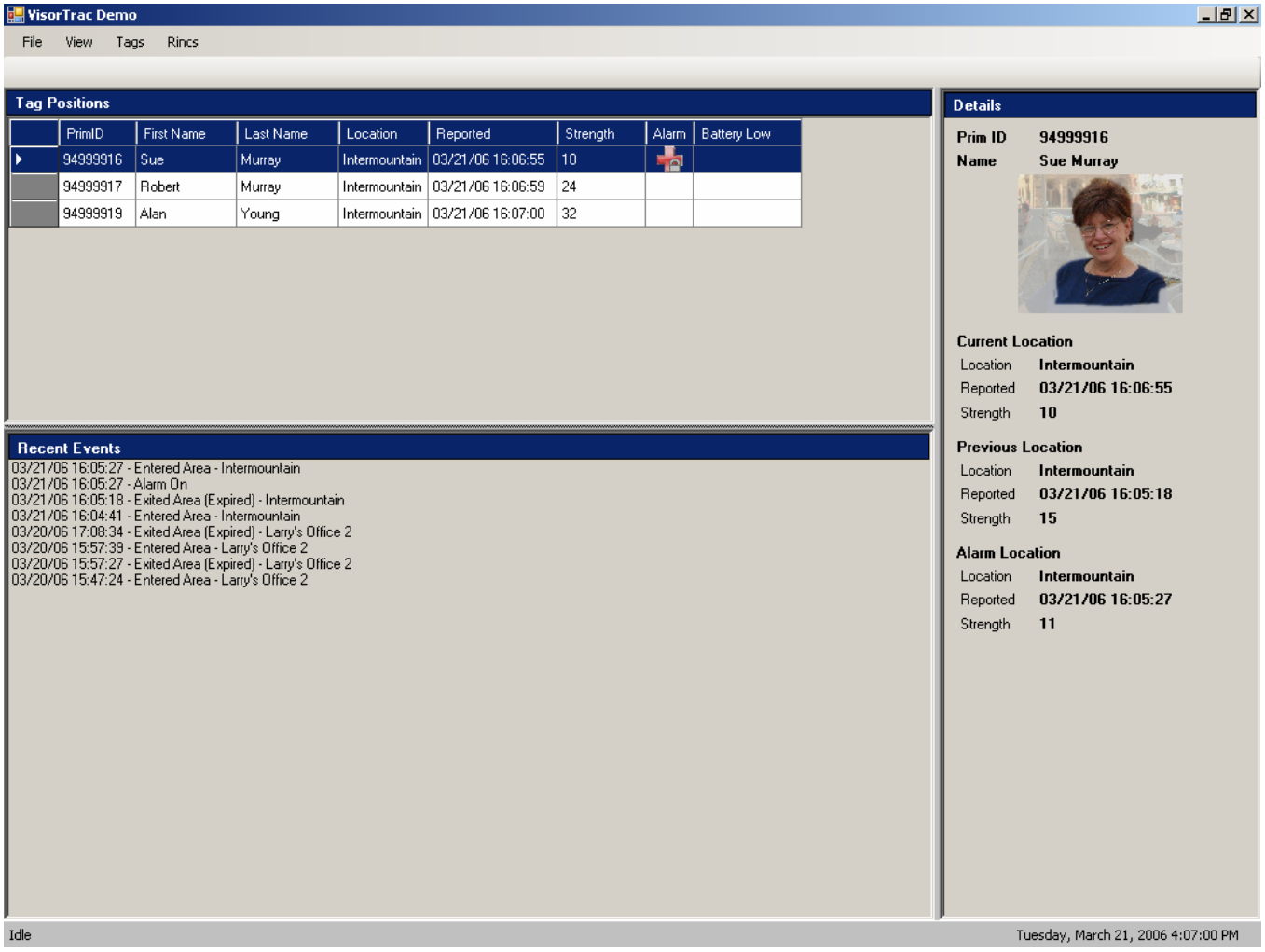
- Complete history of vehicles and PRIM's can be stored in the database for later review and/or storage.

