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Design of advanced embedded system by using WSN for Industrial automated systems

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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 a re configurable smart sensor interface for industrial WSN in IoT environment. 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 CPLD programmable technology and the standard of IEEE1451.2 intelligent sensor specification. Performance of the proposed system is verified and good effects are achieved in practical application of IoT to water environment monitor.***

Index Terms— WSN, IoT, ARM processor.

I. INTRODUCTION

A wireless sensor network (WSN) of spatially distributed autonomous sensors to *monitor* physical or environmental conditions, such as temperature, LDR, Fire, etc. and to cooperatively pass their data through the network to a main location. The more modern networks are bi-directional, also enabling *control* of sensor activity. The development of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control, machine health monitoring.

The Internet of Things (IoT) refers to the interconnection of uniquely identifiable embedded computing-like devices within the existing Internet infrastructure. Typically, IoT is expected to offer advanced connectivity of devices, systems, and services that goes beyond machine –to-machine communication and covers a variety of protocols, domains, and applications. The interconnection of these embedded devices (including smart objects), is expected to user in automation in nearly all fields, while also enabling advanced applications like a smart grid. Automatic control panel are available in industries for monitoring and controlling the parameters of machines and hence final product. But most of the control panels in industries are wire panels and machines are controlled and monitor by the control room operator using wire network. The wires are moving through conducts, sometimes inside walls and sometimes underground also.

So breakdown maintenance of these wires are difficult task in industries. As these wires are not open so it is difficult to locate the fault. And even after locating the fault it takes time to repair them. The second disadvantage of this method is operator console cannot move from one room to another. Every time operator has to go to particular room to monitor and control the operation.

II. PROPOSED SYSTEM

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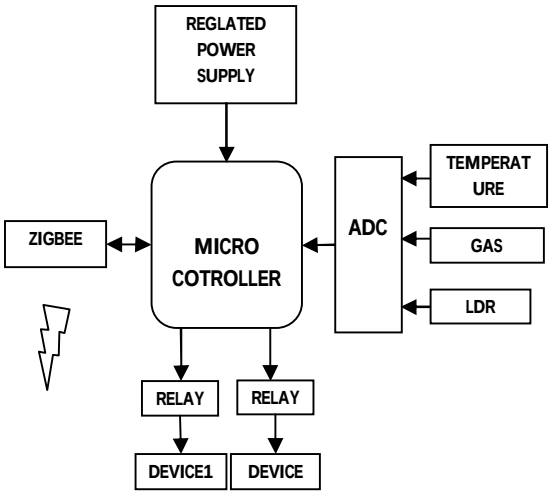
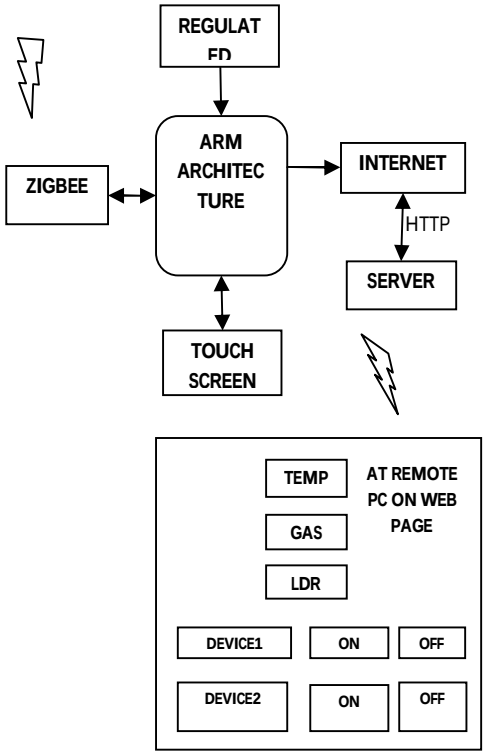


