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IoT-Enabled Wearable Sensor Network for Real-Time Industrial Worker Safety and Health Monitoring

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ABSTRACT

This study presents a wearable sensor network system for safety and health applications connected to the Internet of Things (IoT). Because industrial worker health and safety are so important, an Internet of Things network system that can keep an eye on environmental and physiological variables might greatly improve workplace safety. The proposed network architecture incorporates multiple wearable sensors to monitor environmental and physiological data. The wearable sensors on different people can communicate with one other and transmit the data to a gateway via a heterogeneous IoT platform. As soon as hazardous conditions are detected, the sensor node will provide users with an effective warning and notification system. Data processing, a local web server, and cloud communication are provided via an ingenious IoT gateway. After receiving the data from wearable sensors, the gateway will forward it to an IoT cloud for further data processing, storage, and display.

Keywords: Wearable Sensor Network, Internet of Things (IoT), Industrial Worker Safety, Physiological Monitoring, Environmental Sensing.

1. INTRODUCTION

Wearable sensor nodes are generally deployed in wireless body area networks (WBAN) to monitor physiological parameters, such as body skin temperature photoplethysmogram (PPG), or electrocardiogram (ECG). In addition to medical signals, they can be deployed to monitor environmental conditions around the human body as well, such as in the safety application and environmental monitoring applications. Such a wearable sensor system can also provide invaluable and useful information about the environmental impact on subjects' health. People can also gain a deeper understanding of their local micro-environment. A wearable system is not only limited to personal use, it can also be installed on a bicycle, car, and animal to form a wearable or mobile wireless sensor network. For example, a mobile node is installed on bicycles for environmental monitoring. The power supply of sensor nodes is a major challenge for autonomous wearable sensor nodes, because many devices require regular battery replacement or charging. To allow long-term operation and minimize the human interaction of the wearable sensor node, the system has to be low power consumption and adopt energy harvesting. There is a need for an efficient and effective energy harvesting module, which can address this power supply issue. There are several options for energy sources, such as thermoelectric, piezo-electric, micro-magneto-electric, or photoelectric harvesting techniques. Solar energy provides the highest power density among these with high output voltages. The drawback is that the solar energy will disappear at night and this should be considered in the power management unit of a sensor node. In this project we present a wearable IoT sensor network, named as Safe Node for safety environ-mental

monitoring and a health node. Each sensor node consists of a micro-power manager, a sensing unit, and a wireless module.

2. EXISTING SYSTEM

As technology is still evolving, there is not a specific appropriate standard to define a 'smart home' nor a distinctive feature to classifying 'smart home' in relation to various related terms used and from similar other systems. We can say home system as 'smarter' due to collective intelligence of individual home appliances, all electronics and non-electronic items in collaboration with other devices in surroundings. The term 'smart home' is used for all residence those are equipped with something that makes inhabitants to monitoring all things automatically and facilitates home environment so as optimize and automate all facilities designed for basic day today need of an individual.

Development in technology from last few decades open doors to various threats to human and his surroundings. Individuals with the advancement in security had taken several measures to control the threats for safeguarding their belongings. From time-to-time various intrusion detection systems established for earmark intruders from home environment and provide tangible benefits to users, but can also expose users to significant security risk. Smart home security system is gaining popularity for industry, government, and academia as well as for individual that has the potential to bring significant personal, professional and economic benefits. This paper presents design and implementation of smart home security system based on GSM/GPRS (Global System for Mobile Communication/General Packet Radio Service)and response rapidly to alarm incidents and has a friendly user interface including a LCD (Liquid Crystal Display) and keypad. Special emphasis is placed on the empirical security analysis of such emerging smart home platformby dividing into two case scenarios. The paper will conclude by discussing future perspective and challenges associated with the development of security system for home.

In processed Numerical management (industrial machines) systems the communication bus between thecontroller and axis servo drives should provide high information measure, noise immunity and time philosophical doctrine. More and additional industrial machines systems use period of time local area network protocols like local area network Power Link (EPL). Many trendy controllers' area unit closed pricey hardware-based solutions. during this article the implementation of EPL communication bus in a very PC-based industrial machines system is bestowed. The industrial machines system includes a computer pc, software system industrial machines controller running underneath UNIX Real Time Application Interface (RTAI) period of time software (RTOS) and servo-drives human action via EPL.

Automated factories and processes are too expensive to be rebuilt for every modification and design change –so they have to be highly configurable and flexible. To successfully reconfigure an entire production line or process requires direct access to most of its control elements –switches, valves, motors and drives –down to a fine level of detail. The vision of fully automated factories has already existed for some time now: customers order online, with electronic transactions that negotiate batch size (in some cases as low as one), price, size and color; intelligent robots and sophisticated machines smoothly and rapidly fabricate a variety of customized products on demand.