EXAMPLE OF ONE OF THE USER SCREENS

- Employee name
- Location
- Date / Time stamp
- Signal strength
- Status of keypad alarm



- Record of recent events

EXAMPLE OF SCREEN VIEW

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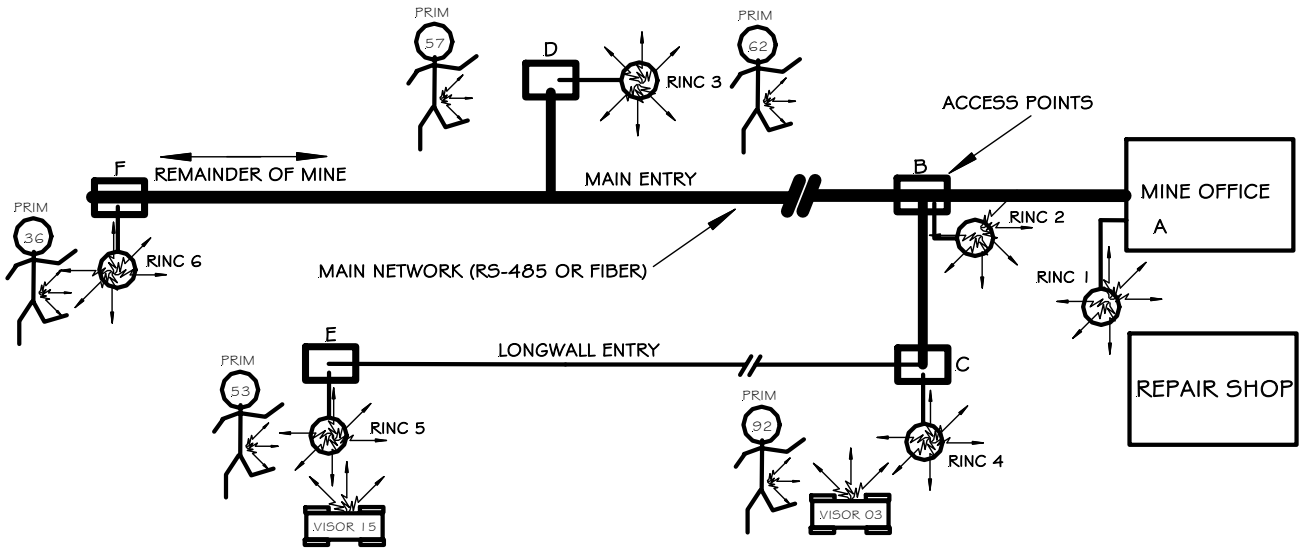
GENERAL DESCRIPTION OF REQUIREMENTS

1. System will be password protected.
2. All software, Operating and Application will be provided on the VISORTRAC server.
3. VISORTRAC operating manual provided on CD-ROM
4. The hardware will be delivered with all software loaded. A list of setup data will be provided on CD-ROM. One of our engineers will provide training at your location.
5. The system can provide data transfer to and from your Microsoft system via ODBC.
6. All VISORTRAC units, VISOR, RINC, PRIM may be re-located as needed. The system operator must only assign a new location in a user screen that will update the data base table.
7. The system will not provide instantaneous response because it must depend upon many factors beyond the control of our system. Any system with distributed units networked with radio links and underground propagation of signals cannot guarantee instantaneous response. We will warrant the system to operate as described and it will provide a reasonable response time based upon your communications infistructure.
8. The VISORTRAC system is currently in operation. We have more than 20 years experience in RF design and embedded microprocessor applications. The receivers and transmitters have been burned in and have passed our internal testing.
9. The RINC and Visor products are not required to be MSHA approved at this time as long as they are not located in-bye last open crosscut. The PRIM is MSHA certified as intrinsically safe under CFR 30 part 23 as it will be carried into in-bye areas.



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