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IoT Based Wireless Sensornode for Mine Safety Application

Ratnamala Prakash More, Prof. Dr. Anil. S. Hiwale

Department of E&TC (Embedded & VLSI), Genba Sopanrao Moze collage of Engineering, Balewadi, Pune, India

Department of E&TC, MIT College of Engineering Kothrud, Pune, India

ABSTRACT: Remote Sensor Networks (WSN) has been utilized to gather information about physical marvel in different applications, for example, living space checking. Web of Things (IoT) has pulled in a considerable measure of consideration and is relied upon to convey advantages to various application territories including modern WSN frameworks, and ecological frameworks for information procurement for IoT representation. A sensor interface gadget is key for sensor information accumulation of mechanical remote sensor systems in IoT situations. Every sensor associated with the gadget is required to compose confounded and awkward information accumulation code. To take care of these issues another technique is proposed to plan a reconfigurable sensor interface for modern WSN in IoT environment. Hence it can read information in parallel and continuously with rapid.

KEYWORDS: CPLD/FPGA, High speed, Internet of Things (IoT), Sensor Interface Device, WSN.

I. INTRODUCTION

A sensor is a gadget that recognizes occasions or changes in amounts and gives a comparing yield, by and large as an electrical or optical sign; for instance, a thermocouple changes over temperature to a yield voltage. Yet, mercury in glass thermometer is likewise a sensor; it changes over the deliberate temperature into extension and constriction of a fluid which can be perused on an adjusted glass tube. Web of Things (IOT) is the interconnection of exceptionally identifiable installed registering gadgets inside the current Internet framework. Commonly, IOT is relied upon to offer propelled availability of gadgets, frameworks and administrations that goes past machine - to-machine correspondences (M2M) and spreads an assortment of conventions, areas, and applications. The entomb association of these installed gadgets (counting brilliant articles), is required to introduce mechanization in about all fields, while additionally empowering propelled applications like a Smart Grid. Remote sensor system (WSN), which coordinates sensor innovation, remote correspondence innovation, implanted processing innovation and conveyed data administration innovation, has been under fast Improvement amid late years [4].A remote sensor system is an accumulation of hubs sorted out into an Intuitivesystem.The hubs convey remotely and regularly self-arrange in the wake of being sent in an impromptu technique. Such frameworks can upset the way we live and work in this way in this anticipate we need to utilize WSN innovation to control and oversee vitality in building. Reconfigurable sensor interface gadget that coordinates information gathering information handling, and wired or remote transmission. The gadget can be broadly utilized as a part of numerous application ranges of the IOT and WSN to gather different sorts of sensor information continuously. The general structure of reconfigurable shrewd sensor interface comprises The focal center gathers data from the distinctive recurrence channels and controls these channels through the ZigBee module. The framework has been intended for estimation of temperature and LDR parameters. Vital capacities to the framework are the simplicity of demonstrating, setup, and use. From the purchaser perspective. With fast improvement of IoT, real producers are devoted to the examination of multisensory securing interface gear [8]. Be that as it may, these interface gadgets are exceptionally represented considerable authority in working style, so they are not exclusively versatile to the changing IoT environment [9].

II. RELATED WORK

A remote brilliant sensor stage focused for instrumentation and prescient upkeep frameworks is introduced. The Generic brilliant sensor stage with plug-and-play‟ capacity underpins equipment interface, payload and

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Communications needs of numerous inertial and position sensors, and actuators, utilizing a RF join for correspondences [5].The outline additionally gives intends to upgrade working and Test usage for mechanical applications and System execution is talked about. In this anticipate has utilized on Zigbee. This expense is too high and the WSN are controlled by remote access. Radio Frequency Identification and Wireless Sensor Network are two essential remote advances that have wide assortment of utilizations and give boundless future possibilities. Be that as it may, RFID and sensor organizes just about are being worked on in parallel way. Joining of RFID and remote sensor systems pulls in little consideration from exploration group. [3] This paper first exhibits a brief presentation on RFID, and afterward explores late research works, new items/licenses and applications that coordinate RFID with sensor systems. Four sorts of combination are talked about. They are incorporating labels with sensors, coordinating labels with remote sensor hubs, coordinating perusers with remote sensor hubs and remote gadgets, and blend of RFID and sensors. New difficulties and future works are examined at last. RFID peruses have generally low range and are very costly; we imagine that the principal applications won't have RFID peruses sent universally. The applications which permit portable peruses to be appended to individual's hands, autos or robots will be great competitors. Remote sensor systems (WSNs) have turned into a hot exploration point lately bunching is considered as a successful way to deal with decrease arrange overhead and enhance adaptability. Remote sensor system would one say one is of the pervasive systems which sense our surroundings through different parameters like warmth, temperature, weight, and so forth [1]Since sensor systems depend on the thick arrangement of dispensable and ease sensor hubs, decimation of a few hubs by unfriendly activity does not influence a military operation as much as the pulverization of a customary sensor, Which makes the sensor system idea a superior methodology for front lines? [2]. The transmission between the two hubs will minimize alternate hubs to demonstrate the enhance throughput and more prominent than spatial reuse than remote systems to do not have the force controls. Versatile Transmission Power procedure to enhance the Network Life Time in Wireless Sensor Networks utilizing diagram hypothesis [3].

