International Journal of Engineering Science Invention (IJESI)
ISSN (Online): 2319 – 6734, ISSN (Print): 2319 – 6726
www.ijesi.org ||Volume 7 Issue 2|| February 2018 || PP. 83-89

Design of Real Time Alerts on Multi Mode Communication System for Critical Health Parameter from Intensive Care Unit

Narendra Swaroop K [#1], Dr.Kavitha Chandu [*2], Ramesh Gorrepotu [#3]

[#1] *Research Scholar, Department of Electronics and Physics, GITAM University Rushikonda, Visakapatnam, Andhra Pradesh, INDIA,*

[#2] *Associate Professor, Department of Physics, GITAM University Rushikonda, Visakapatnam, Andhra Pradesh, INDIA,*

[#3] *Research Scholar, Department of Electronics and Physics, GITAM University Rushikonda, Visakapatnam, Andhra Pradesh, INDIA,*

Corresponding Author: Narendra Swaroop K

ABSTRACT— In today's world, healthcare technology associates are always under pressure to continuously innovate which enables to improve and enhance the patient experience with personalized care. At the same time, they need minimize the cost-of-care. Healthcare is making great progress driven by the advancements made in pharmaceuticals, medical devices, and biotechnology. This paper provides the elements of much needed enhancements in alert system to doctor where data is made available for immediate remedy. Remote patient monitoring is an effective way to extend the reach of the hospital inside and outside of its walls which engage patients as partners in their own care. Empowering doctors to manage the chronic conditions where there could receive alerts in multiple mode such as SMS on mobile, Mobile application to alert the condition and detailed data over Web application.

The concept "Real time Alerts on multi mode communication system for critical health parameter from Intensive Care Unit" objective is to design enhanced alert system with intense data which will haul the attention of duty doctor and in case of non availability for immediate attention, the data will support for remote instructions to the support staff to initiate the treatment process [1][2][3].

Index Terms— Raspberry PI, GSM, Bluetooth, Wi-Fi, Python scripting, Real Time, body temperature sensor and blood pressure sensor.

Date of Submission: 05-02-2018 Date of acceptance: 23-02-2018

I. Introduction

Health care needs the transformative power of digital technology. This white paper provides an overview of the future of digital health. It describes the skepticism and hype what is needed for the medical community to embrace a world where data, machines, and analytics are employed to deliver higher quality, more efficient care. It also includes real cases that demonstrate the clinical benefits of incorporating digital tools into the workflow and care of patients. Today, "digital health" one means is advanced communication based on multi-modal data the "Health Care Internet of Things," which uses sensors, apps, and remote monitoring to provide continuous clinical information and data in the cloud that enables clinicians to access the information they need to care for patients in their home, their office, or miles away, and to collaborate with specialists in another country. Real time communication is the key factor for utilization and supporting this need embedded device platforms have evolved rapidly with means of communication options. It is the fact to realize communication preference is towards wireless mode and many means of wireless mode of communications are established and successfully utilized.

Wireless technologies are expected to be bit expensive when compared with wired solution. This paper presents the "concepts of achieving and establishing multiplexed wireless communication platform which enable critical health parameters data to exchange in multi mode system without compromising on real time monitoring from Intensive care unit".

Fig. 1. Advancement in Health care data facilitation

II. Concept

The concept of Real time alerts in Multiplexed Multi mode communication system is to establish and achieve data to exchange in multi mode multiplexed communication system without compromising on real time services. In this concept three wireless means of communication is utilized which are described below.

Figure 2 depicts the concept where the patient parameters are monitored continuously and enabled parameters are transfer through three communication modes to reached authorized recipients.

