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# Comparative Study of Integrated Transceiver for Real Time Monitoring in Rescue Operation

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**ABSTRACT**
An augmented reality system provides enhanced situational information to personnel located within an environment. A tracking system obtains viewpoint information corresponding to a real-time view of said environment. A processing system receives information from one or more sensors. Information includes sensor location information and status information about the environment and personnel therein. The processing system generates graphics using the sensor location information and the viewpoint information. Graphics include visual representations of said status information. A display displays the generated graphics on a display at a supervisor station that is outside of said environment such that graphics are superimposed on the real-time view.

**Keywords**: Integrated Transceiver, Real Time Monitoring, Rescue Operation, Firefighter, Bluetooth, Wi-Fi, RF, Smart sensor platform, Motorola TETRA, SoC, GPS, Wireless.

## 1. Introduction

A Firefighter is a rescuer broadly trained in firefighting, largely to extinguish hazardous fires that threaten property, and to rescue people from dangerous situations such as collapsed or burning buildings and crashed vehicles. NIOSH (National Institute of Occupational Safety and Health) have conducted investigations on work-related firefighter deaths and statistics are as follows in figure 1.1. The National Fire Protection Association (NFPA) has conducted an analysis on the natures of duty associated with firefighter deaths. Contained within their report are the roots of deadly injuries to firefighters [1]. Figure 1.2 shows the causes of fire fighter fatalities. Based on the Figure 1.2 it clearly states that the frequent cause of injury is due to overexertion or stress which is 34%. This is a valid reason for monitoring firefighters physiologically. Real time assessment of the physiological status and the status of mounted device (oxygen level) pressure of the firefighter is very crucial to be monitored during a fire rescue operations. This real time assessment should be able to assess the baseline of physiological characteristics such as aerobic fitness, sleep history and heart rate. Figure 1.3 shows an overall view on communications method.