III. INTERNET OF THINGS (IoT)

With the headways in Internet advances and WSNs, another pattern is shaping in the period of universality [7], [4]. "IoT" is about physical things conversing with each other, where machine to-machine (M2M) interchanges and individual to-PC correspondences will be reached out to "things" [9], [3]. Key innovations that drive the fate of IoT are identified with brilliant sensor advancements including WSN nanotechnology, and scaling down [8]. Since IoT is connected with an extensive number of remote sensor gadgets, it creates countless [1]. shown as in Fig. 1.
It comprises of three layers: 1) observation layer; 2) system layer; and 3) application layer [3]. The outline of information obtaining interface is for the most part connected to the observation layer of IoT [5]. The observation layer of IoT is chiefly made out of sensors, Zigbee, M2M terminals, and different information accumulation terminals [6]

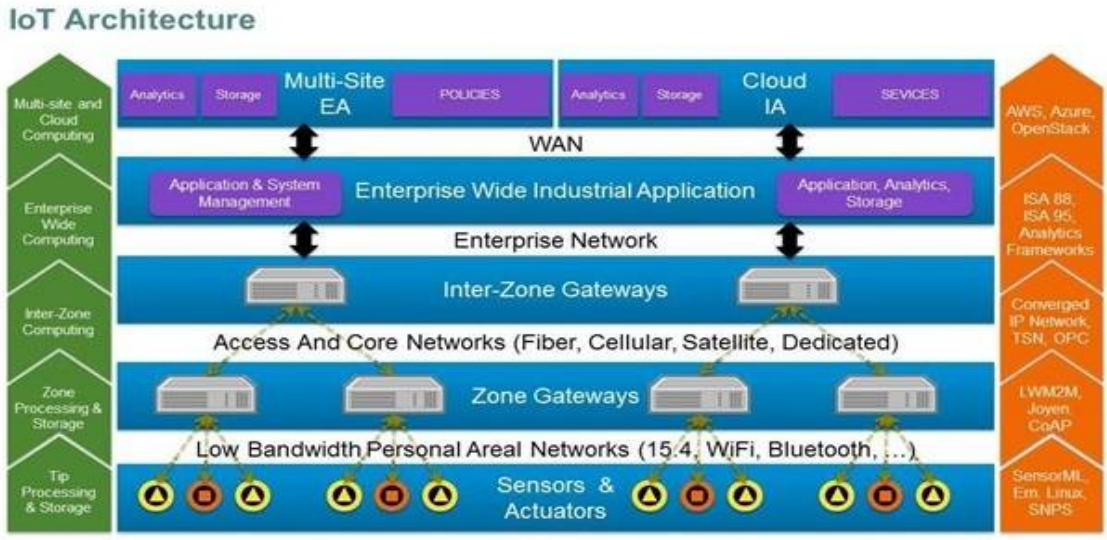

Fig No.1. IOT Architecture

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The information procurement interface is in charge of the reconciliation and joint effort of different situations and accumulation of sensor information. Case of such a work process incorporates a domain checking framework that embraces sensors to temperature and light [7].