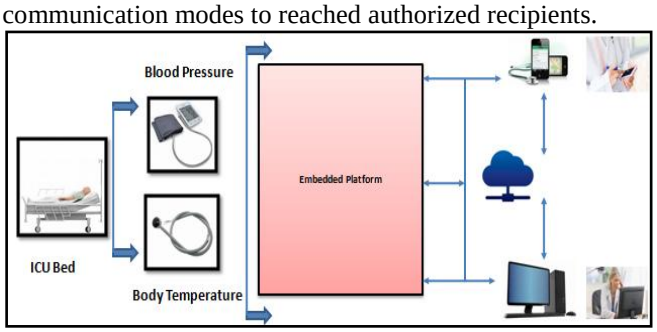

Fig. 2. Concept of Multiplexed Multi mode communication system

Implementation of this concept is phased out in three stages

- Patient interface with sensors to monitor blood pressure and body temperature
- Sensor output interfaced with Embedded platform for data acquisition
- Embedded platform interface with transceivers via BLE, Wi-Fi and GSM

I. METHODOLOGY

The Design of real time Multiplexed multi mode communication System is both Hardware and software centric [1. The section to follow will detail the design aspects. Figure 3 layouts the high level blocks associated to implement the concept.

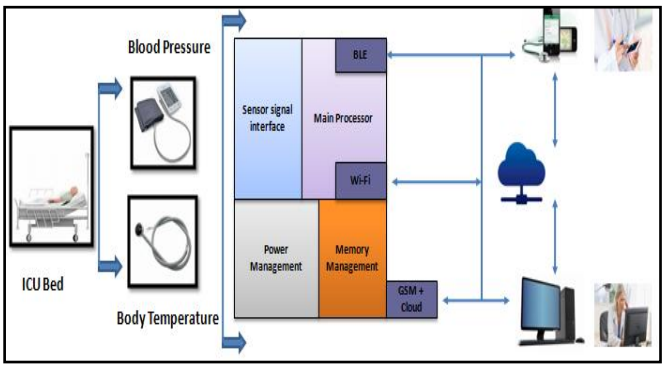

Fig. 3. Block diagram of Multiplexed Multi mode communication system

III. Hardware Design

This section details the major hardware components that are deployed in hardware design of real time Multiplexed multi mode communication System. Figure 4 below provides the high level block diagram where the interfaces are indicated.

The interface in defined in phases below

The sensor data is interface with Raspberry Pi 3 and the firmware compiles the data. Compiled data shall undergo multiplexed multimode algorithm

Temperature sensor is interfaced with Raspberry Pi 3, the temperature data in analog format is read by Raspberry Pi 3

The Sunrom Blood Pressure/Heart Rate Sensor is interfaced with Raspberry Pi 3. The Blood Pressure/Heart Rate Sensor data in RS 232 port is read by Raspberry Pi 3

Onboard BLE, Wi-Fi and external interfaced USB GSM modem shall be vital elements to perform multiplexed multimode algorithm

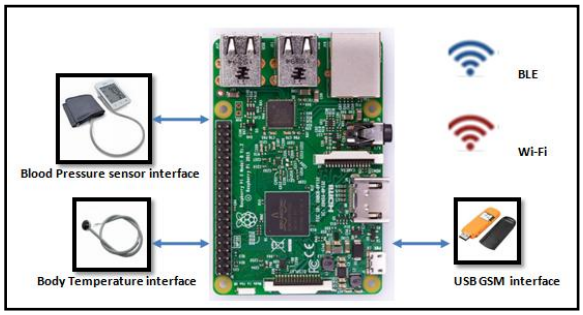

Fig. 4. Interface diagram of Multiplexed Multi mode communication system

1. **Raspberry Pi 3**

The primary circuits in the concept real time Multiplexed multi mode communication System are provided in this section. The schematics related to Raspberry Pi 3 and external modules interface with Raspberry Pi3 are provided below.