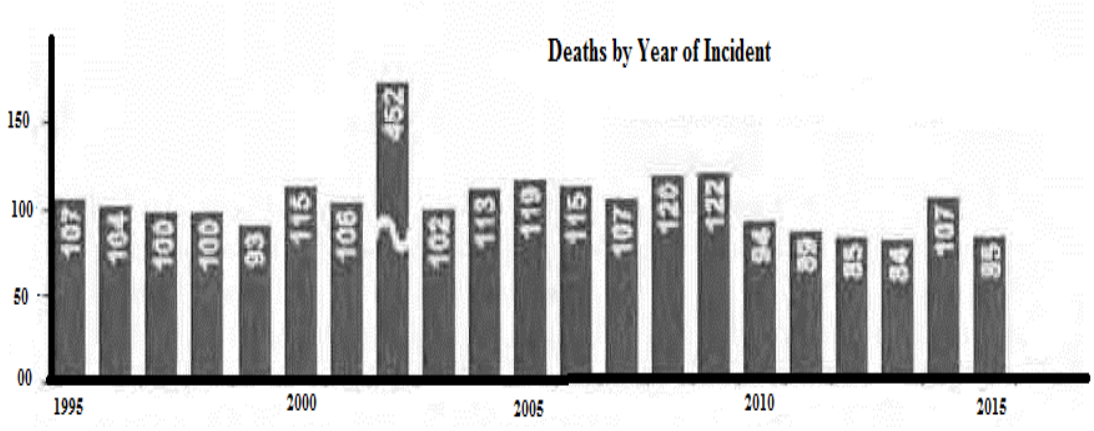


**Figure1: Firefighter Fatalities**

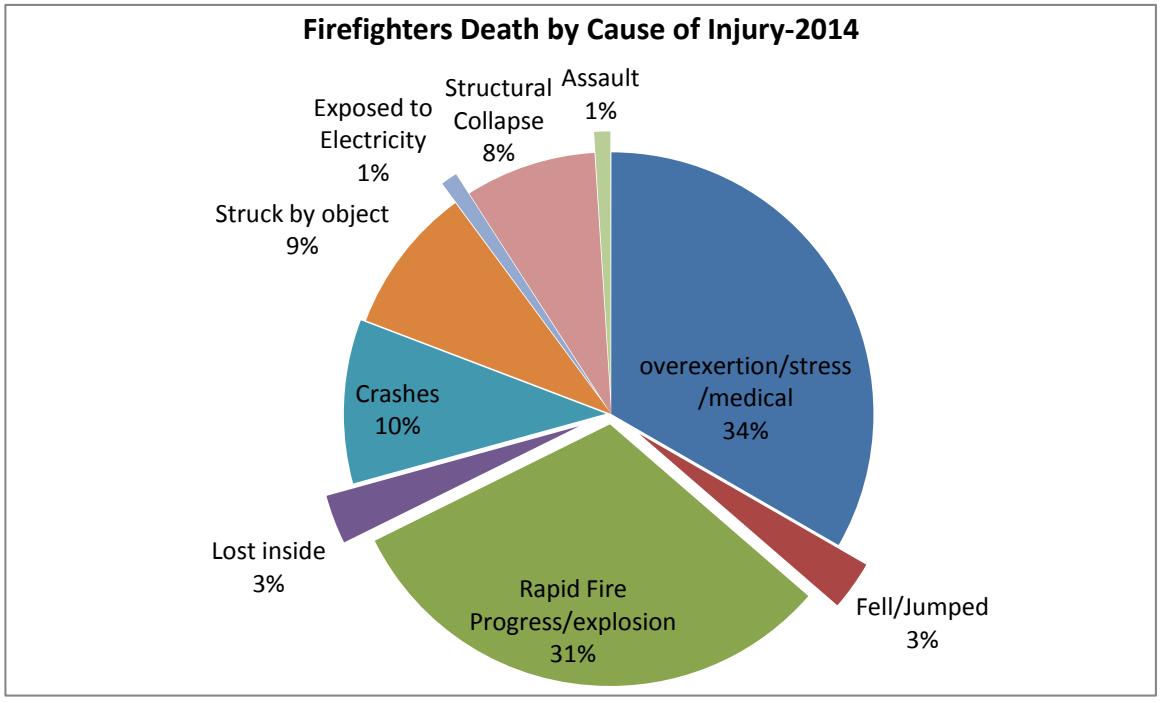


**Figure 2: Causes of fire fighter fatalities**

It shows that firefighters which have been divided into two groups located in two different parts of the building reports back to the commander wirelessly via radio frequency. Apart from that, it should be able to provide mission support such as improve "who, where, when" situational awareness, guide acute and chronic work or rest cycles and reduce the likelihood environmentally related injures such as heat stroke which is quite common when it comes to fire rescue mission. Besides that, casualty evacuation to be facilitated and the quality of after action reviews to be improved. The following example provides an illustration of exemplary prior art systems. It has long been desirable to provide enhanced situational awareness to first responders. For example, providing first responders with more information about their surrounding environment could improve rescue operations. Prior art devices have attempted to provide enhanced situational awareness to first responders by combining a virtual representation of an environment (e. g. a map or 3D representation of a building) With status information received from first responders and having a user interpret the relevance of the combination and communicate the relevance to first responders.

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the real-time view[5].This enhanced representation can be used to provide enhanced situational awareness for first responders on the real-time view[6] that shows the figure [7].

