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Real Time Tracking of Fire Fighters Using IOT Enabled Wireless Sensor Networks

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Abstract:
Fire accidents which are often happening, which causes serious problems to the society. Firefighters risks their own life in order to safeguard others. There is no proper mechanism to monitor the vital parameters of the firefighters during dangerous situations. The goal of the project is to save the firefighter life during fire accidents by continuously monitoring their vital body parameters using Internet of Things (IoT) enabled Wireless Sensor Networks (WSN). Suppose any firefighter goes to a critical condition it can be noticed by the commander using a PC. So a backup-team can be called from the fire department to assist the suffering firefighter. The parameters monitored during fire accident are temp, co2, co, blood pressure, body temp. All the above parameters are sensed using the sensors that are placed in the firefighter's body. If any parameter goes beyond the threshold range as mentioned, then it should be intimated to the firefighter using LTE modem.

Keywords:*Internet of Things, LTE*

I. INTRODUCTION

IoT enabled Wireless Sensor Network got a major roleplay in fire rescue operations. During fire accident based rescue operation fire fighters may end up in risking their own life. For rescue operation the firefighters uses a senor node which are fitted in to their jacket which contains all relevant sensors for monitoring the vital body parameters like blood pressure,co2, co, body/external temperature. These sensor nodes are used to monitor the body parameters of the fire figheters as well as the environment around them during rescue as well as safe return path. In case of any anomaly, it immediately intimate the central commander who continuously monitor the rescue operation inside the fire engine. Secondly, these sensor networks allow any firefighters can communicate with their fellow members and group leader during critical situation for help.Third the group leader can able to communicate with the central commander for indoor navigation inside the fire affected building.

II. FIRFIGHTER SCENARIO AND SOLUTION

During rescue operation the firefighters may lose their path due to extreme conditions. With the help of 4G enabled GSM modem the central commander uninterruptedly guide the firefighters to take the safest path inside the building to reach their destination. The firefighters carry a GSM mobile phone which continuously relay the exact location of the firefighters to the central command. The mote view integrated development environment software installed in the command central will monitor the vital parameters of all the firefighters involved in the rescue operation by the sensor data it obtained from the group leader who will act as a sink or gateway node which collects information from all other sensor nodes of the respective fire fighters and relay the same to the central commander. If any abnormality found in any one of the firefighter's vital parameter he will be alerted and if not rescued by the back-up team or by fellow firefighters.

III. PROPOSED ARICHTECTURE

The firefighters are fitted with a sensor boards which forms a heterogenous self-organizes senor network.

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The central command issued the instructions and order to the fellow fighters through a 4G enabled GSM modem in the fire engine. These command and instructions will be delivered to the group leader who currently undergoes rescue operation along with his fellow firefighters. The group leader holds a GSM mobile which receives the command and instructions from central command. The group leader will act as a sink node for the sensor network. He relay the instruction to all other firefighters as well as receives the vital parameters from them. Once received these information are collectively relayed to the central commander. The central commander receives these parameters from group leaders and he analyze the overall parameters of all the firefighters through his laptop. He even able to visualize the health parameters like monitoring co,co2,blood pressure, body temperature of a particular fire fighter through his allotted node id. If any anomaly found the commander instruct the group leader or a particular fire fighter to rescue the wounded firefighter. The central commander can able to assist the group leader to successfully navigate inside the fire affected building and help those who are in danger. The GSM modem inside the fire engine will collect the location information from the group leaders who act as a sink node for the sensor network. Then through a serial port the information is fed to the laptop.

Each firefighter is equipped with MICA2 mote which contains lots of sensors embedded in it. It sense the health parameters of the firefighter as well as sense the environment around the firefighter like temperature and humidity and relay this information to group leader. The group leader also contains the MICA 2 mote which collects the information from

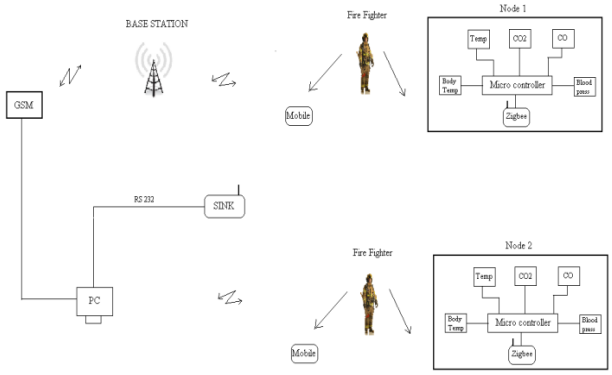

Fig 1. Block diagram of proposed architecture

IV.REAL TIME MONITORING

The overall rescue operation and health parameters of individual firefighters are viewed through a software called MoteView. Apart from health parameters of firefighters and their location, more real time information is needed for central commander and group leader.

