Automatic Patient Care System using ARM Processor

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Abstract— In advanced world the innovative medical advancements plays vital role to provide the solution for many biological problems. In most of the hospitals the patient monitoring system is done in manual process. Generally, it required the time consuming process to maintain the database. In case of anesthesia, measurement of bio-medical parameters such as heart rate, glucose level, and body temperature is very important to monitor at normal and abnormal cases. Either doctor or nurse must always be there to monitor present condition of the patient. Conventional method patient care systems are not reliable. On the other hand most of the automated systems are only concentrating on monitoring systems. The proposed system provides a solution by developing a real time module to monitor and maintain the patient database effectively. This system provides the individual login for doctor and nurse. Bio sensors send patient status to UTLP kit through wireless network to monitor continuously. This is achieved by means of Unified Technology Learning Platform (UTLP) which is connected with Wide Area Network (WAN). Thus the patient care system can be made automatic and patient condition can be monitored from anywhere in the hospital. Buzzer indication will be given during abnormal condition. This will reduce time consumption, manual work, risk factor, and other inconveniences exist in the conventional systems.

Key words: UTLP, WAN, Application Peripheral Interface (API), ZIGBEE, Sensors, Buzzer

I. INTRODUCTION

Today many technologies are there to enhance the effectiveness of medical fields by providing accurate solutions for complex biological problems. The technologies and their applications improve the comfort level of human, it doesn't improve their health condition instead it gives solutions for their health problems. Number of patients also increases along with increasing population. It is very difficult to monitor all these databases. The conventional systems provide computer applications where one person has to enter those values which reduces paper work but not human's work. For instance, in case of anesthesia where the patient must be in unconscious state, more number of bio medical parameters must be monitored and report has to be generated for the reference of doctor and patient. Continuous monitoring of all parameters requires the presence of a person to identify abnormal conditions. However, conventional systems provide solution for these problems by patient monitoring systems which are less sensitive. Proposed system aims to improve the conventional systems sensitivity and reliability and provides remote monitoring using UTLP and WAN connection. The UTLP kit comprise of advanced ARM processor, which can sense the minute changes of patient status and intimate to doctor immediately. It provides all the functionality within and on top of the runtime system. The project is implemented under the star topologies.

II. LITERATURE SURVEY

Karthick *et al.* [1] paper focuses to implement a prototype model for the real time patient monitoring system. It measures the physical parameters like body temperature, heartbeat, ECG, blood sugar, and oxygen level for monitoring purpose with the help of biosensors. Embedded processor plays vital role in analyzing the input from the patient. If any abnormality felt, automatic alarm sound will arrive and the message will be sent to the doctor's mobile automatically by using GSM module.

Sivaranjani's *et al.* [2] Wireless sensor network provides a useful method to acquire and monitor the physiological signals of a patient. Bluetooth has a wide variety of applications in the medical field. This system is using Bluetooth scatternet where 3 piconets are interconnected to form Scatternet Sensor Network. The first and second piconet consists of one master node (local nurse) and five slaves nodes (patients). The third piconet consists of one master node (Chief nurse) and three slave nodes (Chief Doctors). Chief nurse act as a bridge node, which interconnect three piconets. The patients are at 24×7 critical care. If anything critical occurs, the Chief Doctor receives the data and sends acknowledge to the concerned patient.

Purunima's *et al.* [3] paper demonstrates monitoring of patients in real time module. It is able to send parameters of patient in real time. It enables the doctors to monitor patient's health parameters (temp, heartbeat, ECG, position) in real time. Here the parameters of patient are measured continuously (temp, heartbeat, ECG) and wirelessly transmitted using Zigbee. If a particular patient's health parameter falls below the threshold value, an automated SMS is sent to the pre-configured Doctor's mobile number using a standard GSM module interfaced to the ARM microcontroller.

Jaiee sitaram adivarekar's *et al.* [4] paper presents the methodology for monitoring patients remotely using GSM network and very large scale integration (VLSI) technology. Patient monitoring systems measure physiological characteristics either continuously or at regular intervals of time.

Aart Van Halteren's *et al.* [5] discusses the forthcoming wide availability of high bandwidth public wireless networks will give rise to new mobile healthcare services. To this end, the mobihealth project has developed and trialed a highly customizable vital signs monitoring system based on a body area network (BAN) and a mobile-health (M-health) service platform utilizing next generation public wireless networks. The developed system allows the incorporation of diverse medical sensors via wireless connections, and the live transmission of the measured vital signs over public wireless networks to healthcare providers. Nine trials with different healthcare scenarios and patient

groups in four different European countries have been conducted. These have been performed to test the service and the network infrastructure including its suitability for mobile healthcare applications.

