Accomplished locomotives in wireless sensor
Proprietary wireless protocols

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ABSTRACT

Fire accident is a serious problem in our world especially the populated and illiterate region. Fire accident mainly takes place due to unknowingness of safety precautions about safe travel and also some technical consideration during travel. So the railways department should take the precautionary action to prevent the unnecessary damages and deaths.

In this system, for continuous communication through wireless communication has been preferred. The data's and acknowledgement signals are handled by the RF Transceiver due to that low power consumption. Each and every compartment are networked with engine of train which acts as master node of the train and other are acts as slaves.

A clear insight about the proposed system is given and block diagram and implementation of the system is designed. This paper aims at proposing a mechanism to save people from fire accidents.

KEY WORDS: PIC microcontroller, smoke sensors, temperature sensor, Fire accident, RF transceivers.

1. INTRODUCTION

Nowadays Fire accidents are more frequent. It occurs in different modes like fire accident in industrial areas, all modes of transportation like air ways seaways and water ways. Many living beings are been killed and heavy loss is been faced by the government to overcome from these fire accidents. Some of the main sources for occurrence of fire accidents in train are Carrying stoves, gas cylinders, kerosene oil, petrol, and fireworks etc. in passenger compartments and Lighted match sticks, cigarette ends carelessly thrown and Short circuit in electrical wirings. This paper aims to design an automatic control system to avoid and control fire accident in railways. This system consists of two unit compartment unit and driver unit. Compartment unit will monitor the status of the compartment and report it to the driver unit. When the train unit (driver mote and compartment motes) has been turned on they form a network for communication. Each compartment in train having water sprinkler and smoke sensor has been placed to detect the fire. The engine unit has a display unit and alarm too. If the sensor threshold value exceeds, then automatically the compartment unit given fire alarm and the water sprinkler system will turn on and this fire accident location is sent through wireless to the engine unit. When the engine unit receives the information, it automatically will stops the train ,which prevents further fire spreading to another compartment and saves peoples too the alert will be given to engine unit. At the same time the driver can know the alert and the fire can be automatically prevented. If the threshold value of smoke sensor reaches 150, then the compartment unit will send the alert system and stop the train. (Li, 2005; Zhang, 2010; Ramachandran, 2000, Gungor, 2006).

Proposed System: Fire accident is a serious problem in our world especially the populated and illiterate region. Fire accident mainly takes place due to unknowingness of safety precautions about safe travel and also some technical consideration during travel. So the railways department should take the precautionary action to prevent the unnecessary damages and deaths. In existing system, the communication between the compartments in train takes place by unreliable wired connection. Unfortunate accidents may terminate the communication by damage which leads to human's death. In this system, for continuous communication the wireless communication has been preferred. The data's and acknowledgement signals are handled by the RF Transceiver due to that low power consumption. Each and every compartment are networked with engine of train which acts as master node of the train and other are acts as slaves(Malhara, 2010; Ausen, 2006; Gungor, 2010; Ullo, 2010; Bose, 2010).

2. WORKING

The setup is made as shown in the block diagram with the components and tools specified. The main concept of the project depends on the RSSI of the RF Transceiver i.e., received signal strength indicator (Moslehi, 2010; Hung, 2010; Wu, 2012; Hung, 2013).

The PIC microcontroller is connected to the IEEE 802.15.4 RF Transceiver MiWi of the display mote via SPI. The result to be displayed is shown in LCD which is connected to the microcontroller via I2C. Similarly for the reference mote IEEE 802.15.4 RF Transceiver is connected to the microcontroller via SPI – serial peripheral Interface (Jasmin, 2015; Philomina, 2014; Karthik, 2014).

Once the setup is made, the display mote and reference motes are switched on. The motes start communicating as soon as the power is on by transmitting and receiving the RF signal. The motes are placed very

close to each other and the RSSI values are studied and noted (Saravanan, 2014; Gopalakrishnan, 2014; Vijayaragavan, 2014).

Then the display mote is taken slowly away from the reference mote and the change in RSSI values is noted. Now display motes are taken far until there is no RSSI value to display and again bought closer slowly to observe the increase in value and also to study the coverage area of the system.

Thus different values are noted in different position. According to the values noted the controller are programmed to monitor and compare the RSSI value and display the desired result in the LCD via I2C.

Thus how the power is been taken and noted down and the extra power is been cut offed. This is really a user friendly system.
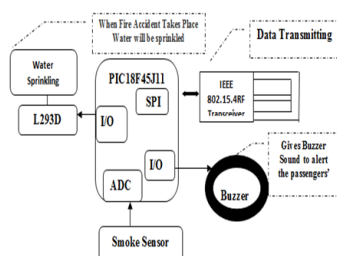
Block Diagram

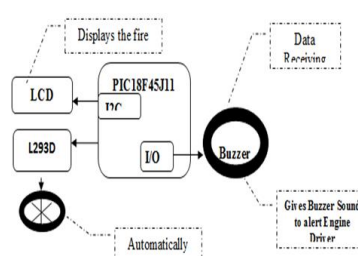

Figure.1. Compartment unit: Figure.2. Driver unit

Hardware Description: Following are the hardware used to develop this system.

