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Voice Controlled Sensor Network Measuring Human Physiological Parameters

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Abstract: A human body is an aggregate of various systems such as circulatory system, digestive system, nervous system and so on. Each system contains several physiological parameters that can be measured using 21st century sensors. With time these sensors have become more sophisticated, robust and compatible with existing measuring technologies and controllers. In this paper we interconnect various physiological bio sensors forming a sensor network. The parameters can be wirelessly monitored on a smartphone. In this paper we have put in efforts to control these networks using VOICE commands processed as strings of data.

Keywords: Physiological Parameters, Bio Sensors, Sensor Network, Smartphone, Voice Commands, Rapid Prototyping

I. INTRODUCTION

Physiological parameters are the measure of the systems performance and comparing it with standard threshold values. Any reading close to the standard threshold value is believed to be a normal body parameter and the person is said to be normal. Any fluctuations or deviation in the measured values from the standard values, the person needs medical assistance to avoid harm to his living and routine activities. Few of the physiological parameters of our interest are

- Heart beat in bpm
- Oxygen level in the blood in %
- ECG
- Body temperature in degree C
- Blood sugar levels

There are 2 types of measurement of physiological parameters

- Non-invasive method
- Invasive method (blood sugar monitoring)

II. SENSOR NETWORK AND PARAMETERS

Figure 1 shows the Wireless Body Area Network (WBAN) of physiological sensors [1]. Nodes are depicted by thick dots and links by straight lines. The human body of our interest or the subject is bound by a wireless network and this frequency is unique to that individual and is secured (password protected). We have considered OSPF routing protocol to guide the packets of information to take the shortest path through dynamic routing. [2][3]

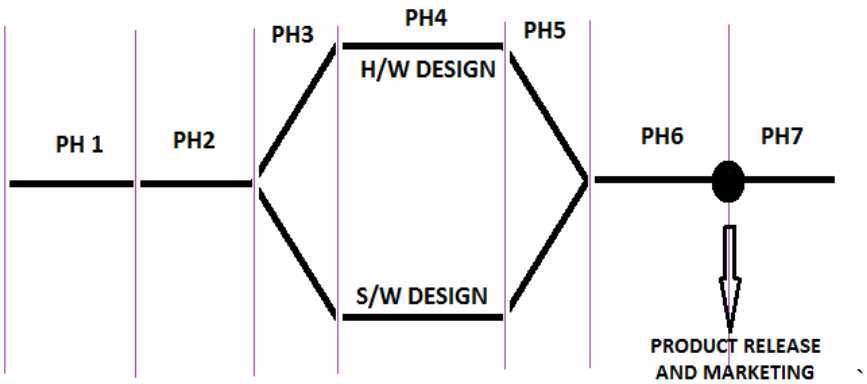

Figure 2 shows different phases of the EDLC model.

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III. EMBEDDED SYSTEM LIFE CYCLE AND RAPID PROTOTYPING

Software Development Life Cycle (SDLC) involves the development of a software or application in several setups ranging from requirements, design and implementation, testing and maintenance. Unlike the design of a software or application, embedded system design involves design of software and hardware in parallel. This parallel approach will reduce time, cost and complexity. Different phases of Embedded System Life Cycle are shown in figure 2 and are mentioned below

- Phase 1- Product specification
- Phase 2- Hardware and Software partition
- Phase 3- Iteration and implementation
- Phase 4- detailed hardware/software design (parallel approach)
- Phase 5- Hardware and software integration
- Phase 6- Testing
- Phase 6-7- product release and marketing
- Phase 7- maintenance and upgrade

