Design and Execution of Microcontroller based on Sensor Network for Predicting and Forecasting of Fire Accident Building

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Abstract **- Safety is the most important issue to rescue the lives of people and damage of assets. To achieve this goal, a fire accident existence predictor which also avoids hazard is crucial. The system is sensitive to temperature and pressure above the threshold values thereby produces different kinds of signals to stimulate that a fire may take place in the multi-store building at some time and location. In this paper, it has been developed a prototype of an autonomous wireless sensor network predicting and forecasting fire accident in a multi-store building. This prototype is a low cost, efficient and portable. It also is capable of avoiding the fire accident. The system displays when and where the event takes place and gives alarm signals in the form of visual, audible and SMS on LEDs and LCD, buzzer, and user mobile phones respectively. Approximation methods exist to provide estimates of smoke detector response based on optical density, temperature rise, and gas velocity thresholds. The objective of this study was to assess the uncertainty associated with these estimation methods.**

Index Terms **- Forecasting; wireless Sensor Network, microcontroller, sensor, registers, capacitors, transformer, buzzer driver, LED.**

1.INTRODUCTION

Nowadays, global warming is a burning issue throughout the world. Climate change is a result of changes in the physical world caused either due to natural or human factors and can lead to disaster. The goal is to come out with a device which serves as fire accident predicting and forecasting, detecting, and avoiding system. When there is a situation that a fire is going to take place, the system generates different hazard indicator signals such as the buzzer, LCD, LEDs displays and SMS to user's cell phones using GSM Network and send signal to the servo motor controller to open the fire extinguisher hose in case of fire accident.[1] A smoke detector is a device that senses smoke, typically as an indicator of fire. Commercial and residential security devices issue a signal to a fire alarm control panel as part of a fire alarm system, while household detectors, known as smoke alarms, generally issue a local audible or visual alarm from the detector itself. Smoke detectors are typically housed in a disk-shaped plastic enclosure about 150 millimeters in diameter and 25 millimeters thick, but the shape can vary by manufacturer or product line. [2] Most smoke detectors work either by optical detection (photoelectric) or by physical process (ionization), while others use both detection methods to increase sensitivity to smoke. Sensitive alarms can be used to detect, and thus deter, smoking in areas where it is banned. Smoke detectors in large commercial, industrial, and residential buildings are usually powered by a central fire alarm system, which is powered by the building power with a battery backup.

1.1. Wireless Sensor Network-

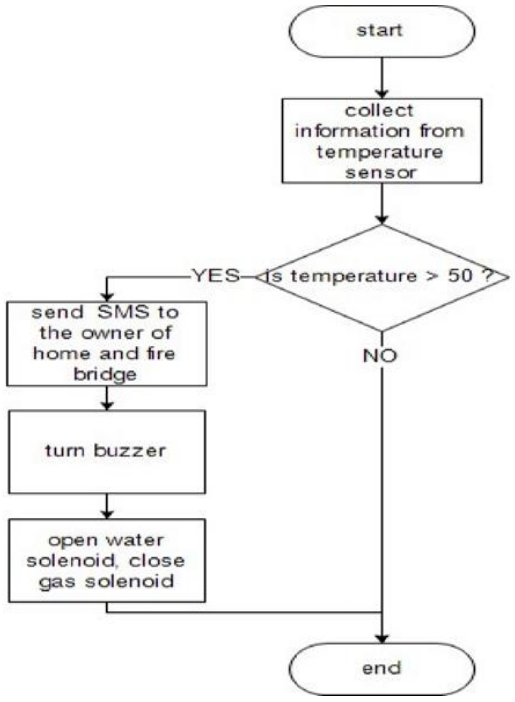
A wireless Sensor Network is the liking of two or more electronics devices that utilize the frequency modulation technique based on radio waves without physical connection in the local area network. [3] As the name portrays, there is no physical connection among the electronic devices, the communication is then achieved through the radio waves. There is a high mobility in wireless communication within the limited coverage area and remains connected.