External temperature sensor PT 1000 is mainly used to measure the environment temperature near by the fire fighter. This sensor has a temperature range of -70 degree celcius to 600 degree celcius. The sensor can be self-heated up to < 0.5 degree. The sensor is made up of platinum. MQ-5 is a gas sensor to monitor the surrounding heating substance especially coal .This sensor is very high sensitive to natural gas ,LPG gas, Town gas. The MOTE works normally in the range of 2.v to 3.5v.when it exceeds beyond that the readings wont be normal .In case any sensor has a upper operating limit of 3.5v then a voltage regulator circuit is necessary

The blood pressure sensor 26pc01smt it allow to monitor the pressure level of a fire fighter. Though it increases above a thershold value it will generate a alert form. Still we didn't integrated this blood pressure sensor with mda 300,but checked the output value with multimeter

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FIG 2 BLOOD PRESSURE SENSOR

V. HARDWARE DESIGN

i) MIB 510 BOARD

The senor node namely MIB510 which is carried by the firefighters accumulates all the vital parameters using its inbuilt sensors and relay the same to group leader or to the central commander's laptop via GSM modem. The MIB510 board will act as base station as well as sink node depends upon the situation. The reason for using MIB 510 is it can be used in a harsh environment

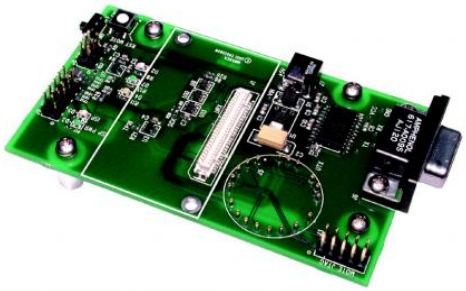

Fig 3 MIB 510 programming board

ii)MDA 300 board

The MDA300 is a most multipurpose and adaptable data acquisition board which includes on board temperature , humidity and ambient light sensors which is extreamly helpful in monitoring the environmental parameters.

. The MDA 300 is protected using ZETEX fibre material. This material will protect the device from high temperature.

This board is used to integrate several external sensors such as temperature sensor(pt 10000),blood pressure sensor(26 pc smt),co sensor,c02 sensor

Digi XBee CellularModem

Digi XBee Cellular modem is a versatile modem that gives 4G connectivity for our existing project. It has low power consumption and optimized for longer battery life. It has enhanced security framework for transporting the information safely fro end to end.

VI. ROUTING

The XMesh is a multi-hop, mesh topology based sensor network protocol created by Crossbow Inc.The XMesh network protocol consists of many number of nodes which can able to communicate with each other wirelessly and hop the radio message from one node to another node until the message reaches the base node or sink node. Because of this hopping sequence power efficiency and radio coverage are achieved to a great extent in order to transmit the messages efficiently.

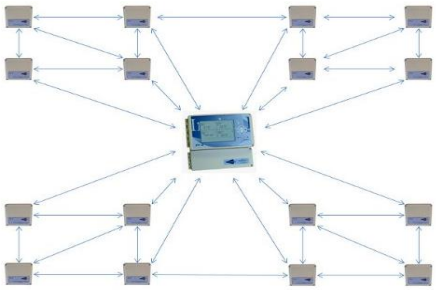

Fig 4 Mesh structure

In future to make more efficient in routing MICRA protocol is going to implement in XMESH. The MICRA is the extension of HEED and LEECH. But this two routing protocol is applicable to only small set of nodes.In order to overcome that MICRA is used. The choosing of cluster head is different from the two algorithm. By using this formula the cluster head is calculated.

CHprob =((Eres/Epeak)*(1-(cluster length/nodes no)))

Where,

Eres: Estimated energy

Epeak:Maximum energy

VII.DATA MANAGEMENT

The open source embedded operating system used as a platform for wireless sensor network is called TinyOS. The language in which TinyOS is written is

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called nesC which contains cooperating tasks and processes.

The database specifically created for embedded wireless operating system is called TinyDB. It is used to extract the information from MICA motes. TinyDB provides SQL based query interface for extracting information from wireless sensor network. It is used to extract specific data you want to extract from sensor network. And also used to specify the data refreshing timestamp and so on.