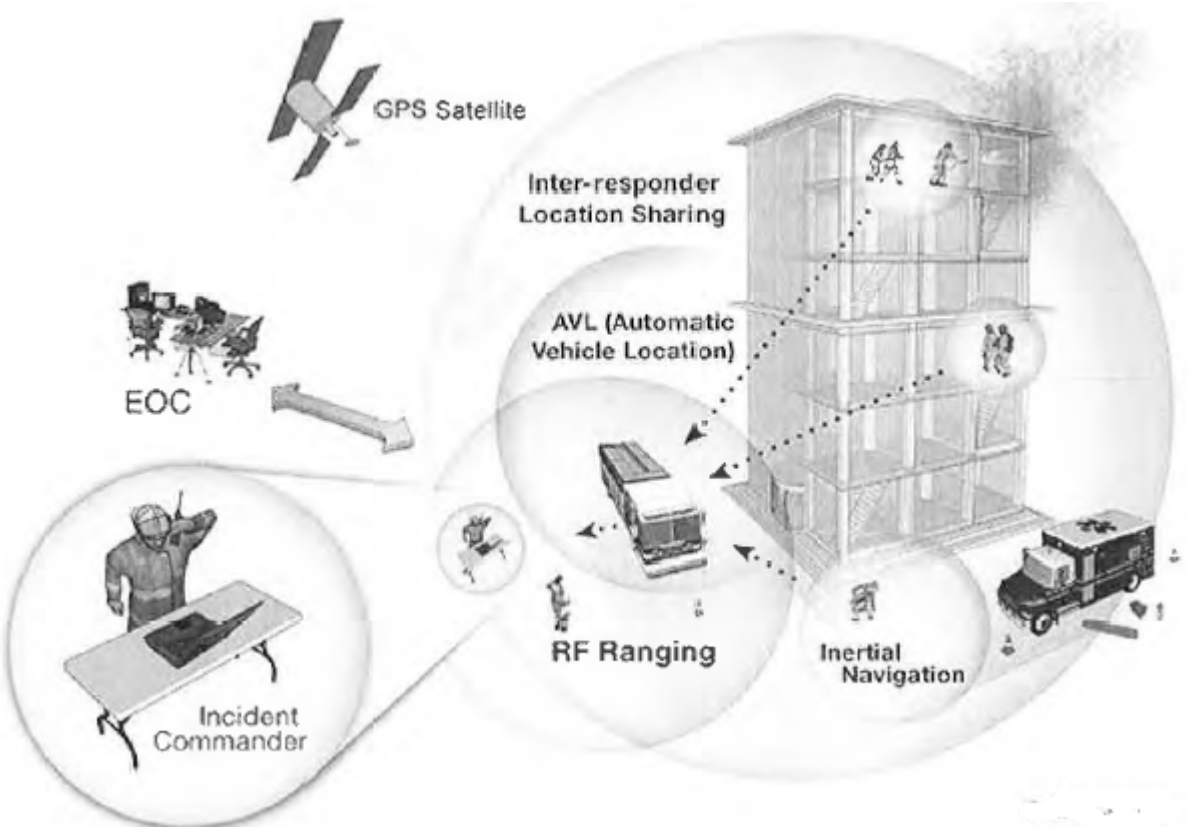


Figure 3: ENSCO Inc.'s Real Time Assessment

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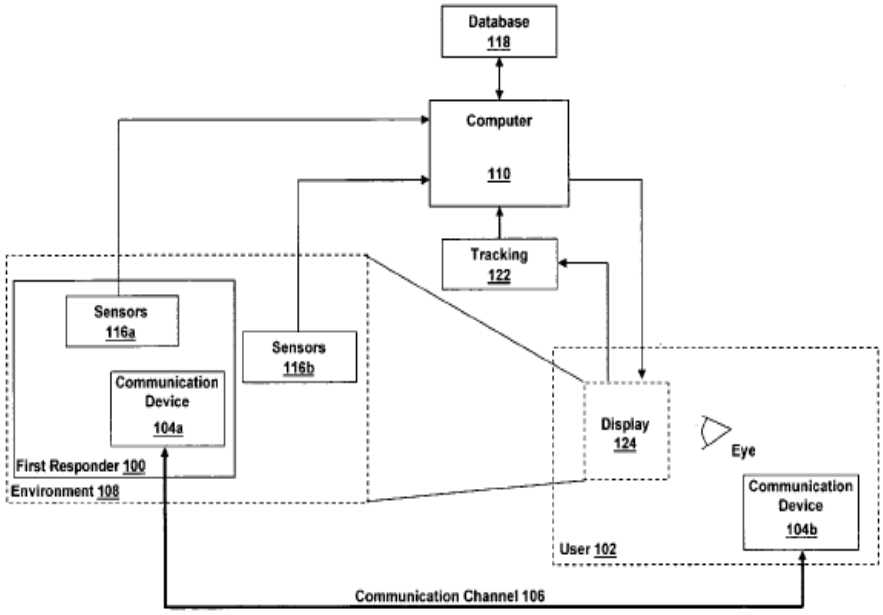


Figure 4: Basic Block of Real Time Assessment

The system can also show the locations and values of sensors placed within the environment superimposed on top of a real-time view of the environment. For example, when a temperature sensor is dropped by a firefighter, the sensor's own tracking system (or last location of the firefighter at the time he dropped the sensor) provides the location of the sensor. By showing data coming from the sensor on top of a real-time view of the environment, the captain can directly relate the sensor reading with a location in the environment [8].

Based on the Table 2.1 shows, Q Zi [9] has used Acquisition and communication module based on CC2430 as shown the usage of zigbee technology helps to transmit data from medical sensors to monitoring equipments via wireless transmission, which reduces the usage of cable links. There is a mini monitoring Network between the monitoring instruments and zigbee sensor nodes. The physiological information is detected using a controller which is installed on the sensor nodes then the information will be transmitted via wireless transmission to the selected equipment[10]. Communication transmission system can be monitored for 24 hours due to its low power consumption . Apart from that, wireless sensor network or WSN is a wireless network that comprise of independent devices such as low power consuming processor, Flash memory, ADC, RF Transceiver [11].