Transmitter



Receiver

We are designing advanced embedded system by using wireless sensor network and Internet of Things. We are designed a system by using ARM 11/arm9 and 8051 which supports different features and algorithms for the development of industrial automation systems. In these project we are using two systems for two-way communication, One system consist of Microcontroller-Atmel (89s52) is used for interfacing sensors to read data relays for controlling devices and zigbee is used for wireless communication to transfer sensor data to ARM 9/ARM11 controller. Second system consists of ARM9/ARM11, Ethernet controller and zigbee module. In second System, zigbee collects sensor data from first system and transfer the data to Internet through Embedded web-server technology. We can access the data through Remote location computer. Any abnormal conditions we can control devices

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through remote computer. Many open source libraries and tools are available for ARM-linux wireless sensor network development and controlling. We can monitor and control the wireless sensor network remotely using internet and web server.

III. SOFTWARE SPECIFICATIONS AND FRAMEWORK

A. *Software Specifications*

1) *Linux Operating System:* The Linux open source operating system, or Linux OS, is a freely distributable, cross-platform operating system based on Unix that can be installed on PCs, laptops, net books, mobile and tablet devices, video game consoles, servers, supercomputers and more.

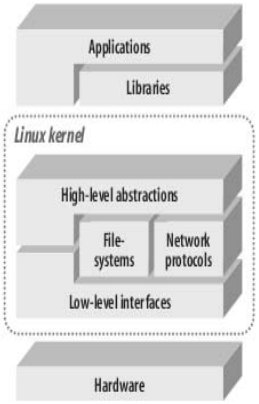

Figure.1: Linux OS Architecture

2) *Qt for Embedded Linux:* Qt for Embedded Linux is a C++ framework for GUI and application development for embedded devices. It runs on a variety of processors, usually with Embedded Linux. Qt for Embedded Linux provides the standard Qt API for embedded devices with a lightweight window system.

IV. HARDWARE IMPLEMENTATION

The Friendly ARM9 is a single board computer based on a Samsung S3C2440 ARM9 microprocessor. The board measures 10 cm x 10 cm, ideal for learning about ARM systems or integrating into numerous products.

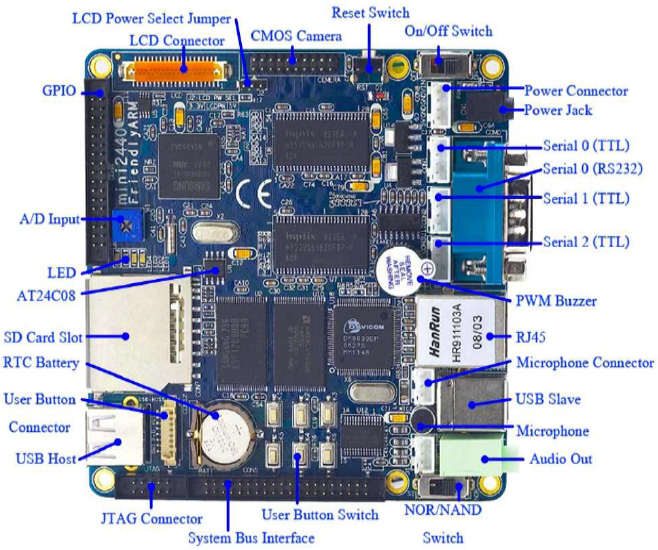

Fig: S3C2440 ARM9 Board

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A. ZIGBEE

ZigBee is a low-cost, low-power, wireless mesh networking proprietary 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. The ZigBee Alliance, the standards body that defines ZigBee, also publishes application profiles that allow multiple OEM vendors to create interoperable products. The current list of application profiles either published or in the works are:

1) Home Automation
2) ZigBee Smart Energy
3) Commercial Building Automation
4) Telecommunication Applications
5) Personal, Home, and Hospital Care
6) Toys