VIII. RESULTS

To analyze the overall performance of the wireless sensor network some experiments are conducted and the results are shown below.

i) Mote view

In front end it contain different adc ports.all these ports are get connected by a different sensors(co,co2,26 pc smt,pt 1000).The increasing and fluctuating values are seen .By setting a threshold value we can able to generate an alert form,this is seen by a commander outside the fire zone.In the above figure we can to see the increase in value of co and external sensor(pt 1000) in adc 0 and adc 1.Setting a threshold value for adc 1 it generates an alert form as shown below

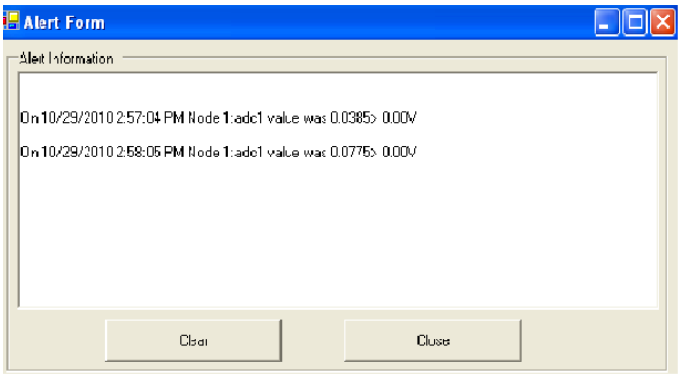

Fig 5 Alert form in mote view

ii) Graphical representation

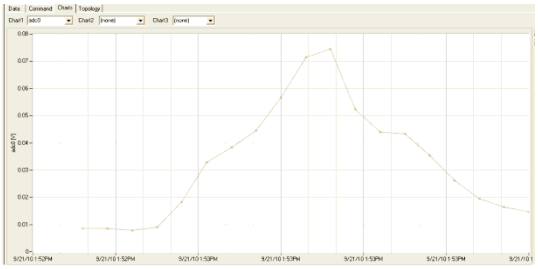

Fig 6 Example showing increase in gas value

It shows an increase in value when adc 0 port get connected

iii) Laboratory setup

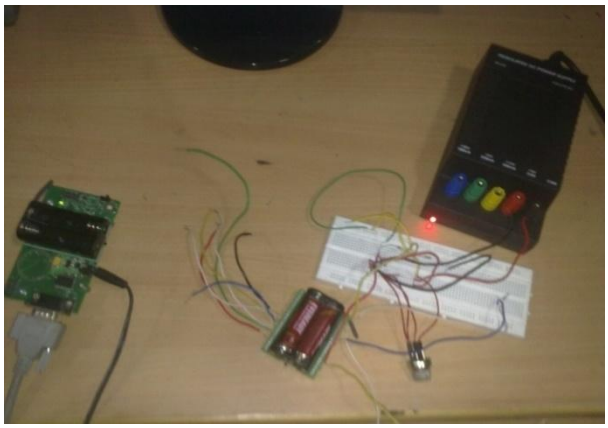

Fig 7 Laboratory set up

In the above figure I have connected the temperature, CO sensor in a mote. All these sensor will send the value to gate way. From there data is taken through RS 232 cable

IX. CONCLUSION

In this paper we mainly focus on how the mesh topology will work in harsh environment and how the parameters are viewed and intimated

REFERENCES:

[1]. Yanwei Chen, Demin Li, Chenwen Wang ,"MAP SYNchronization and alternatives optimization for fire fighter cooperative decision support in ad-hoc network" JOURNAL OF NETWORKS, VOL. 5, NO. 1, JANUARY 2010.

[2]. Chunlei An Andreas Timm-Giel Carmelita Goerg," Virtual Sensor Network Lifeline for Communications in Fire Fighting Rescue Scenarios" conference on University of Bremen, TZI ikom/ComNets, Germany,

January - February 2020
ISSN: 0193 - 4120 Page No. 4775 - 4779

[3]. Yuanyuan Zeng Cormac J. Sreenan Lanny Sitanayah," A Real-Time and Robust Routing Protocol for Building Fire Emergency Applications Using Wireless Sensor Networks", conference on Mobile & Internet Systems Laboratory Department of Computer Science University College Cork

[4]. Kewei Sha Weisong Shi, IEEE Member Orlando Watkins," Using Wireless Sensor Networks for Fire Rescue Applications: Requirements and Challenges" ,conference on Orlando WatkinsDetroit Fire Department250 West Larned

[5]. Lei Wang and K. Wendy Tang," Topology-Based Routing for Xmesh inWireless Sensor Networks",

[6]. Kavi K. Khedo, and R. K. Subramanian," MiSense Hierarchical Cluster-Based Routing Algorithm (MiCRA) for Wireless Sensor Networks"