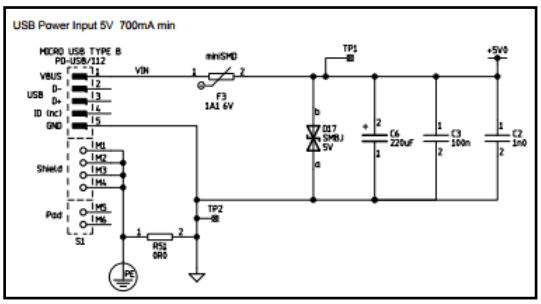

Fig. 5. Raspberry PI USB Power input circuit

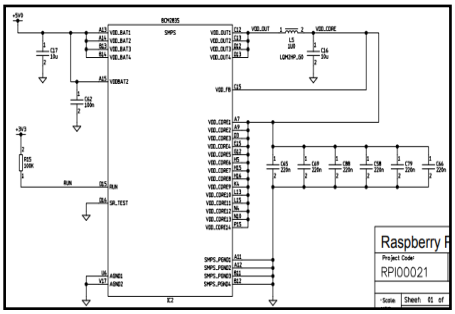

Fig. 6. Raspberry PI SMPS circuit

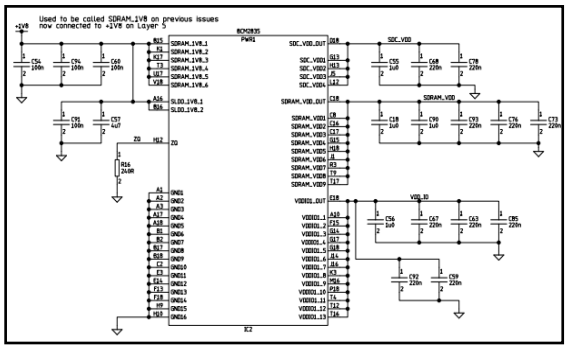

Fig. 7. Raspberry PI Power input circuit

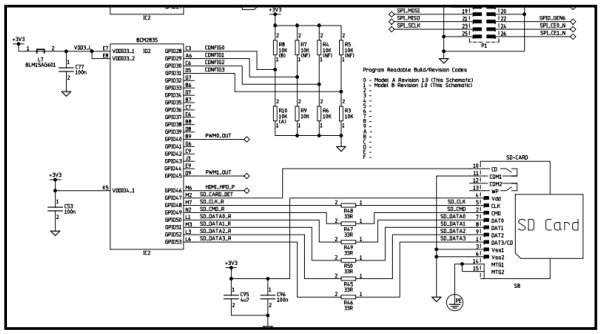

Fig. 8. Raspberry PI SD CARD Interface

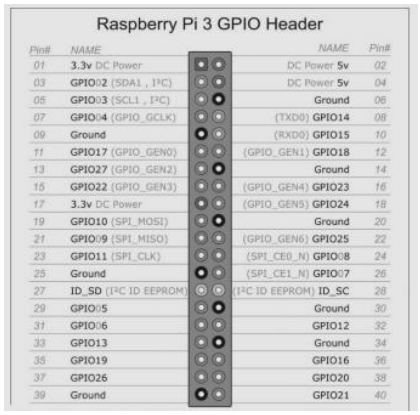

Fig. 9. Raspberry PI 3 GPIO Header

2. Blood Pressure / Heart Rate Sensor.

Features of Sunrom Blood Pressure/Heart Rate Sensor which shall interface with Raspberry Pi 3 for implementation of this concept. Sunrom Intelligent automatic compression and decompression .Easy to operate, switching button to start measuring. Capable for 60 store groups memory measurements Power by 2 x 1.5V AAA batteries. Analog output voltage for external circuit processing or display.

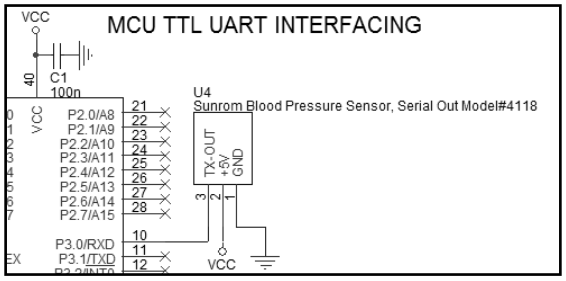

Fig. 10. Raspberry PI Interface with Sunrom blood pressure sensor circuit

Raspberry Pi 3 shall interface with Sunrom Blood Pressure /Heart Rate Sensor through serial interface. The blood pressure module with serial output reads blood pressure and heart rate and communicates at 9600 baud rate (8 bit data, No parity, and 1 stop bit).Blood Pressure & Pulse readings are shown on the local display with serial out for external processing and display. The local display shows Systolic, Diastolic and Pulse Readings. The BP module has been interfaced with the Raspberry Pi 3 through UART receiver pin. The Raspberry Pi 3 is configured to communicate serially at 9600 baud rate.

