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WSN based Industrial Parameters Monitoring and Controlling System

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ABSTRACT: A sensor interface device is essential for sensor data collection of industrial wireless sensor networks (WSN) in IoT environments. However, the current connect number, sampling rate, and signal types of sensors are generally restricted by the device. Meanwhile, in the Internet of Things (IoT) environment, each sensor connected to the device is required to write complicated and cumber some data collection program code. In this paper, to solve these problems, a new method is proposed to design WSN BASED INDUSTRIAL PARAMETERS MONITORING AND CONTROLLING SYSTEM, in which ARM 11 chip is adopted as the core controller. Thus, it can read data in parallel and in real time with high speed on multiple different sensor data. It comprehensively stipulates the smart sensor hardware and software design framework and relevant interface protocol to realize the intelligent acquisition for common sensors. A new solution is provided for the traditional sensor data acquisitions. The device is combined with the newest embedded Linux technology and the standard of sensor specification.

Keywords: Internet of Things (IoT), sensor data acquisition,ARM 11,wireless sensor networks (WSN)

(I) INTRODUCTION

Wireless sensor networks (WSNs) have become a hotresearch topic in recent years Clustering is considered as aneffective approach to reduce network overhead and improvescalability. Wireless sensor network is one of the pervasivenetworks which sense our environment through variousparameters like heat, temperature, pressure, etc… Sincesensor networks are based on the dense deployment ofdisposable and low-cost sensor nodes, destruction of somenodes by hostile action does not affect a military operationas much as the destruction of a traditional sensor, whichmakes the sensor network concept a better approach forbattle fields. The transmission between the two nodes willminimize the other nodes to show the improve throughputand greater than spatial reuse than wireless networks to lackthe power controls. Adaptive Transmission Power techniqueto improve the Network Life Time in Wireless SensorNetworks using graph theory. We have distance comparisonbetween the neighbour nodes and also local level connectedfrom the nearest edges in wireless sensor networks.

(II) Related Work

A wireless smart sensor platform targeted forinstrumentation and predictive maintenance systems ispresented. The generic smart sensor platform with plug and play "capability supports hardware interface, payloadand communications needs of multiple inertial and positionsensors, and actuators, using a RF link for communications,in a point-to-point topology. The design also provides meansto update operating and monitoring parameters as well assensor/RF link specific firmware modules"over-the-air ".Sample implementations for industrial applications andsystem performance are discussed. In this Paper has usedon Zigbee. This cost is too high and the WSN are controlledby remote access. Radio Frequency Identification andWireless Sensor Network are two important wirelesstechnologies that have wide variety of applications andprovide limitless future potentials. However, RFID andsensor networks almost are under development in parallelway. Integration of RFID and wireless sensor networksattracts little attention from research community. This paperfirst presents a brief introduction on RFID, and theninvestigates recent research works, new products/patents andapplications that integrate RFID with sensor networks. Fourtypes of integration are discussed. They are integrating tagswith sensors, integrating tags with wireless sensor nodes,integrating readers with wireless sensor nodes and wirelessdevices, and mix of RFID and sensors. New challenges andfuture works are discussed in the end. RFID readers haverelatively low range and are quite expensive; we envisionthat the first applications will not have RFID readersdeployed ubiquitously. The applications which allow mobilereaders to be attached to person's hands, cars or robots willbe good candidates. In the existing work, the developedsystem was not efficient in the view of task scheduling, asthe system was used was a non

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Linux device and alsoexternal Ethernet was used for the communication purpose.

(III) Proposed System

On a Raspberry Pi2(Single-Board Computer) board of ARM11 architecture will be ported with an Embedded Linuxoperating system and using Ethernet protocol for IOTapplications, we will acquire the data from the WirelessSensor Network (WSN), post the data over the web such thatit can be viewed over internet on any browser as well also inadvancement will operate the appliance from the web.Using ARM controller we can connect all types of sensorsand we can connect 8 bit microcontroller based sensornetwork to ARM controller using different wired or wirelesstechnology. Many open source libraries and tools areavailable for ARM-linux wireless sensor networkdevelopment and controlling. We can monitor and controlthe wireless sensor network remotely using internet and webserver. The system describes the development of a wirelessindustrial environment measuring temperature, humidity,atmospheric pressure, soil moisture, water level and lightdetection. Where the wireless connection is implemented toacquire data from the various sensors, in addition to allowset up difficulty to be as reduced. By using Wi-Fitechnology we send the sensors data to authorized person.

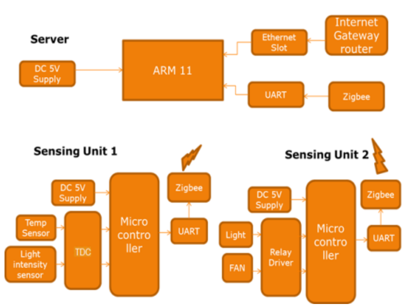

Figure 1: Block Diagram of the proposed system.

