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DESIGN AND IMPLEMENTATION OF VITAL SIGNS MONITORING SYSTEM

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Abstract: Network communication and micro-electro-mechanical embedded technologies have attracted much attention in recent years. Through these technologies, the capabilities of sensing, identification, and communication can be embedded in various smart devices. These smart devices can automatically connect to the Internet and form an intelligent network called Internet of Things (IoT). However, these devices are embedded with different wireless communication interfaces such as Wi-Fi and ZIGBEE. This paper presents the design and implementation of an IoT access point that supports functionalities of coordination of various wireless transmission protocols. Based on the existing Wi-Fi access point, we have embedded a ZIGBEE module and implemented ZIGBEE and UPnP protocols into the designed IOT access point, which supports ZIGBEE communication capabilities over the Internet.

Keywords: *access point; home automation; Internet of things (IoT); ZigBee.*

I. INTRODUCTION

In recent years, the Internet of Things (IoT) has attracted much attention because of the provided functionalities that can advance humanity in terms of intelligence, automation, convenience, *etc.* The IoT can change objects that are precisely unidentifiable into identifiable, recognized, interconnected intelligent objects based on the standard communication protocols, called Smart Objects. The IoT consists of a number of smart objects that are embedded with wired/wireless communication interfaces to communicate and interact with each other without human intervention. The basic concept of IoT is that various smart objects can be automatically linked into a network for interacting with humans through perception and networking technologies. Smart objects in the IoT have the ability to send information through the Internet to provide the interaction among multiple things and people. For example, a smart power meter can get information with regard to energy usage from various electrical devices. Afterward, the smart power meter sends information wirelessly to the access point and the information is further forwarded to user devices through the Internet.

The development of IoT technologies can support a variety of applications, including the intelligent power grid, intelligent transportation, intelligent medicine and healthcare, intelligent art, intelligent logistics, intelligent environmental monitoring, smart life, *etc.* In a smart home context, numerous smart objects need to use wireless communications due to the requirements of supporting mobile applications and maintaining neat living space. So far, numerous wireless technologies had been integrated and designed for various purposes, however, most applications of smart home neglect a well-designed

wireless technology—ZigBee. ZigBee is an efficient short-range wireless technology in terms of power consumption and deployment scalability. It is a low-power wireless transmission protocol, providing a suitable data rate for control and monitoring purposes. However, most of the developed devices can only communicate with those devices that are also embedded with the ZigBee module.

II. HARDWARE SYSTEM

Micro controller: 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.

ARM7TDMI: ARM is the abbreviation of Advanced RISC Machines, it is the name of a class of processors, and is the name of a kind technology too. The RISC instruction set, and related decode mechanism are much simpler than those of Complex Instruction Set Computer (CISC) designs.

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.

RFID Technology for IoT-Based Personal Healthcare in Smart Spaces system that benefits in terms of cost, energy, consumption and complexity. Various smart spaces service use cases such as temperature, humidity, and other gases) about the user's living environment as example that make use of this system. Here we are placing RFID tags to two things one is for room identification that is we are monitoring the indoor environment conditions so depending upon the card we are going to identify the nodes.

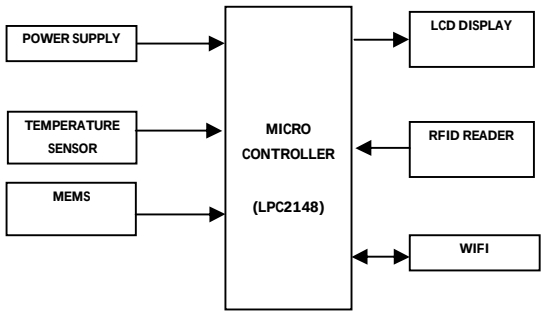

Fig: Block diagram

Second we are interfacing tags to inside human body to detect the body parts .when we are reading the body inertial data the tag will helps us in identifying which body part it is. Thus the data acquired from indoor environment and inertial body moments are plotted on graphical representation.

III. System hardware requirements

Temperature sensor:

A thermistor is a type of resistor whose resistance is dependent on temperature. Thermistors are widely used as inrush current limiter, temperature sensors (NTC type typically), self-resetting overcurrent protectors, and self-regulating heating elements. The TMP103 is a digital output temperature sensor in a

four-ball wafer chip-scale package (WCSP). The TMP103 is capable of reading temperatures to a resolution of 1°C.