IV. Usb Gsm Modem

- HSUPA/HSDPA/UMTS/EDGE/ GPRS high-speed data
- 7.2Mbps Downlink, 5.76Mbps Uplink
- World-wide Roaming and Internet Connectivity
- Supports Data/ SMS functions
- Automatic installation driver, No CD required
- Support Micro SD memory, up to 16GB
- Supports Microsoft Windows 7 32/64 bytes, XP/2000/Vista /Mac OS, Linux

Fig. 11. Raspberry PI Interface with USB GSM module

3. On chip BLE and WI-FI

The biggest change that has been enacted with the Raspberry Pi 3 is an upgrade to a next generation main processor and improved connectivity with Bluetooth Low Energy (BLE) and BCM43143 Wi-Fi on board. Additionally, the Raspberry Pi 3 has improved power management, with an upgraded switched power source up to 2.5 Amps, to support more powerful external USB devices.

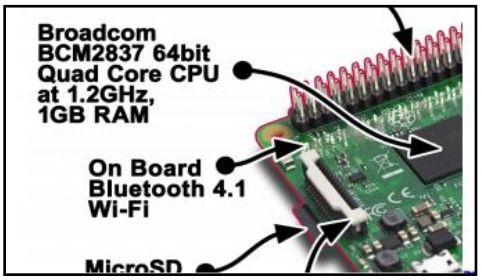

Fig. 12. Raspberry PI on chip BLE and Wi-Fi

V. SOFTWARE DESIGN

The software operation flow chart in indicated in figure 13, followed by initialization and configuration process the operation loop is initialized and performed in continuous mode.

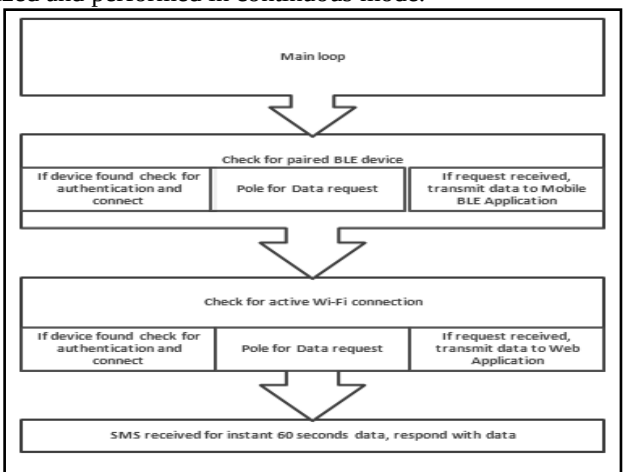

Fig. 13. Software Design flow

Data packet formation and transfer through BLE [8] and Wi-Fi [9] is indicated in figure 14 and 15. The data related to following fields are formed in packet and transmitted.

- Time stamp
- Doctor ID
- Patient ID
- BP 1
- BP 2
- Temperature
- XX
- BLE Data packet