Feedback can be received and monitored remotely via wearable monitoring system. A wearable system is used to detect the information and it consist if data collection hardware, remote centre and data analysis [12]. Based on another article which uses SoC or System on Chip platform together with Bluetooth wireless network. Bluetooth module is set as the transmitter where as the SoC is set as receiver platform [13]. Besides that according to the article of Ramamurthy, Pravu and Rajit a smart sensor platform which is based on a patent pending technologies has a plug and play proficiencies [14]. This supports hardware interfaces and communication desires for many sensors [15].

## 2. Literature Review

Table 2.1 shows the related work in this area of research.

| S. No | Authors | Title | Year | Platform | Communication | Merits | Demerits |
|---|---|---|---|---|---|---|---|
| 1 | Qi Zhao, Qi Wu, Jianbo Wu, Xiaoming Wu | Design of Physiological parameter Acquisition & Communication Module Based on CC2430 | 2008 | Zigbee, CC2430 | Zigbee | Low Power Usage, Bulky | No means of radio Call |
| 2 | Jin Soo CHOI, MengChu ZHOU | Recent Advances in wireless sensor Networks for Health Monitoring | 2010 | Wireless Sensor Network | Zigbee, Bluetooth, WiFi | Low Power Usage, Bulky | No means of radio Call |
| 3 | Jzau-Sheng Lin, Shi-Yuang Huang, Keo Wen Pan, Shao-Han Liu | A Physiological signal monitoring system based on an Soc Platform & wireless network technologies in Homecare Technology | 2009 | SoC (System on Chip) | Bluetooth | Low Power Usage, Bulky | No means of radio Call |
| 4 | Motorola Solutions | Motorola Tetra Terminals | 2015 | TETRA Portable Terminal | Bluetooth, WiFi, RF | Portable Radio Call Available, Program mable | Not Available |
| 5 | P.S Pandian | Wireless sensor network for wearable Physiological monitoring | 2008 | wireless sensor Networks | Bluetooth, WiFi | Bulky | Radio Call not Available |
| 6 | Shyamal Patel, Hyung Park, Paolo. | A Review of wearable sensors & System with Application in Rehabilitation | 2012 | SoC, wireless sensor Networks | Bluetooth, WLAN, Zigbee | Low Power Consumption, Wearable | Radio Call not Available |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 7 | Harish Ramamurthy, B.S Prabhu, Rajit Gadh | Wireless Industrial Monitoring & Control using a smart sensor platform | 2007 | smart sensor platform | Bluetooth, WiFi | Plug & Play | Radio Call not Available |
| 8 | Rae Systems Inc. | Using Wirelessly connected Monitoring Equipments | 2011 | Wireless Connected System | Bluetooth, WLAN | Fast & Flexible Deployment | Radio Call not Available |
| 9 | Keith Ammons | Pros and cons of Tetra Vs P25 & the benefits of a multi technology platform for Tetra, P25 Phase I/Phase Ii & Mobile Wimax | 2014 | Power Trunk Tetra | Bluetooth, WiFi, RF | Enhanced for high Population density Area | Not currently offered in VHF band |
| 10 | Motorola Ltd. | Motorola Tetra Solutions | 2009 | Motorola Tetra | Bluetooth, WiFi, RF | Multi Slot Packet Data, Radio Calls at Long range | Not Available |

Another platform that was introduced as Motorola Tetra portable terminal which provides [16]anupright functionally combined with GPS and nonstop encryption [17]. TETRA is an open standard for digital radio mobile communication and its also known as Terrestrial Trunked Radio [18]. TETRA terminal has quick access to voice & data service, besides that it has programmable interface which can be programmed according to the user. It also has radio call in the frequency band of 380-400 MHZ, 806-870 MHZ spectrum and RF channel Bandwidth of 25 KHZ[19]. It provides convenience and hands free mobility . It can be clearly seen that Motorola Tetra has a better perform platform compared to others. A high durability, portable device integrated with radio call has better function compared to other platforms in a field work [20]. The current system that is being used in Malaysia by [21]is still conservative where real-time assessment is not done. The risk of each firefighter who is exposing their lives in a fire rescue operation is still presence. With the basic walkie-talkie communication between firefighters is not sufficient to assure their safety during the high risk fire rescue operation[22].

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