1.2. Sensing and Sensors

Sensing is reading some kind of physical world parameters. For instance, a temperature and pressure sensors; it is through these sensors that the system can collect the information of the surrounding which helps it to control the variation in pressure and temperature; taking different kinds of actions when there is something lead to catastrophic.[2] A sensor then is a device which senses physical environmental parameters and produces an electrical signal at its output terminal in either analog or digital form depending on the type of the sensor used. In a narrow sense, a sensor is a device which transforms physical parameter into electrical signals. Subsequently, the resulting signals may need further processing for best matching of the next device which takes these signals as input. Some of the signal processing techniques are signal amplification, to get the sensor output signal to bring up to the required level to best match with the next device input level. Voltage level shifting, for example, when there is a need to communicate through the RS232 standard Serial ports. Analog to digital conversion (ADC) or the other way round digital to analog conversion (DAC).[4] The sensor output signals may also need to step down if the matching device next to the sensor supports low level signal, this time attenuation technique comes into picture.

1.3. The Temperature and Pressure Sensors

In recent times, temperature sensors come in different varieties in their calibration, digital or analog type, range of operation and in IC form or in a kind of wires. The temperature sensor used is (LM35) in the prototype development as it is found low cost, easily available in market as well as in simulators, emulators and above all it is found that suitable for the prototype device. [8] This sensor is an analog sensor produced by National semiconductor calibrated in centigrade scale and its operation range is -55ºC to 150ºC. It is also used in military equipment due to its high range of operation. The output of the sensor changes 10mV/ 1ºC. The pressure sensor (MPX4115) is also used in the system to sense the change in surrounding pressure. This sensor is an analog pressure sensor too, which produces analog signal output on its output terminal. [9] The internal circuitry of this sensor is detailed in the datasheet and can be referred for further explanation and understanding the graphically explained transfer function of this sensor. Flow chart for sensor is as follow-

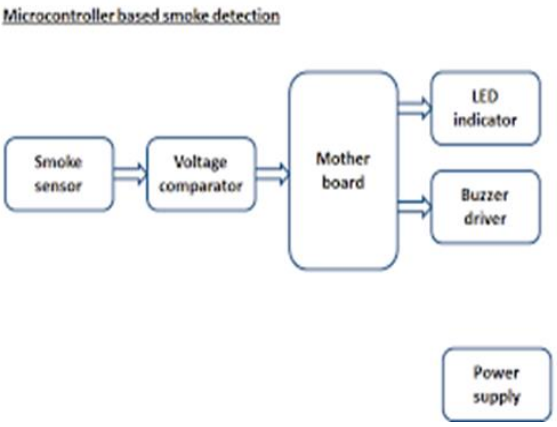


1.4. Simulation Results in Different Scenarios

1. The system displays in which floor a potential fire is going to take place on LCD.
2. The system indicates a potential fire through different signals such as alarm buzzer, visual LEDs and SMS messages within 300ms time.
3. The system generates a signal to servo motor control to open the fire extinguisher hose to avoid hazard. 4. The system automatically stops all the signaling when the hazard is avoided, which means we can see the time taken to avoid the disaster.

2. DESIGN PRINCIPLE FOR SMOKE DETECTOR

In the present scenario technological environment, the embedded system is getting first choice for designer for its flexibility and miniature size.[10] This telecom interfaced security system is very much useful product for remote surveillance and one can monitor the office, home, industrial premise etc. from the remote place. The micro controller-based system monitors the condition of the system and on receiving the fault the controller activate a buzzer for information and monitor it in a lead.



2.1 Power Supply

In this project the power supply required is very much precession and also requires different level of power supply. Basically, the power supply used for the transmitter and receiver is arranged from a battery. Along with the battery the power supply requirement is +12 Volt and +5Volt.