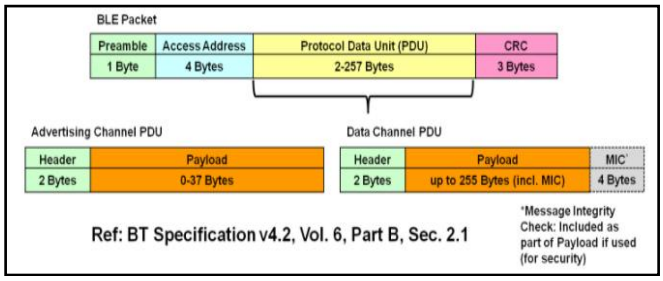

Fig. 14. BLE packet format

WI-FI Data packet

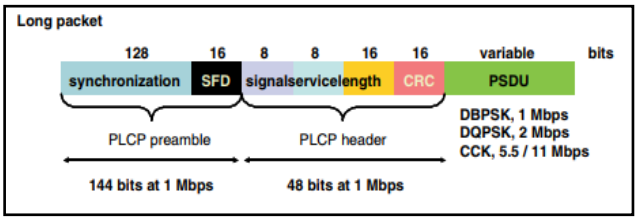

Fig. 15. WI-FI data packet format

VI. Conclusion

Design of Real time Alerts on multi mode communication system for critical health parameter from Intensive Care Unit is implemented and further this concept will be extended with application oriented where data to exchange in multi mode system without compromising on real time service is required.

VII. Result

The concept of achieving and establishing multiplexed wireless communication platform which enable data to exchange in multi mode system without compromising on real time service is implemented. Initially trial had issue with synchronization between BLE and Wi-Fi data reception later with introduction of minor delay in transmission the issue was resolved.

Fig. 16. Data transfer to Mobile Application

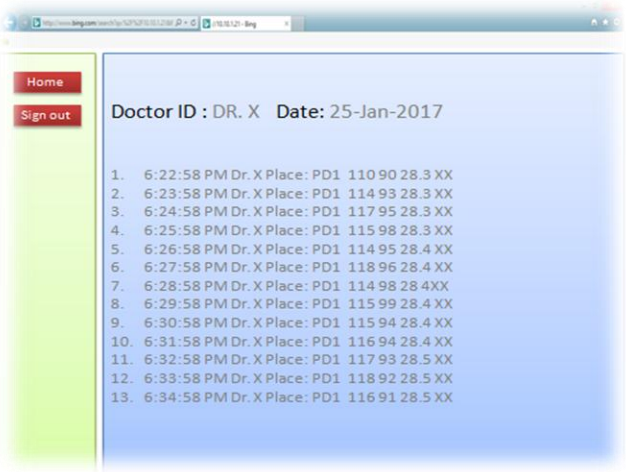

Fig. 17. Data transfer to Web Application

REFERENCES

[1]. Design of Multiplexed Multi-mode Communication System for Real-time Critical Alerts, Vol. 6, Issue 7, July 2017, DOI:10.15680/IJIRSET.2017.0607309

[2]. https://en.wikipedia.org/, reference for definition

[3]. J. Höller, V. Tsiatsis, C. Mulligan, S. Karnouskos, S. Avesand, D. Boyle: From Machine-to-Machine.

[4]. Margaret Rouse, (June 2014), Internet of Things (IOT), [ONLINE] Available:http://whatis.techtarget.com/definition/Internet-of-Things

[5]. Lu, J., Sookoor, T., Srinivasan, V., Gao, G., Holben, B., Stankovic, J. & Whitehouse, K. (2010, November). The smart thermostat: using occupancy sensors to save energy in homes. In Proceedings of the 8th ACM Conference on Embedded Networked Sensor Systems (pp. 211224). ACM.

[6]. Manyika J. et. al. (2013), disruptive technologies: Advance that will transform life, business and the global economy retrieved from McKinsey & Company [ONLINE] Available: http://www.mckinsey.com/insights/business_technology/disruptive_technologies

[7]. A. K. Shrivastava, A. Verma, and S. P. Singh," Distance Measurement of an Object or Obstacle by Ultrasound Sensors using P89C51RD2", International Journal of Computer Theory and Engineering, Vol. 2, No. 1 February, 2010 1793-8201.

[8]. http://microchipdeveloper.com/wireless:ble-link-layer-packet-types

[9]. https://link.springer.com/content/pdf/bbm%3A978-1-4020-5397-9%2F1.pdf

International Journal of Engineering Science Invention (IJESI) is UGC approved Journal with Sl. No. 3822, Journal no. 43302.

Narendra Swaroop K “Design of Real Time Alerts on Multi Mode Communication System for Critical Health Parameter from Intensive Care Unit” International Journal of Engineering Science Invention (IJESI), vol. 07, no. 02, 2018, pp. 83–89.