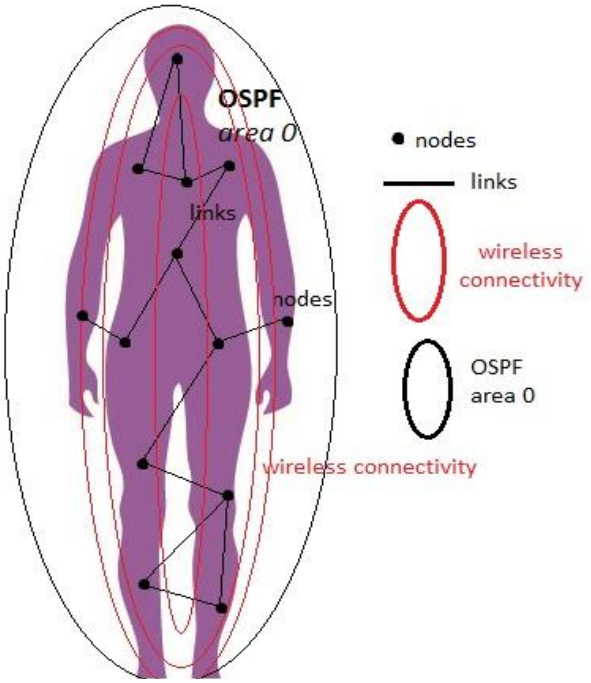

Figure 1 shows the Wireless Body Area Network (WBAN) of physiological sensors.

IV. SOFTWARE REQUIREMENTS SPECIFICATION

A. Functional Requirements

Functional requirements define the functionality of a system to be developed.
The functional requirements of the proposed system are:

- Configuration of OSPF on the body area network.
- Configuration of static routes wherever necessary.
- Programming the controller for processing the data from the sensor network.
- Conversion of voice to string data using suitable libraries.
- Building an android application for bidirectional communication between the 2 systems.

B. Non-functional Requirements

Non-functional requirements play the behaviour and performance of the system at its critical stages.

- Scalability: Provisions will be made to accommodate more sensors to monitor various other physiological parameters when the need arises.

- Security: The system will provide secured transfer of data.

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V. SYSTEM DESIGN

We follow the Embedded System Development Life Cycle approach to build our prototype which can be later released into the market. We follow rapid prototyping, which is an evolutionary method of embedded design. At each step or phase of the embedded cycle we have tested for failures and attention to detail is given. Figure 3 shows the system design of our voice controlled sensor network. A suitable controller with desired [4]

- Number of I/O ports
- Power supply and consumption
- In chip memory is chosen

An application built or customized for this prototype is installed in the smartphone and it allows

- Voice control and response
- 24/7 real time monitoring
- Storage option
- Graphical and statistical representation of real time data
- Enhanced security

The body area network consisting of sensor and network elements are thus said to be wirelessly interfaced with the smartphone transmitting and receiving physiological parameters of interest. The screenshot of one of the screens of the android app is as shown in figure 4.