To design a reconfigurable smart sensor interface device thatintegrates data collection, data processing, and wired orwireless transmission together. The device can be widelyused in many application areas of the IoT and WSN tocollect various kinds of sensor data in real time. To programIP core module in its ARM. Therefore, our interface devicecan automatically discover sensors connected to it, and tocollect multiple sets of sensor data intelligently, and parallelwith high-speed.ARM is the core controller of the interfacedevice. It is used to control data acquisition, processing, andtransmission intelligently, and make some pre-processingwork for the collected data. The driver of chips on theinterface device is also programmed inside the ARM.Multiple scalable interfaces are designed on the equipment.It can be extended to 8-channel analog signal interface and24-channel digital signal interface. This ensures that ourdevice can connect with a number of sensors among theapplication of industrial IoT or WSN and guarantees thediverse collection of the information. In terms of datatransmission, our design can achieve communicationthrough Universal Serial Bus interface. Therefore, we canchoose different transmission mode of the device in differentindustrial application environments. The designed devicecollects analog signal transmitted from colour sensors, lightintensity sensors, and other similar sensors through ananalog signal interface. It can also collect digital signaltransmitted from the digital sensors, such as temperaturesensors, digital humidity sensors, and so on, through adigital signal interface.

The TDC module and signal interface on the interfacedevice are controlled by the ARM, which makes it possibleto collect the 8-channel analog signals and 24-channeldigital signals circularly, and sets these collected data intothe integrated Static Random Access Memory on theinterface device. The collected data can be transmitted to thehost computer side by way of USB serial communication sothat the user can analyze and process the data.

A. Temperature sensor

Temperature sensors are vital to a variety of everydayproducts. For example, household ovens, refrigerators andthermostats all rely on temperature maintenance and controlling order to function properly. Temperature control also hasapplications in chemical engineering. Examples of thisinclude maintaining the temperature of a chemical reactor atthe ideal set-point, monitoring the temperature of a possiblerunaway reaction to ensure the safety of employees andmaintaining the temperature of streams released to theenvironment to minimize harmful environmental impact.

B. Light intensity sensor

A Light sensor generates an output signal indicating theintensity of light by measuring the radiant energy that existsin a very narrow range of frequencies basically called “light”and which ranges in frequency from “infrared” to “visible”up to “ultraviolet” light spectrum. The light sensor is apassive devices that convert this “light energy” whether visible or in the infrared parts of the spectrum into anelectrical signal output. Light sensors are more commonlyknown as “Photoelectric Devices” or “PhotoSensors”.

E. ZigBee wireless module

ZigBee is a specification for a suite of high-levelcommunication protocols used to create personal areanetworks built from small, low-power consumption limitstransmission distances, ZigBeedevices can transmit dataover long distances by passing data through a mesh networkof intermediate devices to reach more distant ones. Zigbee istypically used in low data rate applications that require longbattery life and securenetworking (ZigBee networks are secured by 128 bitsymmetric encryption keys.) Zigbee has a defined rate of250kbit/s, best suited for intermittent data transmissionsfrom a sensor or input device. Applications include wirelesslight switches, electrical meters with in home displays,traffic management systems, and other consumer andindustrial equipment that require short-range low-ratewireless data transfer. The technology defined by the ZigBeespecification is intended to be simpler and less expensivethan other wireless personal area networks (WPANs), suchas Bluetooth or WiFi.

G RASPBERRY PI2 BOARD:

The Raspberry Pi 2 is a credit-card-sized single-board computer developed in the UK by the Raspberry Pi Foundation with the intention of promoting the teaching of basic computer science in schools. The Raspberry Pi is manufactured in two board configurations through licensed manufacturing deals with Newark element14 (Premier Farnell), RS Components and Egoman. These companies sell the Raspberry Pi online. Egoman produces a version for distribution solely in China and Taiwan, which can be distinguished from other Pis by their red coloring and lack of FCC/CE marks. The hardware is the same across all manufacturers. The Raspberry Pi has a Broadcom BCM2836 system on a chip (SoC), which includes an ARM1176JZF-S 900 MHz processor, Video Core IV GPU, and was originally shipped with 256 megabytes of RAM, later upgraded to 512 MB. It does not include a built-in hard disk or solid-state drive, but uses an SD card for booting and persistent storage.

The Foundation provides Debian and Arch Linux ARM distributions for download. Tools are available for Python as the main programming language, with support for BBC BASIC (via the RISC OS image or the Brandy Basic clone for Linux),C, Java and Perl.

