Utilising technology to monitor and analyse mining operations in real-time

4th Biennial Conference

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Connectedness

Understanding

wisdom

knowledge

information

data

Understanding
It is a very sad thing that nowadays there is so little useless information.

Oscar Wilde
What is AziSA?

- A mine-wide network can centralise data capturing
- The infrastructure needed can provide communication channels to the working areas
- However, communication to the surface can be disrupted, so hazard identification and alarming should also take place locally
- This leads to a distributed architecture where sufficient automated decision-making is available at each working area
AziSA System Architecture

- Dumb sensors which are relatively cheap and disposable and must report their data over a wireless link.

- Intelligent sensors which have local decision-making capability and data storage, which optionally communicate wirelessly.

- A local wireless sensor network is managed by an aggregator which is a flexible mine-worthy computer that connects over a wired network to a central server.

- The server manages a central database and all connections to clients; it can make decisions based on mine-wide conditions.
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AziSA Class 4

The AziSA Class 4 is a dumb sensor which is relatively cheap and disposable and must report its data over a wireless link.
The AziSA Class 3 is an intelligent sensor which has local decision-making capability and data storage, which optionally communicate wirelessly.
A local wireless sensor network is managed by an *aggregator* which is a flexible mine-worthy computer that connects over a wired network to a central server. It can make local decisions and issue local alarms.
The server manages a central database and all connections to clients; it can make decisions based on mine-wide conditions.
AziSA System Implications

• Reliable data means that the system must be *self-monitoring*

• Using arbitrary channels means that the hardware and software must flexibly handle multiple standards and protocols

• Sensor metadata must be available at point of *sensor commissioning*

• Multiple sources of data with heterogeneous types, including from human observation and existing SCADA systems

• Wide range of potential consumers means the server architecture must be *extensible*

• Preliminary risk assessments must be passed to relevant decision makers, or *directly* to area through visual/audio alarms.
AziSA applications

• Rockfall risk assessment in hard rock mines
• Early warning of goafing in coal
• Entry examination
• Gas sensing flammable gas in hard rock mines
• Continuous monitoring fragmentation monitoring for blast optimisation
AziSA applications

• Rockfall risk assessment in hard rock mines

Objective – Develop technology for continuously assessing the risk of rockfalls in mines.

Primary Partner: Mine Health and Safety Council
Industry support: Gold Fields of South Africa
Impala Platinum
AziSA applications

- Early warning of goafing in coal

Objective – Apply AziSA to provide early warning of a pending large goafs in coal mines.

Industry support: New Denmark Mine (AngloCoal)
Xstrata Mining
Sasol Mining

Event sequence

- Precursory activity/foreshocks

Date/time:
- 22/11/2011 19:12
- 23/11/2011 04:48, 09:36
- 24/11/2011 14:24, 00:00

Accumulated events:
- 1000 to 4000

Peak particle velocity: mm/sec
- 0 to 90
AziSA applications

- Entry examination

Objective – Provide technology to recognise unstable rock.
AziSA application - Entry examination
AziSA applications

- Gas sensing flammable gas in hard rock mines

Partners: CSIR, Miraka, SINTEF, Norway.
AziSA: The Future

• An *open* standard that all hardware vendors can use

• Practical engineering experience in flexible infrastructure that is robust enough for the challenges of the mining environment

• A data infrastructure that can serve purposes other than safety-critical monitoring, such as communication to the working area

• A standard way to represent all mine data and make it available for different consumers

• Using artificial intelligence techniques to monitor many data sources and provide effective high-level input to decision-makers, without drowning them in details
Thank you