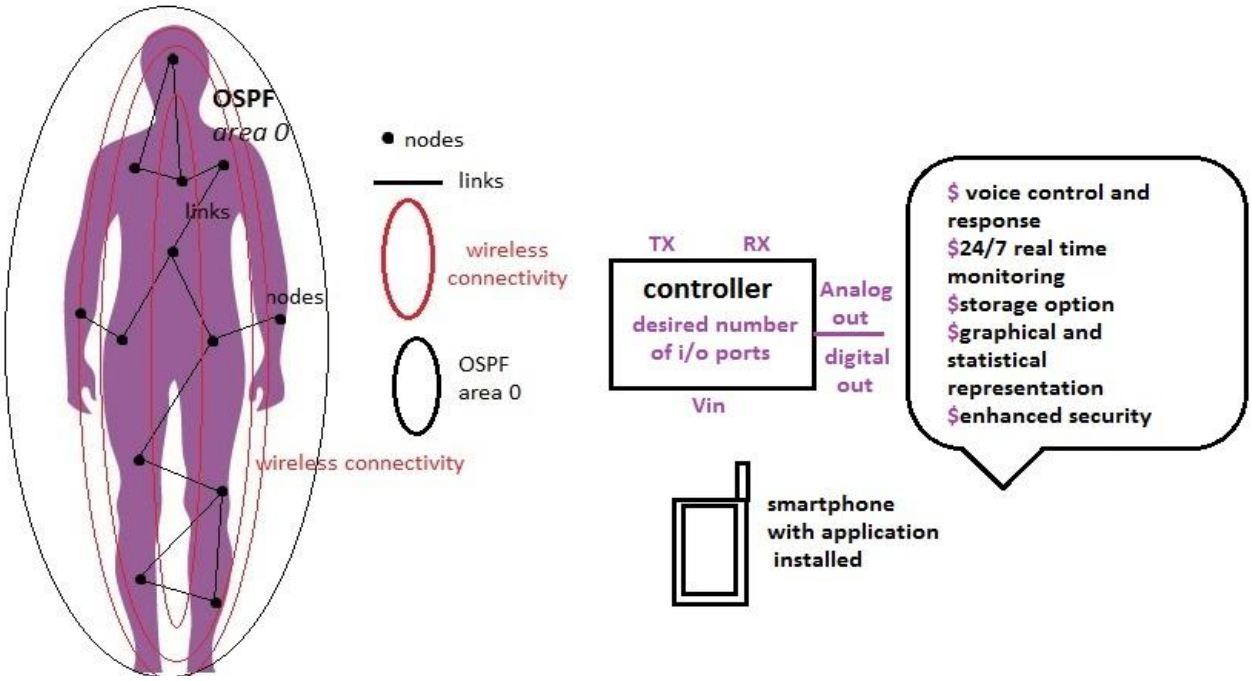

Figure 3 shows the system design of our voice controlled sensor network.

Figure 5 shows the instructions to assign a string to an appropriate I/O pin.

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VI. VOICE CONTROL

The sensor's transmission of data can be controlled using voice commands. The voice commands are converted to data strings and then compared with the stored values to depict the appropriate command line and its response. Figure 5 and 6 show the instructions to assign a string to an appropriate I/O pin and its response respectively.

Figure 6 shows the instructions to assign a string to an appropriate I/O pin and its response.

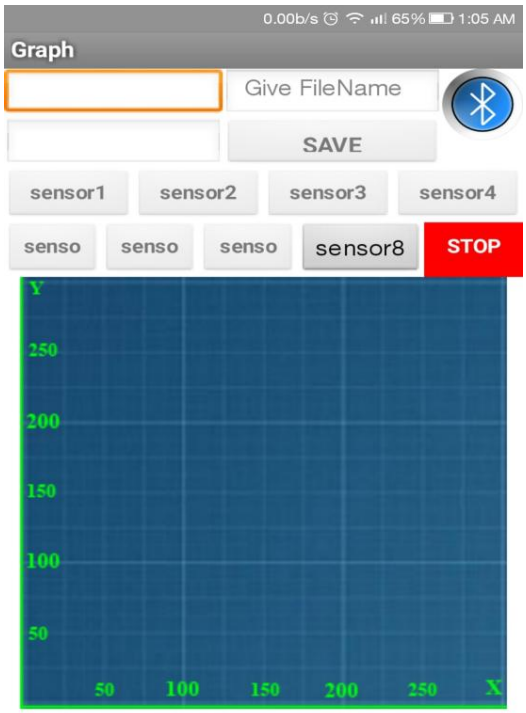

Figure 4 shows one of the screens of the android application.

CONCLUSION

There is a need for a serious breakthrough in Body Area Networking. It would be a failure on the part of researchers to see physical connections like wires or foils running all round the body. A high impedance shoe is essential in situations where electrons flow through the body and carry the information/data. Since human body is a very good conductor of electricity and acts as a short to the flow of charges in the body. A very good alternative for the above is the wireless

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Body Area Network. The transmission and reception of data takes place within the circumference of a body. We have developed a prototype containing a network of various bio sensors at the node communicating with each other and the outside world. The smartphone application enables control of these sensors wirelessly. Since a smartphone consists of various built in sensors used to interact with the human race, passing of commands (text, voice or images) is easier and also processed within seconds. The use of Rapid prototyping, which is one of the evolutionary methods of embedded system design, enables the engineers to solve the problems practically at each phase of the EDLC model. This reduces the cost, complexity and increases reliability.

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OUR GUIDE

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