

# ARM11 based Network Gateway for Critical Patient Monitoring System using LAB View Simulation



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## ABSTRACT

In the present scenario, hospital management is one of the very important and critical systems to deal with. In most of the cases, it is very difficult to monitor patient in hospital, as there are lot of patients in different section of hospital. In this type of scenario it is difficult to monitor the condition of each patient and this may lead to casualty.

This problem is important to focus as after solving it, hospital management can monitor each patient's condition continuously. This will also store the history of patient's condition and can show it in pictorial format. This will reduce the mortality rate and will help hospital to take preventive action quickly. Also management will get the alarm indication of critical patient if some parameter of the patient goes wrong. In the current scenario, due to single and direct network point, there is more amount of traffic going on single server and is usually overloaded.

Till now, the problem is being solved by following ways:

- 1) Simple network communication between the patient and the doctor over the network.
- 2) RFID transmission is used as the communication medium in some of the cases, where the distance is very small.
- 3) Email is sent to the doctor, who is monitoring the specific patient. An observer is required all the time to monitor the patient, this observer further inform the condition of patient to doctor by different medium

**Keywords:-**a. TCP, Wi-Fi, energy meter, ARM 11

## ARTICLE INFO

### Article History

Received:28<sup>th</sup> September 2015

Received in revised form :

1<sup>st</sup> October 2015

Accepted:5<sup>th</sup> October, 2015

Published online :

7<sup>th</sup> October 2015

## I. INTRODUCTION

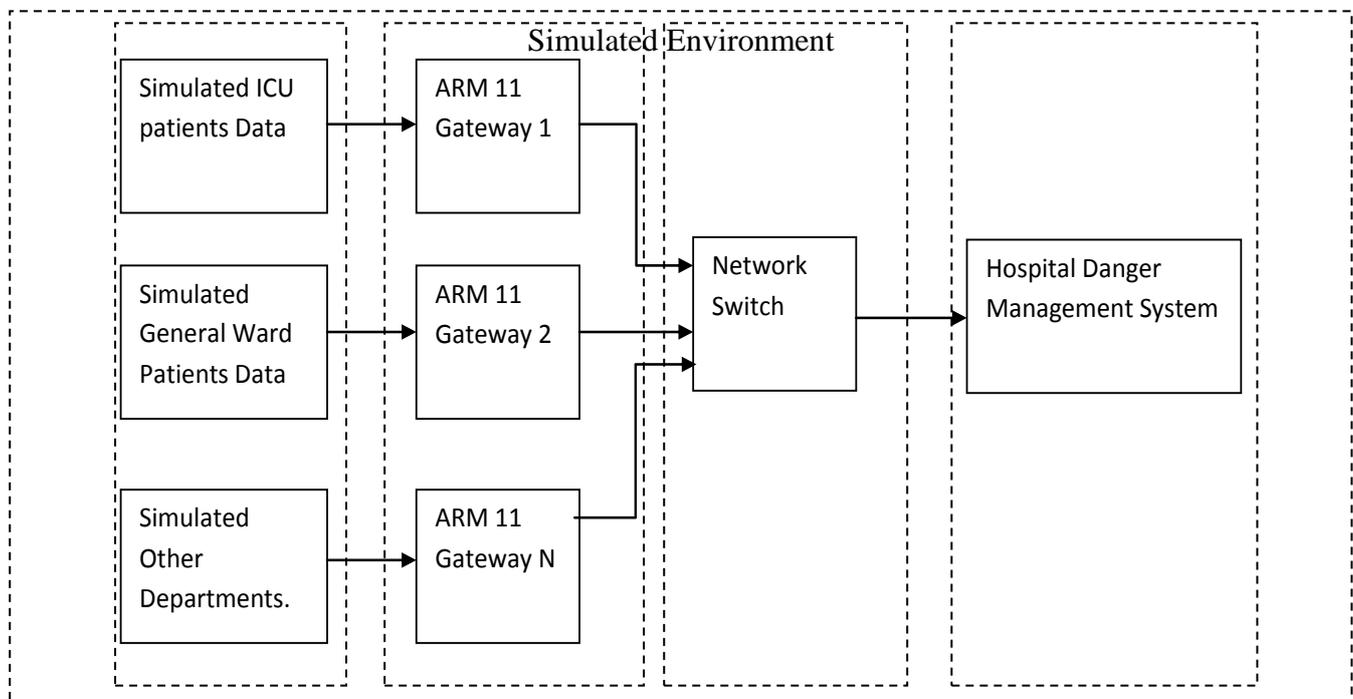
E-Health is a recent term came for health care practice supported by electronic processes and communication. The terminology for E-health is interchangeable with health informatics and distributed health care system, in a broad definition covering electronic/digital processes in health while others use it in the narrower sense of healthcare