2.2 Description

The power supply designed for catering a fixed demand connected in this project. The basic requirement for designing a power supply is as follows, 1. The different voltage levels required for operating the devices. Here +5Volt required for operating microcontroller. And +12Volt required for drivers etc. 2. The current requirement of each device or load must be added to estimate the final capacity of the power supply. The power supply always specified with one or multiple voltage outputs along with a current capacity.[10] As it is estimating the requirement of power is approximately as follows, Out Put Voltage = +5Volt, +12Volt Capacity = 1000mA

The power supply is basically consisting of three sections as follows,

1. Step down section,
2. Rectifier Section,
3. Regulator section.

2.3 Design principle

There are two methods for designing power supply, the average value method and peak value method. In case of small power supply peak value method is quite economical, for a particular value of DC output the input AC requirement is appreciably less. In this method the Dc output is approximately equal to Vm. The rectifier output is approximately charged to Vcc due to charging of the capacitor.[11] The capacitance provides the backup during the discharge period. So, the value of the capacitor is calculated.

2.3 Buzzer Driver

This section interfaces one audible piezo electric buzzer with the controller. The controller activates the buzzer whenever there is any fault appears in any of the channel.

Figure 8: Buzzer

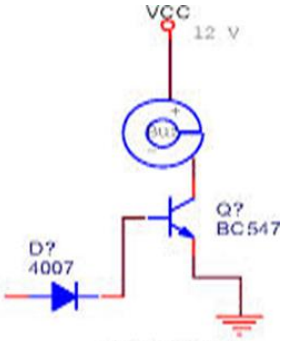


Figure 9: Buzzer driver

3. CONCLUSION

The developed system is a Microcontroller based prototype of an Autonomous Wireless Sensor Network for fire accident Predicting and forecasting in Multi-Store Building. The system is very accurate while responding in a time of 300ms. The system has been tested in different scenarios for its robustness and reliability. This system displays when and where the event takes place within a delay of 300ms time and gives alarms in the form of visual, audible and SMS on LEDs and LCD, buzzer and user mobile phones respectively. In fact, delay time depends on many factors; the system is emulated on core i5 system and software, coded on Micro and Circuit Emulator is proteus. And this project is designed and tested in the laboratory condition and found to be working satisfactorily. The response time for any fault in this design is approximately 1 sec. The system tolerance is well below the limits of experimental errors.

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REFERENCES

[1] J. Bennet Solomi, M. Rajalakshmi, C.V. Mala, December 2012, GPRS Based HealthCare Telemonitoring System, International Journal of Scientific and Research Publications, Volume 2, Issue 12, ISSN 2250-3153

[2] Iman Morsi, a and Loay Mohy El-Din Rasheed, 2013, Microcontroller System for Oil Refinery Parameters Measurements Based on Piezoresistive and Strain Gauge Pressure Sensors, Applied Mechanics and Materials Vols. 249-250, pp 1133-1138, Trans Tech Publications, Switzerlanddoi:10.4028/www.scientific.net/AMM.249-250.1133

[3] N. Anju Latha, B. Rama Murthy, U. Sunitha, September- October 2012, Design and Development of a Microcontroller Based System for the Measurement of Blood Glucose, International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622, Vol. 2, Issue 5.

[4] Rashedul Qayum nimA lunashE M.S Md Kamrul Hussain, October-2012, Enhanced Wireless Control System for Smoke and Fire Detection, International Journal of Scientific and Engineering Research, Volume 3, Issue 10, ISSN-2229-5518.

[5] Sunil MP, Ashik Narayan, Vidyasagar Bhat, Vinay S, August 2013, Smart Biogas Plant, International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-3, Issue-3.

[6] Manaswi M. Latthe1, S. B. Patil, February 2014, Online Monitoring and Alarm Indication of Status of Air for Automation, International Journal of Science and Research (IJSR) ISSN (Online): 2319 7064, Volume3, Issue-2.

[7] Fundamentals of Wireless Sensor Network Theory and Practice, 2010, A John Wiley and Sons, Ltd., Publication.

[8] J.Bird, Electrical circuit theory and technology, oxford: Newnes, 2003 .

[9] C. K. A.&. M.N. Sadiku, Fundamentals of electrical circuits.

[10] I.S &. J Dunton, Practical Electronics Handbook, Oxford, 2007.

[11] Venkata Naga Rohit Gunturi, "MICRO CONTROLLER Based Automatic plant irrigation system", International Journal of Advancement in Research and technology, 2013.