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WBAN and Cloud Computing

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Abstract: A data or a computer network can be classified based on the range up to which it can operate. It can be classified into Local Area Network (LAN), Personal Area Network (PAN), Wide Area Network (WAN) and global network. Body Area Network (BAN) is a special class of Personal Area Networks in which the signals are restricted to the circumference of the body of human beings. Wireless Body Area Networks (WBAN) includes the use of wireless technologies to interconnect the devices, sensors or other network components within the body. This can also be called wireless intra-body communication [1]. WBAN development includes the amalgamation of embedded system technology and resound networking. Embedded system lifecycle is followed in the development of WBAN. In this paper, we report the ongoing research and the developments in the project based on rapid prototyping technology. In this module, two sensors- Heartbeat sensor and body temperature sensor values are fed to the cloud via Wi-Fi. OSPF routing protocol is used for routing and sharing the data along the best available path.

Keywords: Local Area Network (LAN), Personal Area Network (PAN), Wide Area Network (WAN) and global network, wireless intra-body communication, Heartbeat sensor and body temperature sensor, OSPF routing protocol.

I. INTRODUCTION

WBAN is a wireless network of sensors; network elements like routers and switches; signal conditioners like filters, amplifiers and attenuators; output devices like LEDs, capacitive or resistive touchscreen displays and connectivity elements like Bluetooth circuit or Wi-Fi circuit. These network elements are placed at the nodes and consists of a wireless link running on top of them. Figure 1 shows abstract nature of WBAN network consisting of nodes and links. Figure 2 shows the WBAN running on OSPF protocol [2] and enclosed within area 0. Open Shortest Path First is a dynamic routing protocol with the following features

- It is an Interior Gateway Protocol (IGP).
- It is a dynamic routing protocol.
- It is a Link-state routing protocol or LSA routing protocol.
- OSPF follows hierarchical network structure and each network can be subdivided into logical sections of the network called areas.
- It is a classless protocol and supports Variable Length Subnet Masking (VLSM).

The above features of OSPF make it a handy protocol to be deployed into WBAN as compared to other routing protocols like EIGRP, RIP and IS-IS.

II. EMBEDDED SYSTEM LIFE CYCLE AND RAPID PROTOTYPING

A Software Development Life Cycle (SDLC) involves the development of a software or application in several setups ranging from requirements design, implementation testing and maintainance. Unlike the design of a software application Embedded system design involves design of hardware and software in parallel. This parallel approach will reduce time and cost complexity and desired product and service output. Figure 3 shows Embedded system life cycle and its different phases.

Following are the phases of Embedded system life cycle

- Phase 1- Product specification.
- Phase 2- Hardware/Software partition.
- Phase 3- Iteration and implementation.
- Phase 4- Detailed hardware/software design.
- Phase 5- Hardware/Software integration.
- Phase 6- Testing.
- Phase 6-7- Product release and marketing.
- Phase 7- Maintainance and upgrade.