ZigBee coordinator (ZC): The most capable device, the coordinator forms the root of the network tree and might bridge to other networks. There is exactly one ZigBee coordinator in each network since it is the device that started the network originally. It is able to store information about the network, including acting as the Trust Centre & repository for security keys.
ZigBee Router (ZR): As well as running an application function a router can act as an intermediate router, passing data from other devices.
ZigBee End Device (ZED): Contains just enough functionality to talk to the parent node (either the coordinator or a router); it cannot relay data from other devices. This relationship allows the node to be asleep a significant amount of the time thereby giving long battery life. A ZED requires the least amount of memory, and therefore can be less expensive to manufacture than a ZR or ZC.
The protocols build on recent algorithmic research (Ad-hoc On-demand Distance Vector, neuRFon) to automatically construct a low-speed ad-hoc network of nodes. In most large network instances, the network will be a cluster of clusters. It can also form a mesh or a single cluster. The current profiles derived from the ZigBee protocols support beacon and non-beacon enabled networks. In non-beacon-enabled networks (those whose beacon order is 15), an unslotted CSMA/CA channel access mechanism is used. In this type of network, ZigBee Routers typically have their receivers continuously active, requiring a more robust power supply. However, this allows for heterogeneous networks in which some devices receive continuously, while others only transmit when an external stimulus is detected. The typical example of a heterogeneous network is a wireless light switch: the ZigBee node at the lamp may receive constantly, since it is connected to the mains supply.

B. Gas Sensor

A CO gas sensor according to the present invention includes a gas collecting container for collecting a measured gas therein; a detecting section provided within the gas collecting container and having at least a pair of electrodes positioned through electrolyte; and a voltage applying apparatus for applying voltage to the detecting section. One of the electrodes of the detecting section is a detection electrode having the capability of adsorbing at least one of hydrogenous gas and CO gas when a voltage is applied and then oxidizing it.

C. Light Dependent Resistor

Light dependent resistors are used to re-charge a light during different changes in the light, or they are made to turn a light on during certain changes in lights. One of the most common uses for light dependent resistors is in traffic lights. The light dependent resistor controls a built in heater inside the traffic light, and causes it to recharge over night so that the light never dies. Other common places to find light dependent resistors are in: infrared detectors, clocks and security alarms.

D. Ethernet

1) Ethernet LAN Features

a) Bus topology, Wired LAN in IEEE 802.3 physical layer standard

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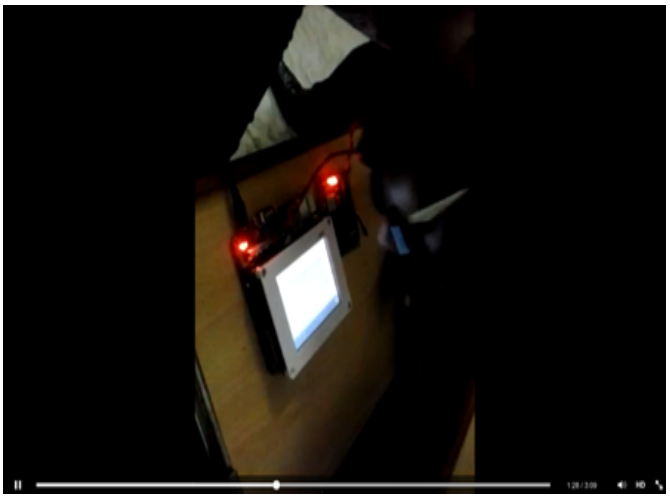
b) 10 Mbps, 100 Mbps (Unshielded and Shielded wires) and 4 Gbps (in twisted pair wiring mode)
c) Broadcast medium─ Passive, Wired connections based.
d) Frame format like the IEEE 802.2
e) SNMP (Simple Network Management Protocol) Open system (therefore allows equipment of different specifications)
f) Each one connected to a common communication channel in the network listens and if the channel is idle then transmits. If not idle, waits and tries again.
g) Multi access is like in a Packet switched network

E. TFT Display Unit

TFT stands for Thin Film Transistor, and is a type of technology used to improve the image quality of an LCD. Each pixel on a TFT-LCD has its own transistor on the glass itself, which offers more control over the images and colors that it renders.

While TFT-LCDs can deliver sharp images, they also tend to offer relatively poor viewing angles, meaning they look best when viewed head-on. If you view a TFT-LCD from the side, it can be difficult to see.

