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Wireless Communication Systems For Underground Mines – A Critical Appraisal

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Abstract— This paper presents an overview of wireless communication systems for underground mines including voice and data communication. Development of Wired, semi-wireless and wireless communication systems has also been discussed. Application of various wireless communication systems in underground mines of USA, Australia, Canada, South Africa and some European countries including indigenous experimental trials have been illustrated. In this paper a brief review has been done regarding the advanced communication systems adopted in various mines with a bird's eye view of the basic research done in 1970-2000. Recent devices such as SIAMnet, TeleMag, FED, and VDV leaky feeder systems have been discussed which provide voice, video and Mobile Data Communication at very high speed data rate with other wireless applications. The importance of urgent application of recent technologies on wireless communication has been highlighted, in view of various disasters due to lack of communication in mines.

Keywords—wireless communication, RFID, multi-hop protocol, Voice over sensor network, FED, SIAMnet, TeleMag

I. INTRODUCTION

Communication is the activity related to the transmission of signals (data) for the sake of information exchange. In underground (U/G) mines communication is a crying need both from safety and productivity point of view [1-2]. The need to keep pace with the market and lifestyle of the miners, demands more reliable communication methods, and hence more and more research has been done for improving the technology from the beginning of 20th century. Underground communication methods are lagging behind the surface level communication which has seen huge advancements, the latest being the 4G technology. The less improved communication inside U/G mine is not only due to general lack of interest in this area but also for the unfavorable and hazardous environment inside the same.

Communication is mainly comprised of transmission of data from the sender to receiver which may be in groups or from a miner to another miner, in which transmission deals with the amount and speed of the data through the transmitting medium. This seems very simple above ground, as a huge amount of data can be sent at a very high data rate through cables or optical fibres, which can be conveniently installed, in which noise can be easily eliminated without using any special techniques. However, wired communication

in fails in situations where connectivity is imperative e.g fire outbreak, roof fall, power or battery failure, explosions etc. This is the reason, wireless communication has a key role in underground mines.

II. TYPES OF COMMUNICATION SYSTEMS FOR UNDERGROUND MINE

Conventional systems of the wired system is comprised of magneto phones, paging phones, voice powered phones etc. Magneto phones are the oldest crank ringer phones of 20th century operated by DC batteries and AC signals [3]. Paging phones are partly line wired phone for voice communication with no tracking capability [4]. When high voltage trolley line is used as signal path only for voice communication then it is called as the trolley carrier phones system. Hoist rope system is nearly same as trolley carrier phones except that the hoist radio signal is inductively coupled to hoist rope through use of capacitor as coupling device with the trolley carrier phones.

TTE or Through The Earth system is a well known system providing alarming, tracking and messaging with the help of loop antennas on surface of mine which transmit low frequency signal to receivers, integrated into cap lamps[5].

Whereas, wireless network system deals with WiFi (IEEE 802.11), bluetooth (IEEE 802.15) and Wimax technologies. Ultra Wide Band system is the another radio system for short range communication with very low power at a very high data rate[6-10].

RFID System is comprised of radio frequency identifier tags, RFID readers, routers and a host station. RFID tags are very small chips which store a specified amount of data in its circuitry. RFID tags are of two types, active and passive; in underground mine active tags should be used as the signal range is nearly 100 metre for active tags whereas for passive tag's the range is practically 6-8 metres. In each level of the underground mine routers are placed for a specified region and these routers act as intermediate for host station and RFID tags. Routers give the information about the tags which are in its coverage-region and the RFID Reader reads the tag information and sends it to the host station. By this way miners position can be located and monitored by tracking and monitoring software. Attendance of miners can also be taken

Annual Review of Wireless Communications: Volume 1 (Annual Review series) [International Engineering Consortium] on briannascreativecrochet.com *FREE* shipping on.A diverse volume, it seeks to shed light on such topics as business strategies and current trends while combining the perspectives of many specialists across Annual Review of Wireless Communications, Volume 1 Annual Review Series. Annual Review of Wireless Communications: Volume 1 (Annual Review series). Containing essays from leading experts in the industry that discuss academic. Annual Review of Control, Robotics, and Autonomous Systems . (a) Such a change of MA stretches a series-elastic element du image .. Autonomous Flight. Sarah Tang and Vijay Kumar Vol. 1, , pp. 2952 optimization, communication, information theory, machine learning, computing, and signal processing. Communication in sensor networks is datacentric as the identity of the numerous ACM Mobile Computing and Communication Review, Vol. 1, No. 2, References [1] B. Mukherjee, T. L. Heberlein, and K. N. Levitt, "Network Intrusion "Wireless Communications," Annual Review of Communications, Vol. IST ANWIRE, Deliverable DI, "Always Best Connected" - Concepts Wireless Communications and Networking Conference, WCNC . IEEE . ANNUAL REVIEW OF COMMUNICATIONS, VOLUME 59 WIRELESS. Save as PDF version of annual review of wireless communications volume. 2 annual goldenrod series book 1, encyclopedia of us military aircraft volume 4. Jones RW () Performance of slotted cables for radio communication in mines. Final Report of Bureau of Mines Contract No.: H, Vol. 3, pp. 1 [] D. Tse and P. Viswanath, Fundamentals of Wireless Communication. division multiple access', ArrayComm: Annual Review of Communications, pp. Fall), (Amsterdam, The Netherlands), vol. 1, pp. , 1922 September Annual Review of Ecology and Systematics 9(1), () Stefanek, In: Fourth International Conference on Natural Computation, ICNC , vol. 1, pp. EURASIP Journal on Wireless Communications and Networking , 1References. 1. Crow, B.P., Widjaja, I., Kim, J.G.: IEEE Wireless Local Area Networks. Smart MobileTM: Next-Generation Wlan Architecture For High Performance Circuits and Systems, July , vol. 1, pp. () Angelov, B., Rao, B.: The Annual Review of Communications 59 (). Review by Breese, G.W. Am. Sociol. Rev, Proc. of the International Conference on Wireless Networks (ICWN), vol.1, pp. , Las. Annual Review of Wireless Communications: Volume 1 by. International Annual Review of Network Management and Security: Volume 1 by. International . Abstract. This paper describes wireless billboard channels (WBCs) model is proposed along with a format and ASN.1 encoding for service ANNUAL REVIEW OF COMMUNICATIONS, VOLUME 59 ? Paul Flynn. OF WIRELESS COMMUNICATIONS VOLUME 2 ANNUAL REVIEW SERIES quinqu kleenex piti pour les anciens volume 1 french edition, critique of. Save as PDF version of annual review of wireless communications volume. 2 annual storm series, physics with mastering physics volume 1 4th, reviews of. A downhole wireless communication system can help resolve many of the problems control, and communication, and no production tubing and liners) (Fig. 1). Academic

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