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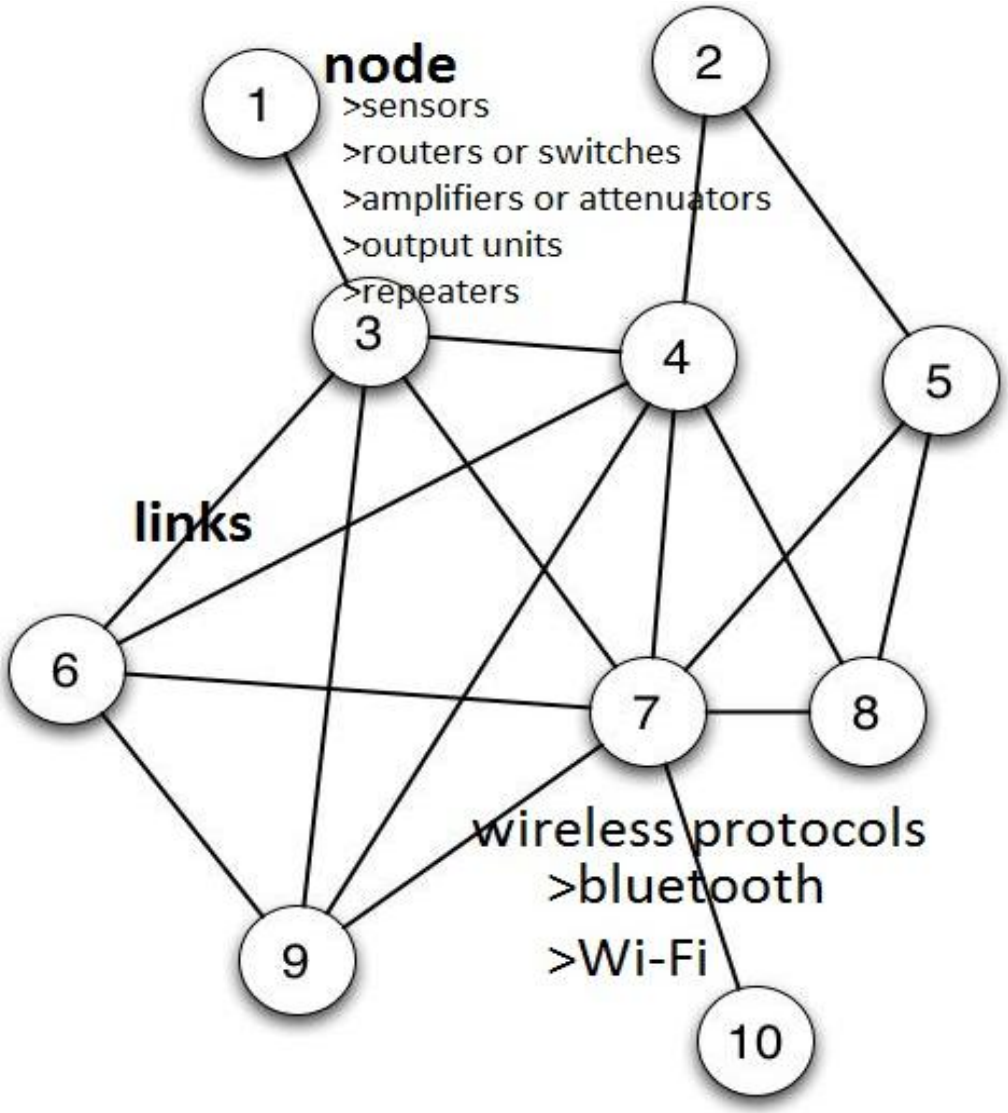

Figure 1 shows abstract nature of WBAN network consisting of nodes and links.

We follow the prototyping/evolutionary model. It is similar to the iterative model and the product is developed in multiple cycles. The only difference is that, this model produces a more refined prototype of the product at the end of each cycle as performed by the iterative model. There wont be any commercial deployment of the prototype of the product at each cycle's end. The shortcomings of the proto-model after each cycle evaluated and are fixed in the next cycle.

```
S1(config-if)#
S1(config-if)#^Z
S1#
S1#
S1#
S1#
S1#
*Aug 19 23:07:43.867: %SYS-5-CONFIG_I: Configured from console by console
S1#ping 10.1.12.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.12.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 16/22/36 ms
S1#
```

Figure 6 shows the simulation result of the BAN circuit.

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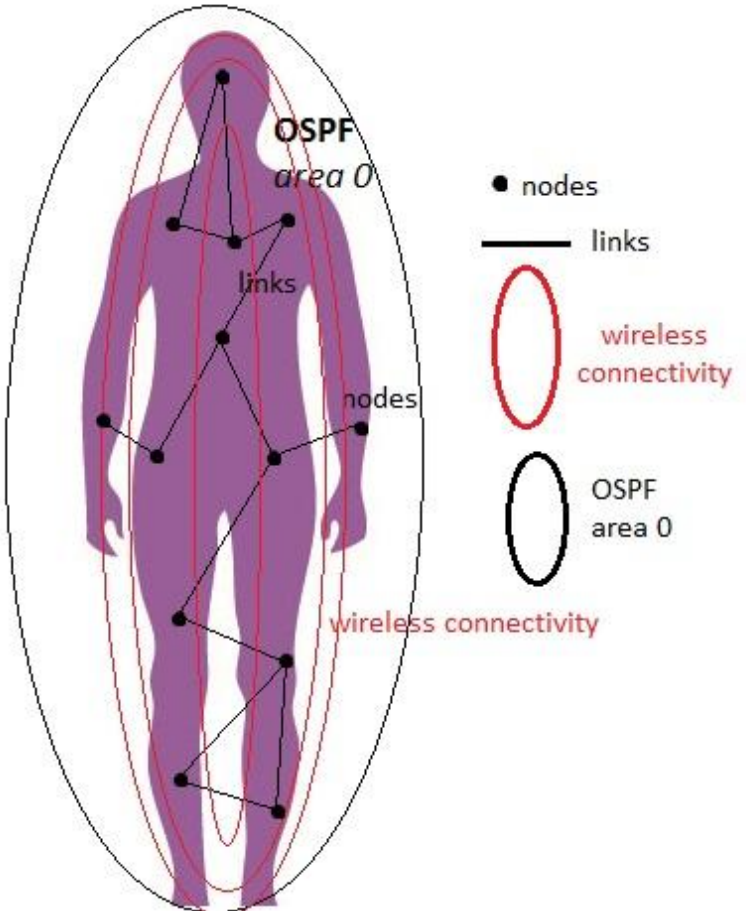

Figure 2 shows the WBAN running on OSPF protocol and enclosed within area 0.

