DESIGN OF SMART HOME BASED HEALTH MONITORING SYSTEM THROUGH EMBEDDED LINUX GATEWAY

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Abstract: Many wireless sensor network applications require a gateway device to interface with services running on the Internet. Because of the software complexity involved in this device, it is often realized using a real-time operating system running on an application processor. Most systems burden the user with developing the protocol handling and device configuration and management inside the application. In this paper, we present the Gateway with a turnkey, low-cost, Linux-powered WSN gateway that provides a socket-based environment for rapid network-enabled application development. The proposed device is capable of high throughput packet I/O, confirming the efficiency of the proposed implementation has been experimented and results are provided.

Keywords: Microcontroller, WIFI, MEMS, Temperature Sensor, Pulse Sensor, Humidity.

INTRODUCTION

In many applications — especially smart home systems —the WSN does not operate alone; it must communicate with other servers, services, and devices — usually over TCP/IP. Because of this, one of the most important elements of a WSN is the gateway, which bridges the local WSN and the Internet (or private intranet).

Depending on the gateway architecture and its processing power, it might also provide data processing, as well as a flexible interface allowing status monitoring, reconfiguration, debugging or even firmware updating. The gateway often has significantly higher processing power than a typical WSN end device, and is typically not required to be battery operated. All gateways have a WSN transceiver to communicate with the other WSN motes, a network transceiver (usually in the form of Wi-Fi, Ethernet, or 3G cellular), and a processor for running software linking these two interfaces together. In the research community, a PC often serves the purpose of the gateway in this scenario – but PCs have limited usefulness in real-world deployments because they are bulky, expensive, and power-hungry.

Embedded operating systems provide task and memory management, as well as a unified hardware abstraction layer, pre-built software components, and useful documentation for building embedded applications. While there are many embedded operating systems, GNU/Linux has mature support for many different processors and platforms from all major silicon manufacturers. Running GNU/Linux on an embedded device can provide a rich environment in which to quickly develop applications, while providing stability required for reliable operation. GNU/Linux can comfortably run many
WSN applications on embedded processors operating in the 200-500 MHz range; though the latest easily-available ARM application processors have as many as 4 cores, and can operate at speeds in excess of 1.5 GHz. To this end, there is a rich ecosystem to choose from when developing WSN gateway hardware with GNU/Linux.

I. The Hardware System

Microcontroller:

This section forms the control unit of the whole project. This section basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors (if needed) and so on. The Microcontroller forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written.

S3C2440A:

S3C2440A is a 16/32-bit RISC microprocessor. SAMSUNG’s S3C2440A is designed to provide hand-held devices and general applications with low-power, and high-performance microcontroller solution in small die size. To reduce total system cost, the S3C2440A includes the following components. The S3C2440A is developed with ARM920T core, 0.13μm CMOS standard cells and a memory compiler. Its low power, simple, elegant and fully static design is particularly suitable for cost- and power-sensitive applications. It adopts a new bus architecture known as Advanced Micro controller Bus Architecture (AMBA). The S3C2440A offers outstanding features with its CPU core, a 16/32-bit ARM920T RISC processor designed by Advanced RISC Machines, Ltd.

Liquid-crystal display:

LCD is a flat panel display, electronic visual display that uses the light modulation properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

I. Design of Proposed Hardware System

The proposed method uses a Low-Cost Embedded Linux Gateway. The proposed gateway device was designed to facilitate rapid application development, while being extremely low cost, making it useful for a wide variety of WSN applications including (and outside of) smart home health monitoring. The proposed gateway consists of an ARM application processor running GNU/Linux, a 900 MHz transceiver (to communicate with the WSN), and USB connectivity supporting both 802.11 (Wi-Fi) and cellular modem communication. A Linux kernel module exposes the WSN transceiver as a Linux network device, introduced a severe performance handicap, and provides poor low-power support, which is critical for most WSN systems.
III .Board Hardware Resources Features

WIFI

VSD03 is the new third-generation embedded Uart WIFI modules studied by VSDTECH. UART-WIFI is an embedded module based on the UART serial, according with the WIFI wireless WLAN standards. It accords with IEEE802.11 protocol stack and TCP / IP protocol stack and it enables the data conversion between the user serial and the wireless network module. Through the UART-WIFI module, the traditional serial devices can easily access to the wireless network. The module supports quick networking by specifying channel number. In the usual course of wireless networking, devices would first scan automatically on the current channel, in order to search for the network (or Ad hoc) built by the target AP. This module provides working channel configuration, when the channel of the target network is known, users can specify the working channel directly, the networking time will be reduced from 2seconds to about 300 milliseconds, then quick networking is achieved.

MEMS

Micro electro mechanical systems (MEMS) are small integrated devices or systems that combine electrical and mechanical components. Their size range from the sub micrometer (or sub micron) level to the millimeter level and there can be any number, from a few to millions, in a particular system. MEMS extend the fabrication techniques developed for the integrated circuit industry to add mechanical elements such as beams, gears, diaphragms, and springs to devices. These systems can sense, control and activate mechanical processes on the micro scale and function individually or in arrays to generate effects on the macro scale. The micro fabrication technology enables fabrication of large arrays of devices, which individually perform simple tasks, but in combination can accomplish complicated functions.

MEMS are not about any one application or device, or they are not defined by a single fabrication process or limited to a few materials. They are a fabrication approach that conveys the advantages of miniaturization, multiple components and microelectronics to the design and construction of integrated electromechanical systems. MEMS are not only about miniaturization of mechanical systems but they are also a new pattern for designing mechanical devices and systems.

Temperature Sensor

A Thermistor is a type of resistor whose resistance varies significantly with temperature, more so than in standard resistors. The word is a portmanteau of thermal and resistor. Thermistors are widely used as inrush current limiters, temperature sensors, self-resetting over current protectors, and self-regulating heating elements. Thermistors differ from resistance temperature detectors (RTD) in that the material used in a thermistor is generally a ceramic or polymer, while RTDs use pure metals. The
temperature response is also different; RTDs are useful over larger temperature ranges, while thermistors typically achieve a higher precision within a limited temperature range, typically $-90\ ^\circ\mathrm{C}$ to $130\ ^\circ\mathrm{C}$.

**Pulse Sensor**

Pulse sensor is also called as Heart Beat Sensor. This heart beat sensor is designed to give digital output of heat beat when a finger is placed inside it. When the heart detector is working, the top-most LED flashes in unison with each heart beat. This digital output can be connected to microcontroller directly to measure the Beats Per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse.

![Fig: Pulse Sensor](image)

**CONCLUSION**

The proposed Gateway solution is useful, feature-rich, and Inexpensive. Using the Linux networking stack allows rapid application prototyping, as the communication is handled independently of the user’s code. The development of network-enabled applications itself can be easily and quickly performed by following generic socket programming techniques. Connectivity measurements have shown satisfying success rate in both transmission and reception. The powerful ARM9 platform, running Linux, allows performing additional processing and network management without the need of bare-metal, low-level C programming. At this point, only uncast IPv4/UDP packet interface is available for the user. Additional network features, like multicasting, will also be explored. Simultaneous, on-board processing and networking is a demanding task for the Gateway. Future performance analysis will determine the processing capacity bounds for network enabled WSN applications.

**REFERENCES**