Fig: Temperature sensor

MEMS:

Micro-Electro-Mechanical Systems (MEMS) is the integration of mechanical elements, sensors, actuators, and electronics on a common silicon substrate through microfabrication technology. While the electronics are fabricated using integrated circuit (IC) process sequences (e.g., CMOS, Bipolar, or BICMOS processes), the micromechanical components are fabricated using compatible "micromachining" processes that selectively etch away parts of the silicon wafer or add new structural layers to form the mechanical and electromechanical devices. MEMS promises to revolutionize nearly every product category by bringing together silicon-based microelectronics with micromachining technology, making possible the realization of complete systems-on-a-chip. MEMS is an enabling technology allowing the development of smart products, augmenting the computational ability of microelectronics with the perception and control capabilities of micro sensors and micro actuators and expanding the space of possible designs and applications.

Microelectronic integrated circuits can be thought of as the "brains" of a system and MEMS augments this decision-making capability with "eyes" and "arms", to allow micro systems to sense and control the environment. Sensors gather information from the environment through measuring mechanical, thermal, biological, chemical, optical, and magnetic phenomena. The electronics then process the information derived from the sensors and through some decision making capability direct the actuators to respond by moving, positioning, regulating, pumping, and filtering, thereby controlling the environment for some desired outcome or purpose. Because MEMS devices are manufactured using batch fabrication techniques similar to those used for integrated circuits, unprecedented levels of functionality, reliability, and sophistication can be placed on a small silicon chip at a relatively low cost.

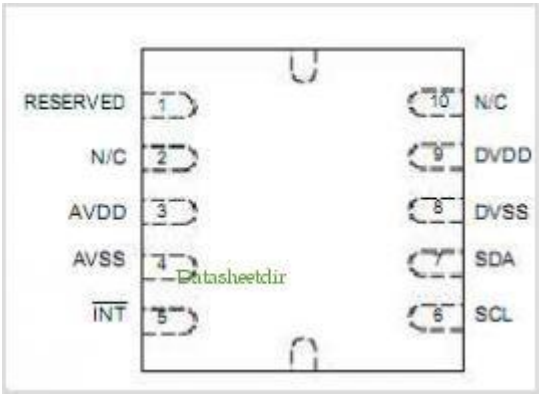

Fig: MEMS IC

WIFI:

Wi-Fi is the name of a popular wireless networking technology that uses radio waves to provide wireless high-speed Internet and network connections. A common misconception is that the term Wi-Fi is short for "*wireless fidelity*," however this is not the case. Wi-Fi is simply a trademarked phrase that means *IEEE 802.11x*. Wi-Fi works with no physical

wired connection between sender and receiver by using radio frequency (RF) technology, a frequency within the electromagnetic spectrum associated with radio wave propagation. When an RF current is supplied to an antenna, an electromagnetic field is created that then is able to propagate through space.

The cornerstone of any wireless network is an access point (AP). The primary job of an access point is to broadcast a wireless signal that computers can detect and "tune" into. In order to connect to an access point and join a wireless network, computers and devices must be equipped with wireless network adapters Wi-Fi is supported by many applications and devices including video game consoles, home networks, PDAs, mobile phones, major operating systems, and other types of consumer electronics. Any products that are tested and approved as "Wi-Fi Certified" (a registered trademark) by the Wi-Fi Alliance are certified as interoperable with each other, even if they are from different manufacturers. For example, a user with a Wi-Fi Certified product can use any brand of access point with any other brand of client hardware that also is also "Wi-Fi Certified". Products that pass this certification are required to carry an identifying seal on their packaging that states "Wi-Fi Certified" and indicates the radio frequency band used (2.5GHz for 802.11b, 802.11g, or 802.11n, and 5GHz for 802.11a).

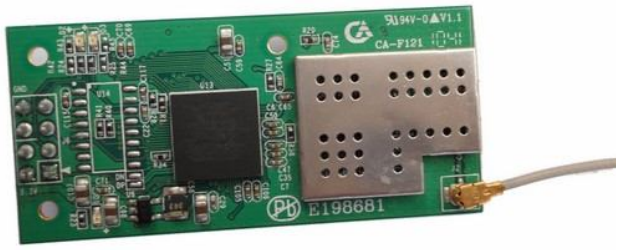

Fig: WIFI Module

VSD03 is the new third-generation embedded Uart-Wifi modules studied by VSD TECH. Uart-Wif 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. VSD03 does a comprehensive hardware and software upgrades based on the products

its main features include:

Interface:

- 2*4 pins of Interface: HDR254M-2X4
- The range of baud rate: 1200~115200bps
- RTS / CTS Hardware flow control
- single 3.3V power supply