3. PROPOSED SYSTEM

In our system, IoT network system which can monitor both environmental and physiological can greatly improve the safety in the work place. The proposed network system incorporates multiple wearable sensors to monitor environmental and physiological parameters. To transmit the data to a gateway via a network which forms a heterogeneous IoT platform. Figure 1 shows the block diagram of the proposed system. Figure 2 presents the flow of events in the proposed system.

All the sensor are used to measure different condition of industrial condition if any condition is abnormal then SMS will be send using GSM module. They are small, inexpensive, low-power, easy to use and don't wear out. Due to this reason, they are commonly found in appliances and gadgets used in homes or businesses. MQ6 is a semiconductor type sensor, which can appropriately sense the presence of smoke, LPG, methane, butane, propane and other hydrocarbon combustible gases. The sensitive material in this sensor is tin-dioxide (SnO2). When it comes in contact with the gas to be monitored, the electrical resistance of the sensor decreases; enabling the microcontroller to respond to the situation.The sensor basically detects infrared light wavelength between 760 nm – 1100 nm that is emitted from fire flame. Most of the flame sensors came with YG1006 sensor which is a high speed and highly sensitive NPN silicon photo transistor. It is covered with black epoxy, since the sensor is sensitive to infrared radiation

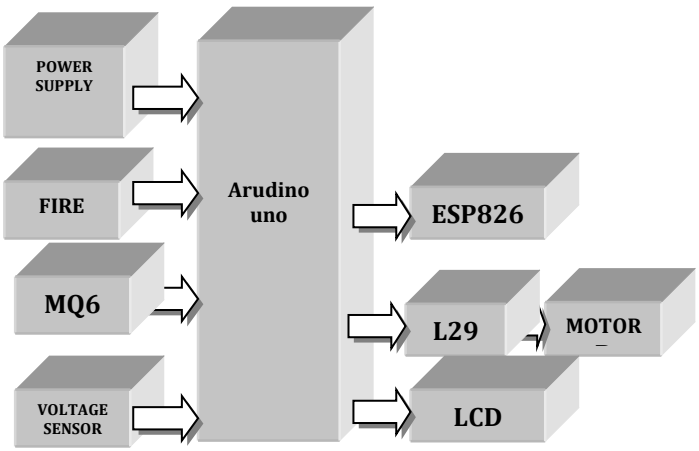

Figure 1: Block diagram of the proposed system

A sensor is a device that detects changes in the environment analog signal, such as fire, gas, etc . A sensor is a device that converts a physical occurrence into an analog signal that can be measured. Our microcontroller analog-to-digital converter (ADC) convert analog signal into a digital signal that can be used for further processing. These signals pass through an interface, which converts them to a binary code and sends it to a microcontroller (computer) for processing. The data is then converted into a human-readable display or transmitted for reading or processed further. Sensors are input devices that continuously record data around the environment. Our microcontroller continuously processes the data received from the sensors.

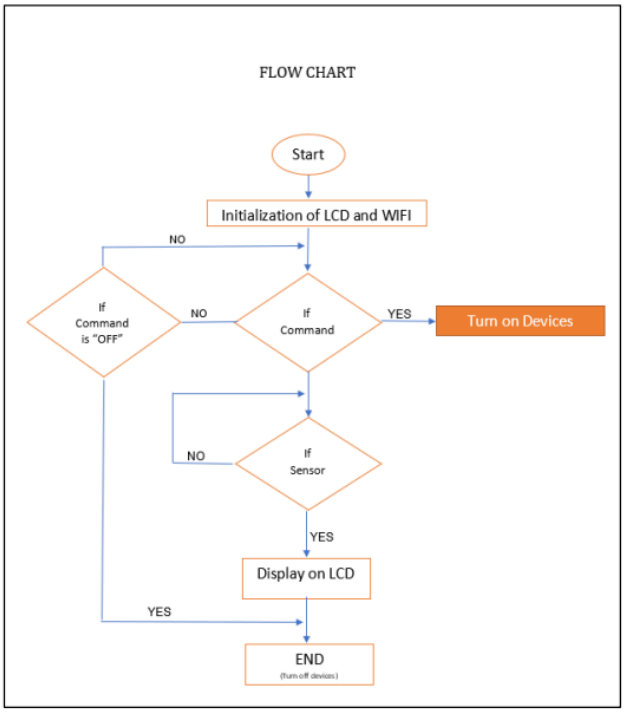

Figure 2: Flow Chart of the proposed system

4. RESULTS& DISCUSSION

The device consists of gas sensor fire, MQ6, voltage levels for the detection of gas leakage, fire detector used to determine fire in the industry. voltage can be measured using the voltage sensor and All sensors are connected to arudino. Water pump is used when the fire and gas emission exceed the permissible limit**.**