practice using the network. There are many forms of E-health which include: electronic health records, telemedicine, consumer healthcare informatics and various other services. A distributed health care system is very helpful in managing the data of data of patients very easily by easy transmission. It is stored in digital form and can be accessed by medical personnel across different healthcare systems by connecting to the network. These data may include medical history, results of lab tests, personal

information, billing information, records of prescribed medicines prescribed etc. Telemedicine is the use of modern electronic communication technologies in order to provide medical care at a distance. It can improve the quality of healthcare that is available at places that are located far from the urban centers. It can also be helpful in emergencies and can save patients far away from medical centers and in need of immediate medical assistance. Distributed health care systems are mainly aimed at patients to provide easy access to health care information to the hospital, doctors and other analyst. Such network provides services such as Information Resources, Communications, Remote Monitoring, Videoconferencing, and Tele presence among others. This distributed network can be further connected to M-Health that is the use of mobile communication devices such as mobile phones, PDAs etc., to facilitate the delivery of healthcare and information. Hospitals and other institutions that provide healthcare are gradually adopting E-Health services. E-Health services are especially useful in India where around 60% of the population lives in rural areas whereas most of the practicing physicians are in urban center.

**II. SYETEM OVERALL SCHEME DESIGN**

Our main aim is to develop remote patient monitoring system gateway, which will have wifi connectivity on one side with Patients and Ethernet connectivity with Hospital Management system on another side. The main focus here is to develop the network gateway, which will be responsible for the communication between the two systems This block diagram consists of 4 stages, these are explaining below:



**1) Stage 1:**

This stage consists of simulated environment for different sections of Hospital. It will be developed in the LABView software. This stage will be responsible to generate the required data of the hospital.

**2) Stage 2:**

In this stage, data received from simulator (Stage 1) will be collected by ARM Gateway over the network using TCP/IP protocol. This gate way will be responsible to encode the data in specific format. The formatted data will be further connected to network switch. Data will be sent over the network using TCP/IP protocol.

**3) Stage 3:**

Data sent from all ARM 11 gateways will be received by network switch. This switch will be responsible to provide communication between Hospital Management Station and different ARM 11 Gateways.

**4) Stage 4:**

Last stage is the simulated Hospital Danger Management System which is developed in LABView. This stage will show the data of each patient in detail, also it will give special indication, whenever the patient will be in critical condition. It will also show the parameter which is not in good state.

**III. ESTABLISHMENT OF SOFTWARE MODEL**

This block diagram consists of 4 stages, these are explaining below:

**Individual Patient System:** This contains the single patient’s controls for Blood Pressure, Heart beats and

Temperature as shown in figure 4.3. This will be input to main screen of Simulator.

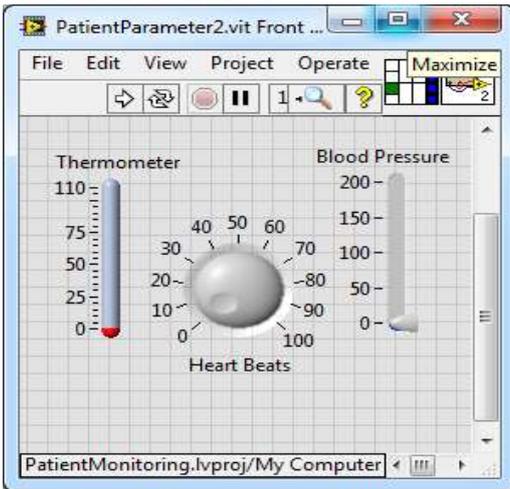


Figure 1: Single Patient Data

**5) Simulated Patient Data:**

We are going to simulate different patients in Hospital by making use of LABVIEW. By using LabVIEW graphical programming blood pressure, Temperature and Heart beats component are developed to simulate these readings which is shown in figure 4.2. Different values of these readings are passed to network gateway which will show the reading in management station according to it.