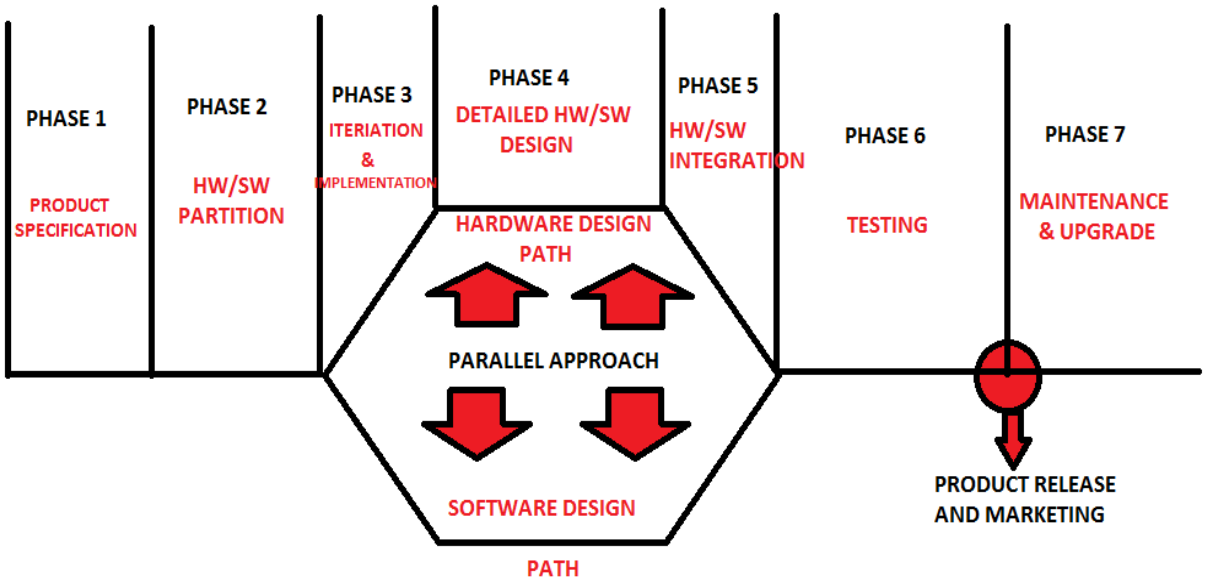

Figure 3 shows Embedded system life cycle and its different phases.

III. METHODOLOGY

The heartbeat and body temperature sensors are embedded on to the body at selected points [3]. The heartbeat sensor is preferably placed at the wrist or plugged to the earlobe. The body temperature sensor is placed under the armpit as

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shown in figure 4. The central router is placed at the centre of the body and is the most powerful router. Wi-Fi is the wireless connecting element between the nodes. All the elements at the nodes employ dynamic routing protocol- OSPF, to route the packets in the network. The OSPF protocol chooses the optimum or shortest path between two nodes [4] – the source node and the destination node. Figure 5 shows the network consisting of the above mentioned network elements. Figure 6 and 7 shows the simulation results in our effort to share and store sensor data. The data from the sensors are sent to the sensor via Wi-Fi and stored in the server database.