Wireless

- support IEEE802.11b / g wireless standards
- support the range of frequency: 2.412~2.484 GHz
- support two types of wireless networks:
    - Ad hoc and Infrastructure
- support multiple security authentication mechanisms:
    - WEP64/WEP128/ TKIP/CCMP(AES)
    - WEP/WPA-PSK/WPA2-PSK
- support quick networking
- support wireless roam

Max 232:

MAX232 converts from RS232 voltage levels to TTL voltage levels, and vice versa. One advantage of the MAX232 chip is that it uses a +5V power source

which, is the same as the source voltage for the 8051. In the other words, with a single +5V power supply we can power both the 8051 and MAX232, with no need for the power supplies. The MAX232 has two sets of line drivers for transferring and receiving data. The line drivers used for TXD are called T1 and T2, while the line drivers for RXD are designated as R1 and R2. In many applications only one of each is used.

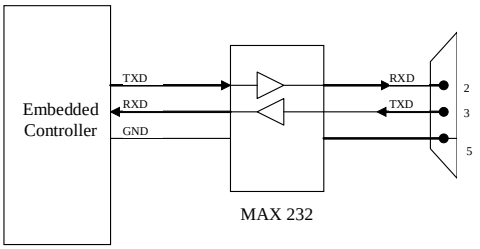

Fig: Communication via Max 232

RFID:

Radio Frequency Identification (RFID) is a silicon chip-based transponder that communicates via radio waves. Radio Frequency Identification is a technology which uses tags as a component in an integrated supply chain solution set that will evolve over the next several years. RFID tags contain a chip which holds an electronic product code (EPC) number that points to additional data detailing the contents of the package. Readers identify the EPC numbers at a distance, without line-of-sight scanning or involving physical contact. Middleware can perform initial filtering on data from the readers. Applications are evolving to comply with shipping products to automatically processing transactions based on RFID technology RFID Reader Module, are also called as interrogators. They convert radio waves returned from the RFID tag into a form that can be passed on to Controllers, which can make use of it. RFID tags and readers have to be tuned to the same frequency in order to Communicate. RFID systems use many different frequencies, but the most common and widely used & supported by our Reader is 125 KHz.

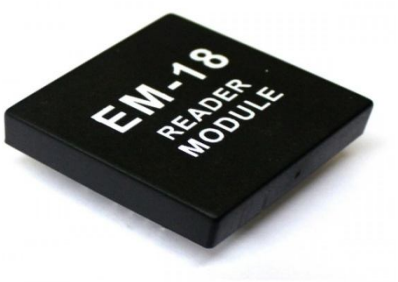

Fig: RFID Reader

Tags are classified into two types based on operating power supply fed to it.

1. Active Tags
2. Passive Tags

Active Tags: These tags have integrated batteries for powering the chip. Active Tags are powered by batteries and either have to be recharged, have their batteries replaced or be disposed of when the batteries fail.

Passive Tags: Passive tags are the tags that do not have batteries and have indefinite life expectancies.

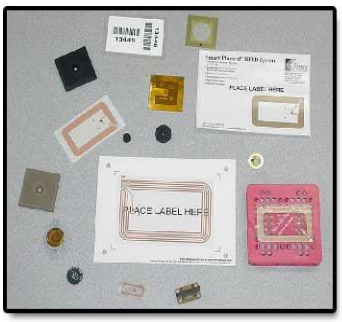

Fig: Different types of tags

IV. CONCLUSION

This paper proposes the integration of ZigBee communication, Wi-Fi communication, and Internet connection capabilities onto a traditional Wi-Fi AP by combining the AP with ZigBee standard. With the proposed approach, the original Wi-Fi AP can be upgraded to an IoT AP. The novelty and contribution of the proposed IoT AP is summarized below. IoT AP adaptively provides negotiation of channel usages between Wi-Fi network and ZigBee networks and help ZigBee network to allocate channel in a shorter response time; Wi-Fi interference can compete with other Wi-Fi devices and reserve the allocated bandwidth resource for ZigBee network. This function fully resolves the existing problem of unbalanced resource competition between Wi-Fi and ZigBee interferences; IoT AP supports dual modes of ZigBee operations, including power saving mode and emergency mode. By reducing the frame size, the IoT AP provides ZigBee devices with more opportunities to transmit data in a short cycle; and (4) the data collected from IoT devices can be forwarded directly to the data server or data center via the Internet in a more efficient way, as compared with the existing solutions. This helps the IoT AP can save more energy consumptions and reduce the response time. Performance results show that the proposed IoT AP not only prevents the ZigBee network contention and collision, but also saves energy consumption, as compared with the existing solutions.

V. REFERENCES

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