Figure 2: Multiple Patient Data

**6) ARM11 (BCM 2835):**

Microcontroller ARM stands for Advanced RISC Machines. It is a 32 bit processor core used for high end applications.

The Raspberry, which is shown in figure 4.11, is a credit card-sized computer with an ARM processor that can run Linux. This item is the **Raspberry Pi Model B+**, which has 512 MB of RAM, an Ethernet port, HDMI output, audio output, RCA composite video output (through the 3.5 mm jack), four USB ports, and 0.1"-spaced pins that provide access to general purpose inputs and outputs (GPIO). The Raspberry Pi requires a microSD card with an operating system on it.



Figure 3: ARM 11 Board

**Power supply:**

A 5 V power source with a micro USB connector. The 5 Volt DC 1 A wall power adapters is recommended for the power supply. While the Raspberry Pi is powered from a 5 V supply, it operates at a 3.3 V logic level and its pins are not 5V-tolerant. Connecting higher voltages, like 5 V, directly to an I/O pin could damage the board.

**7) Wi-Fi :**

We are going to use protocol IEEE802.11 which is a set of media access control (MAC) and physical layer (PHY) specifications for implementing wireless local area network (WLAN) computer communication in the 2.4, 3.6, 5 and 60 GHz frequency bands. They are created and maintained by the IEEE LAN/MAN Standards Committee (IEEE 802).

**8) Ethernet port:**

An Ethernet port is an opening on computer network equipment that Ethernet cables plug into. These ports are alternatively called jacks or sockets. Ethernet ports accept cables with RJ-45 connectors.

**9) Network Switch:**

A network switch is a computer networking device that connects devices together on a computer network, by using a form of packet switching to forward data to the destination device. The sample network switch is shown in figure 4.13.



Figure 4: Network Switch

## 10) Simulated Critical Patient Management Station:

The data of the patient which is received by multiple network gateways, need to be processed in a management station. By using LabVIEW graphical programming, the readings of blood pressure, Temperature and Heart beats are received and then shown in Graphs, text boxes and other medium, this is shown in figure 4.14. This helps the user to understand the data and easily read it.



Figure 5: Management Station

## V.RESULTS & DISCUSSION

The Software and Hardware Implementation was successfully done and its results are as given below.

The output of the various stages is obtained and explained in this chapter:

### Stage-I

Following things are done in stage-I of the present work.

1. At stage-I, Simulation of Patient Data which is shown in the figure 5.1. Every simulated patient's parameters are associated with Blood Pressure, Heart Beats and Temperature which is going to be transferred.
2. This simulated data is sent from the pc-side to microcontroller ARM-11 over the TCP/IP network. Further, this data is sent to Management Station via network gateway.
3. Multi threaded network client and server programming for Single Gateway is tested on ARM 11 gateway.
4. The wifi communication between Stage I Simulator and ARM11 gateway also the TCP communication between Stage 3 and ARM 11 gateway is obtained.
5. Labview simulator for Management station was developed and the results were achieved.

## V.CONCLUSION

The simulation and software development of for "ARM11 based Network Gateway for Critical Patient Monitoring System using LABView Simulation" is carried out successfully and following conclusions are made:

1. The readings of each patient are observed continuously on the management station.
2. Establishment of connection over wifi and Ethernet is achieved using Client Server application on ARM11 gateway. Data is successfully received on ARM 11 gateway and further sent to Management Station.
3. Patient's Data is successfully received on Management Station over Ethernet and is shown in terms of graph and numeric indication (refer figure 5.3).
4. Wifi connectivity improves the hospital management, as the patients data is available on real time bases.
5. Systems can be easily plug-in existing hospital infrastructure.
6. Graphical data in readable format improves the facility, where it is really needed for patients' analysis.

Moreover, this system has Multithreaded client server architecture helps to improve the real-time efficiency and performance of the network which further helps to improve hospital management.

## VI.FUTURE SCOPE

As future work can be done on following points mention below:

1. Communication of hospital management and other devices of hospital management can be put on cloud with secured access.
2. Notification of critical data directly to the assigned doctor or caretaker can be sent by any communication medium.
3. Voice communication from the patient and the hospital management can be established for better service.

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