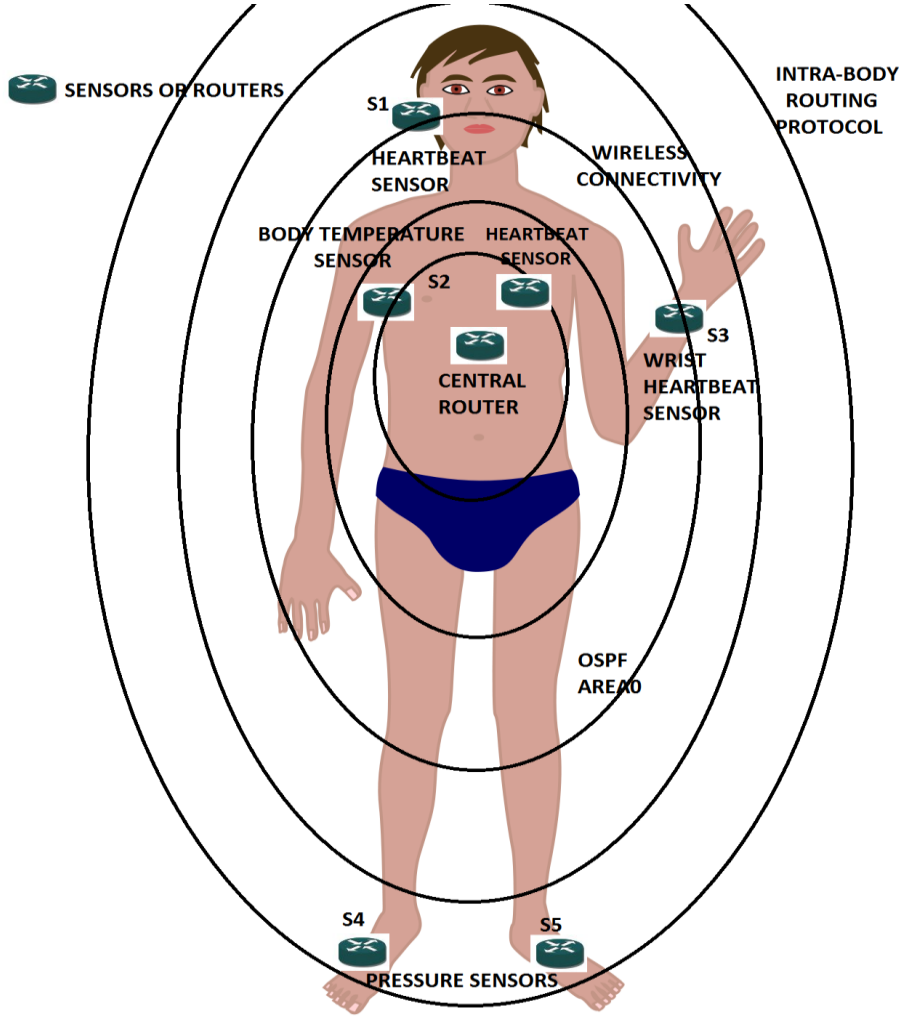

Figure 4 shows the placement of the sensors at strategic positions on the human body.

```
S2(config-if)#^Z
S2#
S2#
S2#
S2#
S2#
S2#
S2#
*Aug 19 23:05:51.091: %SYS-5-CONFIG_I: Configured from console by console
S2#ping 10.1.12.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.12.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/49/68 ms
S2#
```

Figure 7 shows the simulation result of the BAN circuit.

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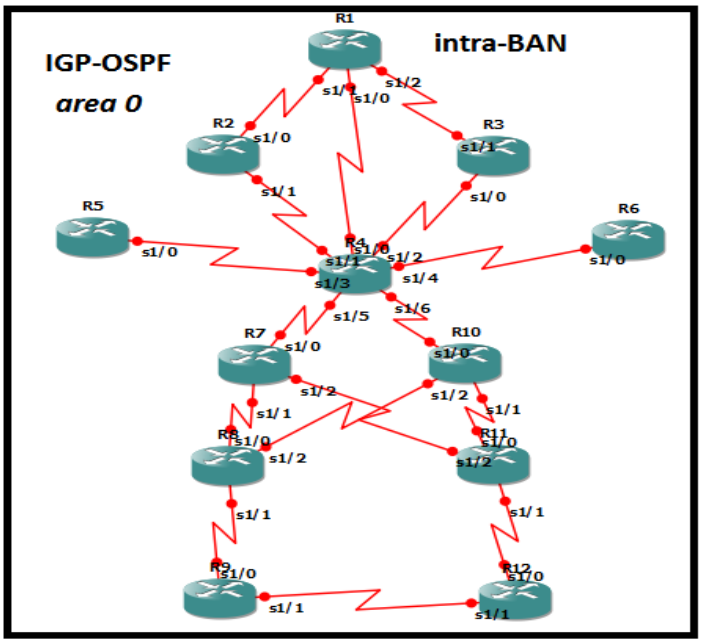

Figure 5 shows the network consisting of the above mentioned network elements.

IV. CONCLUSIONS

Wireless Body Area Networking is the emerging technology in the field of electronics and communication. The rapid growth in physiological sensors, low power integrated circuits, and wireless communication has enabled a new generation of wireless sensor networks, now used for purposes such as monitoring traffic, infrastructure, gaming and health. [5] The BAN is an interdisciplinary area which could allow inexpensive and continuous health monitoring with real-time updates of medical records through the internet. The sensors used in WBAN would have to be low on complexity, small in form factor, light in weight, power efficient, easy to use and reconfigurable. Further, the storage devices need to facilitate remote storage and viewing of patient data as well as access to external processing and analysis tools via the Internet.

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BIOGRAPHY

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