- PIC18F45J11 Microcontroller
- LCD DISPLAY
- IEEE 802.15.4 MIWI MRF24J40
- I2C

PIC18F45J11 Microcontroller: Single chip microcomputers are called microcontrollers. Microcontrollers have inbuilt memory, timers and counters. Harvard architecture is been used for instance separate memory mapping for data and code is available. According to the proposed system, the best choice of microcontroller is PIC microcontroller due to following reasons

- PIC microcontrollers have reduced instruction set RISC.
- MiWi are compatible only with PIC microcontrollers
- Low cost
- Free development tools available

Hence from PIC microcontroller family PIC18F45J11 is used in this system. PIC18F45J11 has 32k program memory and 3.8k data memory. The PIC18F46J11 family provides flexibility for peripheral interfacing. PIC Microcontroller has additional advantage of designing cost effective applications using this PIC18 J-series. This controller also includes two USARTs and two Master Synchronous Serial Port (MSSP) modules. It is also configured with the flexibility to be used as parallel master and slave port. It also has 10-bit a/d converter, Watch dog timer.

IEEE 802.15.4 RF Transceiver: This RF Transceiver is a benchmark, characterizes generous layer and media access control for low-rate remote individual region systems (LR-WPANs). It is taken consideration by the IEEE 802.15 working gathering, which has characterized it in 2003. It is the foundation for the all the wireless devices like ZibBee, MiWi. IEEE standard 802.15.4 can be used for remote communication system (WPAN) which spotlights on minimal effort, low-speed omnipresent correspondence among peripherals (conversely with other, more end-client arranged methodologies, for example, Wi-Fi). The accentuation is on less cost communication of adjacent gadgets with next to zero fundamental bases, planning to adventure this to minimal energy consumption. The minimum needed requirement is a 10-meter range with a data rate of 250 kbit/s. Much lesser rates can be measured with the subsequent impact on energy utilization. The main highlight of IEEE 802.15.4 among WPANs is the importance of accomplishing particularly less design structure, ease of practical use and specialized effortlessness. CSMA/CA functionalities is also an added feature. This additionally incorporates energy saving capability (Vijayaragavan, 2014; Kanniga, 2011, 2013, 2014).

In this undertaking we utilize the transceivers for correspondence between the handheld and the footwear unit. This sort of remote correspondence is finished with the assistance of this wireless correspondence.

LCD: Liquid Crystal Display is widely used replacing LEDs. Because of the following advantages

- Low cost
- It can display alphabets, numerical and symbol.
- Ease of programming for characters and graphics.

Master Synchronous Serial Port (MSSP) Module: The Master Synchronous Serial Port (MSSP) module is a serial interface valuable for corresponding with other fringe or microcontroller gadgets. These fringe gadgets may be serial EEPROMs, shift registers, show drivers, A/D converters, and so forth. The MSSP module can work in one of two modes:

- Serial Peripheral Interface (SPI)
- Inter-Integrated Circuit (I2C)

SPI Mode: The SPI mode permits 8 bits of information to be synchronously transmitted and got at the same time. Every one of the four methods of SPI are bolstered. To fulfil correspondence, ordinarily three pins are utilized:

- Serial Data out (SDO)
- Serial Data in (SDI)
- Serial Clock (SCK)
- SS must have TRISA set

MSSP I2C Operation: The MSSP module in I2C mode completely executes all expert and slave capacities (counting general call bolster) and gives intrudes on-begin and stop bits in equipment to decide a free transport (multi-expert capacity). The MSSP module actualizes the standard mode determinations, and additionally 7-bit and 10-bit tending to.

I²C (Inter-Integrated Circuit, alluded to as I-squared-C, I-two-C, or IIC) is a multimaster serial single-finished PC transport created by Philips utilized for connecting low-speed peripherals to a motherboard, installed framework, phone, or other electronic gadget.

I²C uses just two bidirectional open-channel lines, Serial Data Line (SDA) and Serial Clock (SCL), pulled up with resistors. Ordinary voltages utilized are +5 V or +3.3 V in spite of the fact that frameworks with different voltage
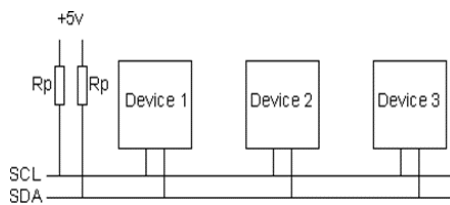

Figure.3. I2c Master Slave Connection with Pull Up Resistors

Software Used: Software used in this project are

- MPLAB IDE
- Hi-Tech Compiler
- C- Language

3. RESULT

In this project the respective hardware is selected, studied and tested. Hence, the software part is empathized. According to the task to be done by the system an algorithm should be developed and flow charts should be designed. Program is developed according to the designed algorithm and flow chart and it is compiled and tested in MPLAB. The program is written in C language for better simplicity and easy implementation. The program is then should be loaded into the microcontroller. Then the circuit connections are given according to the block diagram and pin specification in a bread board to test the result. The initial value obtained by testing the motes placing it nearer and then far with each other should be. The testing should be done in different environment and the values should be noted. Then an average value should be calculated and it is used as a reference value for RSSI received signal strength indication. After verifying the results and desired output PCB is developed for the circuit connection given before. Necessary encasing of the hardware is done to protect it from external force and damage. The proposed system should be tested and then it will be ready to use.

4. CONCLUSION

The aim of the proposed system is to avoid accidents and peoples losing their lives due to fire accidents. The application of the proposed system is vast and not confined, but it will provide a great contribution to the following fields with slight modification.

- It can be used in air conditioned buses.
- It can be used in schools and colleges to save the life and property of the people.
- It can also be used in shopping malls, cinema theatres etc.

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