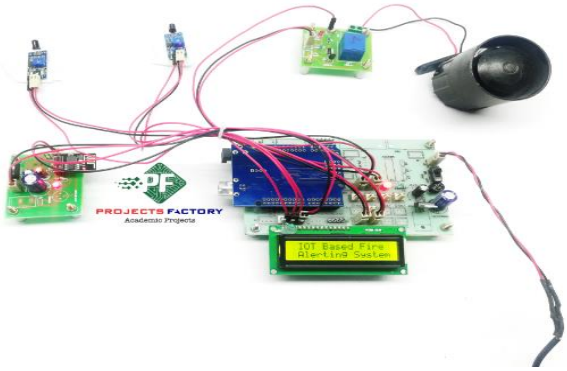

Figure 3: Hardware Implementation of the proposed system

Fire Detection system is shown in figure 4. In this picture, we see that fire is detecting by flame sensor and in display show that F=1and alarm is on. After detecting fire, the water pump motor is turn on. Figure 3 shows the hardware implementation of the proposed system.

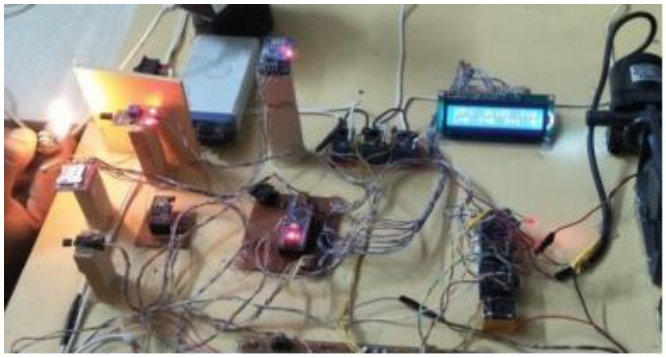

Figure 4: Fire Detection System

Gas Detection system is shown in figure 5. In this picture, we see that gas is detecting by gas sensor (MQ2) and in display show that maximum detecting value of the gas which unit is setup ppm and alarm is on. After detecting gas, the update IoT**.**

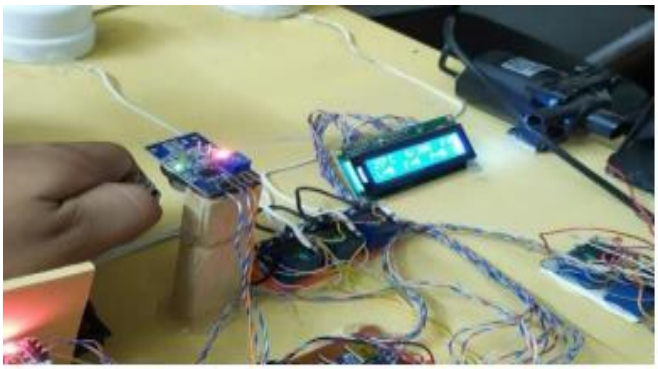

Figure 5: Gas Detection System

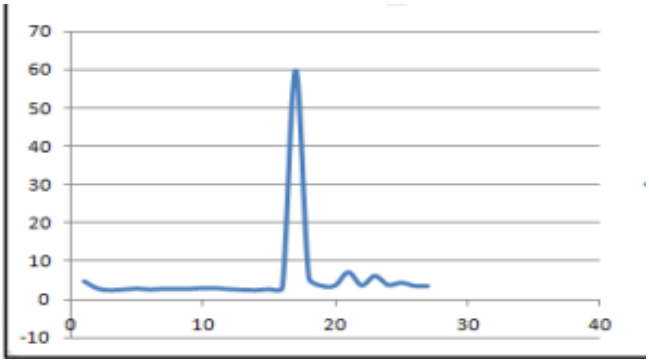

Figure 6: Gas Detection values updated to server using IoT

5. CONCLUSIONS

The developed air quality monitoring and visualization system accurately measured the concentration of pollutants in atmosphere. The sensor has been integrated with IoT framework which has efficiently been used to measure and monitor the pollutants in real time. The data's are automatically stored in the database; this information can be used by the authorities to take prompt Industry is the main earning source of a developing country. But if the industries are not safe and protected, peoples can't get more benefits from its. By using this protection system industry can be more secure. By using this system peoples can monitor protection from anywhere in the world, and if occurs any accident they can take action immediately. More over the owners of the industry can recheck the causes of occurs accident, what are the false and how it was happen. They can act on it and in future it doesn't happen again they

can solve all the problems. This system is monitoring only ten gases and hence can be expanded by considering more parameters that cause the pollution especially by the industries. By uploading on the webpage for the common man, it helps them to know about the pollution in their area. This system consumes more power, by replacing the power source with an solar power then it will definitely improve the reliability of the system.

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