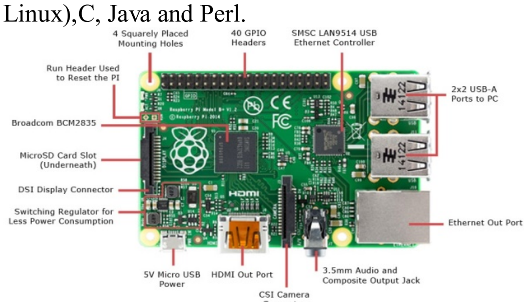

Fig 3 RASPBERRY PI 2 BOARD

WORKING PRINCIPLE:

In this Paper, we are giving the complete description on the proposed system architecture. Here we are using Raspberry Pi 2 board as our platform. It has an ARM-11 SOC with integrated peripherals like USB, Ethernet and serial etc. On this board we are installing Linux operating system with necessary drivers for all peripheral devices and user level software stack which includes a light weight GUI based on XServer, V4L2 API for interacting with video devices like cameras, TCP/IP stack to communicate with network devices and some standard system libraries for system level general IO operations. The Raspberry Pi board equipped with the above software stack is connected to the outside network and a camera is connected to the Raspberry Pi through USB bus.The architecture of the web server has the following layers.

- In the lower level the web server has the physical hosting interfaces used for storing and maintaining the data related to the server.
- Above the Physical hosting interface the server has HTTP server software and other web server components for bypass the direct interaction with the physical interaction with the lower levels.
- The final layer has the tools and services for interacting with the video streams which includes the Image codec and storing interfaces, connection managers and session control interfaces etc.

After connecting all the devices power up the device. When the device starts booting from flash, it first loads the linux to the device and initializes all the drivers and the core kernel. After initialization of the kernel it first checks whether all the devices are working properly or not. After that it loads the file system and starts the start-up scripts for running necessary processes and daemons. Finally it starts the main application. When our application starts running it first check all the devices and resources which it needs are available or not. After that it checks the connection with the devices and gives control to the user.

(IV) FINAL RESULTS

Snapshots:

Monitoring, Sensing and controlling of the Project.

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Fig 4 Sensing the data

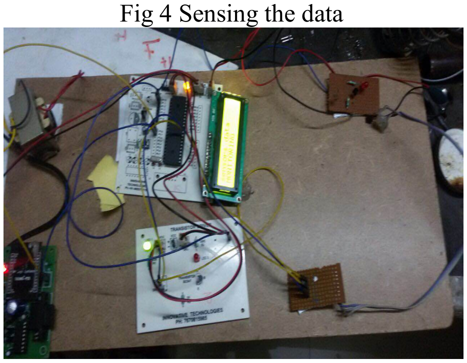

Fig 5 Hardware design

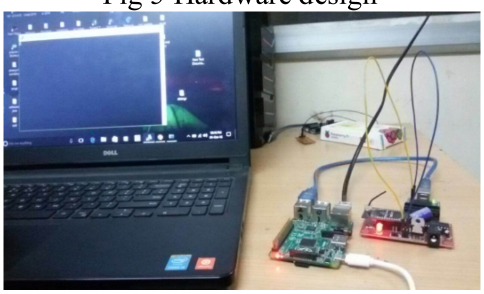

Fig 6 Connecting to the computer

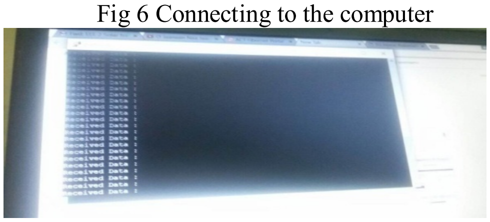

Fig 7 Received The Data

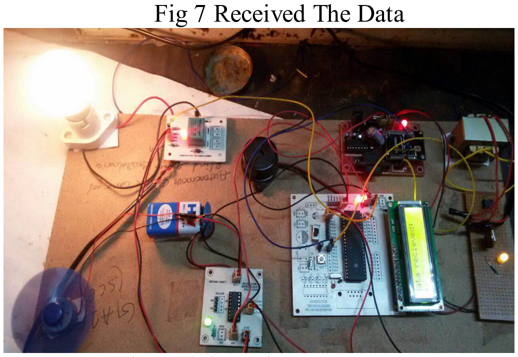

Fig 8 Light and Fan on state

ADVANTAGES:

- Low support cost, easy to implement and low power consumption and controlling is done by using web technology.
- Avoid unplanned lab operation interruptions.
- Increase laboratory efficiency.
- Remotely track critical system parameters.

APPLICATIONS:

Used to monitor the parameters like temperature, darkness etc inside the lab and also control the parameters through web technology.

(V) CONCLUSION

The Paper "WSN BASED INDUSTRIAL PARAMETERS MONITORING AND CONTROLLING SYSTEM" has been successfully designed and tested. It has been developed by integrating features of all the hardware components and software used and tested. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced ARM Cortex A8 Processor board and with the help of growing technology the Paper has been successfully implemented.

FUTURE SCOPE

- The cost of ARM11 is more that's why in future we can implement this system using ARM CORTEX A8, Beagle bone etc as well as updated processors with high frequencies will work fine.
- As the storage space is also less in future we can also record these live streaming data by increasing external memory storage.
- In future we can provide more security to data by using encryption, decryption techniques.

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