V. RESULTS



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VI. CONCLUSION

The project titled **"Design Of Advanced Embedded System By Using WSN For Industrial Automated Systems "** has been successfully designed and tested. It has been developed by integrating features of all the hardware components and software used. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced Raspberry pi board and with the help of growing technology the project has been successfully implemented.

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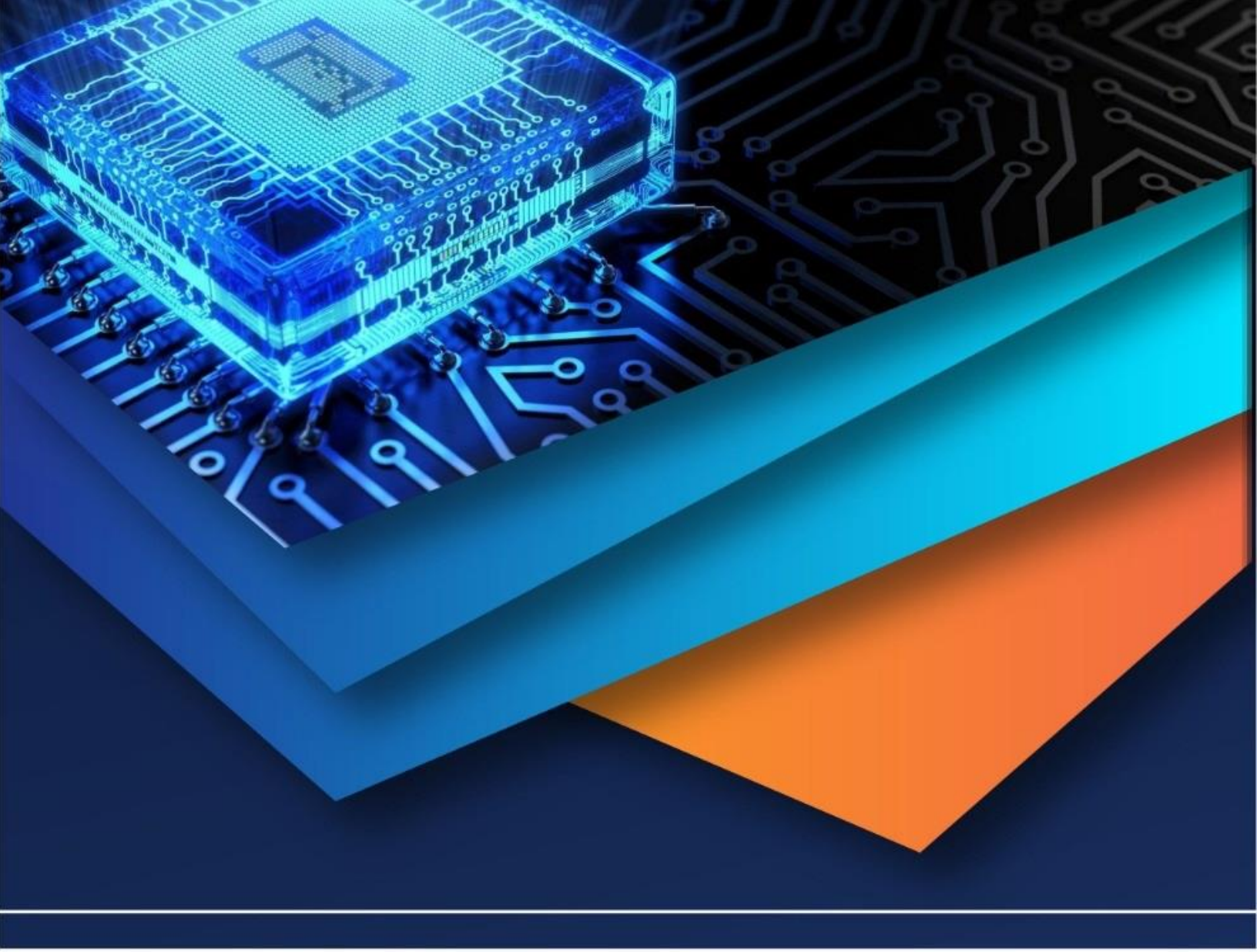

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