IV. HARDWARE DISCRIPTION

In this project we develop the systemfor minesafety application. Mine system information should be collected as much as possible on the kinds of accuracy. But the Mine system equipment used now has many disadvantages, such as bulkiness, complex design, and high cost, etc. It is not suitable for monitoring conducted by small organizations or individual. In this project We use the different sensor that sense the environmental condition such as change in temperature, vibration smoke and light intensity. The overall structure of Mine system monitoring.reconfigurable smart sensor interface Consists as below

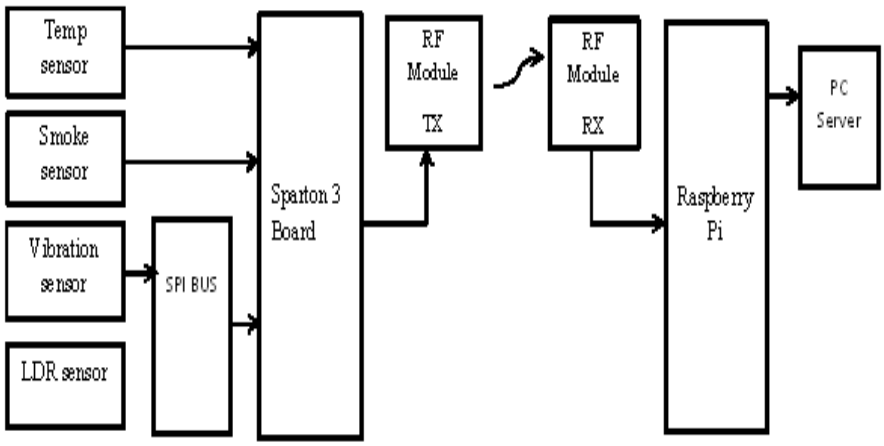

Fig.2.: Block Diagram of the system

A. TEMPERATURE SENSOR (LM35)

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration.Low cost is assured by trimming and calibration at the wafer level. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy.

B. LDR:LDRs or Light Dependent Resistors are very useful especially in light/dark sensor circuits. Normally the resistance of an LDR is very high, sometimes as high as 1,000,000 ohms, but when they are illuminated with light, the resistance drops dramatically. Thus in this project, LDR plays an important role in switching on the lights based on the intensity of light

C. Smoke Sensor: This is simple to use liquefied petroleum gas (LPG) sensor, suitable for sensing LPG (composed of mostly propane and butane) concentration in the air. The MQ-6 can detect gas concentration anywhere from 200 to 1000 ppm. this sensor has a high sensitivity and fast response time. the sensor output is an analog resistance.

D. ZigBee: ZigBee is a low-cost, low-power, wireless mesh networking standard. The low cost allows the technology to be widely deployed in wireless control and monitoring applications, the low power-usage allows longer life with smaller batteries and the mesh networking provides high reliability and larger range. ZigBee has been developed to meet the growing demand for capable wireless networking between numerous low power devices. ZigBee is an established set of specifications for wireless personal area networking (WPAN), i.e. digital radio connections between computers and related devices

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E. Raspberry Pi: To design a reconfigurable smart sensor interface device that integrates data collection, data processing, and wiredOr wireless transmission together. The device can be widely used in many application areas of the IoT and WSN tocollect various kinds of sensor data in real time. To program IP core module in its . Therefore, our interfaceDevice can automatically discover sensors connected to it, and to collect multiple sets of sensor data intelligently, and parallel with high-speed.CPLD/FPGA is the core controller of the interface device. It is used to control data acquisition, processing, and transmission intelligently, and make some preprocessing work for the collected data. The driver of chips on the interface device is also programmed inside the FPGA. Multiple scalable interfaces are designed on the equipment. It can be extended to 8-channel analog signal interface and 24-channel digital signal interface. This ensures that our device can connect with a number of sensors among the application of industrial IoT or WSN and guarantees the diverse collection of the information. In terms of data transmission, our design can achieve communication through Universal Serial Bus interface.

V. SYSTEM EXECUTION STEPS

1. The different sensor read the sensor data and sends this data to FPGA through the Serial peripheral interface bus (SPI) for processing. FPGA access that data in parallel.
2. Converted digital data send wirelessly through RF module to Raspberry Pi. it reads the data serially with the help of Python language and RS232. It also stores data in MySQL database system. Instructions like ‘sudosu’ provide administrative access, ‘Nano’ is the editor where users are able to write code, debug and compile the programs.
3. The different types of sensors with data get stored into the database using MySQL database management system.
4. Every time when the data is read serially, it gets updated into MySQL.
5. Fetching this data from database and displaying it on the web server is done with the help of PHP script. Updating PHP page using Apache server means web page is updated. We can view the result at any place and time using internet.

VI.RESULTS AND DISCUSSION

Proteus VSM uses ISIS schematic capture software to provide the environment for design entry and development. The ISIS software combines ease of use with powerful editing tools. It is capable of supporting schematic capture for both simulation and PCB design. Designs entered in to Proteus VSM for testing can be net-listed for PCB layout either with Proteus PCB Design products or with third party PCB layout tools. ISIS also provides a very high degreeof control over the drawing appearance, in terms of line widths, fill styles, fonts, etc. These capabilities are used to provide the graphics necessary for circuit animation.Very-High-Speed Integrated Circuit Hardware DescriptionLanguage (VHDL) design of the system includes two parts. One part to uses the VHDL language as the basic tool and write related features of the reconfigurable smart sensor interface device by referring to the standard of IEEE1451.2 agreement. It reflects the difference between reconfigurable smart sensor interface device and general data acquisition card, which has a great effect in intelligently collecting sensor data.

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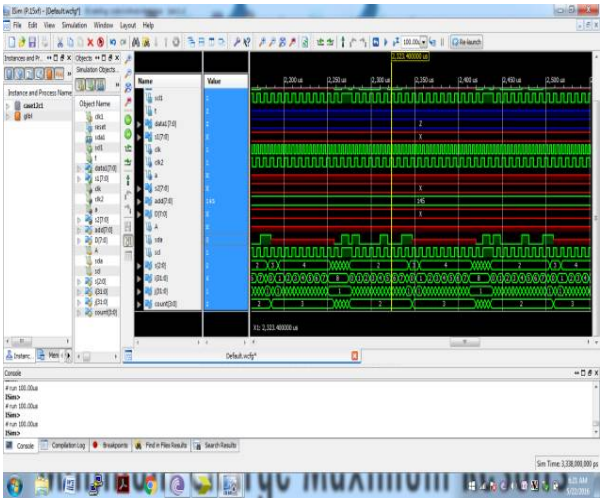

Fig.4.I2Csimulations

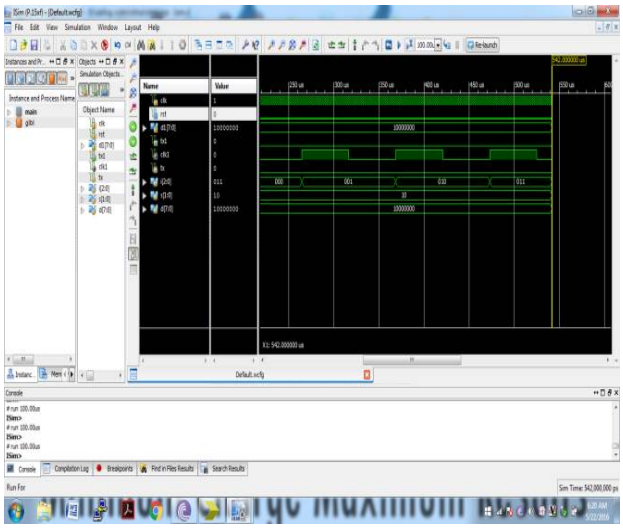

Fig.5. Serial Simulations

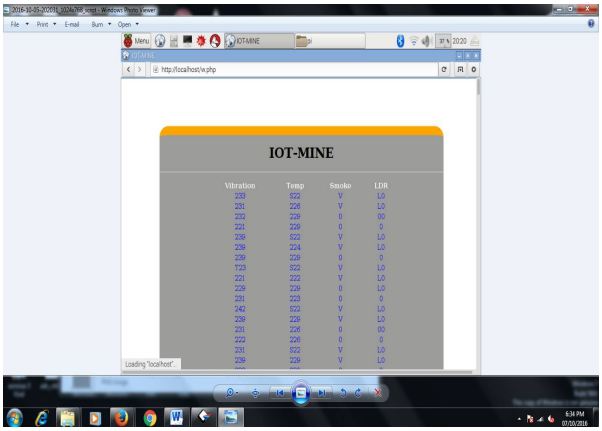

Fig.6. Server data

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VII. CONCLUSION AND FUTURE WORK

In this Project a reconfigurable smart sensor interface is designed for mine safety application in IoT environment. The system can collect sensor data intelligently. This system is designed according to huge need of IOT system in today world to market. In this system we design a sensor node for mine system in which we used vibration sensor, LDR, smoke sensor and temperature sensor. These sensor sense the physical data, FPGA is used as core controller, send the data to server through the wireless zig-bee module. also send the sensor data by email. It is very suitable for real-time and effective requirements of the high speed data acquisition system in IoT environment. The application of FPGA greatly simplifies the design of peripheral circuit, and makes the whole system more flexible and extensible.

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