A.R.Al-Ali's *et al.* [6] paper describes the design of a mobile medical used device that can be used to monitor human temperature and blood pressure using a stand-alone single chip microcontroller. The device hardware architecture consists of the temperature and Pressure sensors, signal conditional circuits(SCC), single chip microcontroller, LCD display and GSM modem. An embedded software algorithm acquires temperature and pressure, processes, transmits, displays and stores it in the built-in EPROM of the microcontroller. A Preset trigger level for the temperature and/or the BP is stored in the EEPROM. Once the desired programmed trigger level of any of the signal is reached, the microcontroller downloads the current value of temperature and BP to the GSM modem. Then, GSM automatically dials presorted mobile numbers and transmits both parameters as a normal mobile message to a physician, nurse and/or emergency personal. A short database containing these parameters are collected and stored in a lookup table. This database can be used to track the patient the patient temperature and BP history if needed.

Nitin.p.Jain *et al.* [7] Wireless, remote patient monitoring system and control using feedback and GSM technology is used to monitor the different parameters of an ICU patient remotely and also control over medicine dosage is provided. Measurement of vital parameters can be done remotely and under risk developing situation can be conveyed to the physician with alarm triggering systems in order to initiate the proper control actions. In the implemented system a reliable and efficient real time remote patient monitoring system that can play a vital role in providing better patient care is developed. This system enables expert doctors to monitor vital parameters via body temperature, blood pressure and heart rate of patients in remote areas of hospital as well as he can monitor the patient when he is out of the premises. The system in addition also provides a feedback to control the dosage of medicine to the patient as guided by the doctor remotely, in response to the health condition message received by the doctor. Mobile phones transfer measured parameters via SMS to clinicians for further analysis or diagnosis. The timely manner of conveying the real time monitored parameter to the doctor and control action taken by him is given high priority which is very much needed and which is the uniqueness of the developed system. The system even facilitates the doctor to monitor the patient's previous history from the data in memory inbuilt in the monitoring device. Also data can be sent to several doctors in case a doctor fails to respond urgently.

Zhibin tan *et al.* [8] paper investigates impact of noise and signal averaging on patient control in anesthesia applications in wireless connected systems. Such systems involve communication channels which introduce noises due to quantization, channel noises, and have limited communication bandwidth resources. Usually signal averaging can be used effectively in reducing noise effects when remote monitoring and diagnosis are involved. However, when feedback is intended, we show that signal averaging will lose its utility substantially. To explain this phenomenon**,** we analyze stability margins under signal averaging and derive some optimal strategies for selecting windows size. A typical case of anesthesia depth control problems is used in this development.

III. EXISTING SYSTEM DESCRIPTION

Conventional system [1] uses wired communication for patient monitoring systems and patient status will be displayed and stored in the memory. These details have to be manually converted into report format. This consumes more time, needs manual effort and may lead to error. Besides it uses message indication method about abnormal conditions using GSM. If the doctor doesn't see the SMS indication, it may lead into trouble.

Interconnecting [2] more number of piconets we can form a large network called scatter net. Up to 273 nodes can be connected in a scattenet. By using that we can monitor more number of patients. Here each piconet will have local master nodes and the local master nodes will be interconnected via one global master node known as a bridge node. By adding number of nodes we can increase the range of communication in the network. On the other hand implementation of this system mainly depends on Bluetooth network which has following drawbacks.

1) Poor response time and problem in synchronization of data communication
2) Not suitable for long distance data transmission
3) Less coverage
4) Not suitable for multiple input multiple output system
5) If distance increases, bandwidth will decrease
6) Implementation of this system is shown in the following figure1.0.

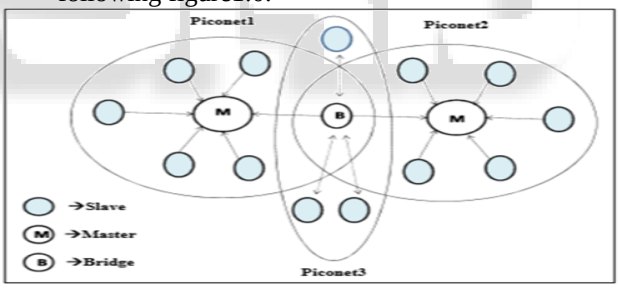

Fig. 1: Implementation of Bluetooth Scatternet

Similar to this most of the conventional systems have few drawbacks. Proposed system aims to eliminate the drawbacks of conventional system, and gives solution to avoid the presence of doctor.

IV. PROPOSED SYSTEM DESCRIPTION

Proposed system is designed to maintain data of the patient using Eclipse software to work with UTLP kit. The application provides different login for doctor and nurse. During registration user name and password will be given for doctor and nurse of a particular hospital to login into the application. After registration user can login and can view patient's current status, medication details, injection levels, all other bio-medical parameter's status, blood donars details and organ donars details. All bio medical parameters values will be sent to the UTLP available in the patient's location using wireless network. These values will be transmitted to all UTLPs present in the hospital through WAN. These values will be stored and displayed in all

locations wherever the login is used. UTLP continuously compares all bio sensor values with the threshold value set by the user. If any value crosses the threshold value buzzer indication will be given and problem statement will be displayed. Using these values report will be generated as programmed for the required format specified by the user. WAN connection provides the facility to view patient details at any place in the hospital. Hence there is no need of doctor's presence near to the patient. Doctor can monitor more than a patient.

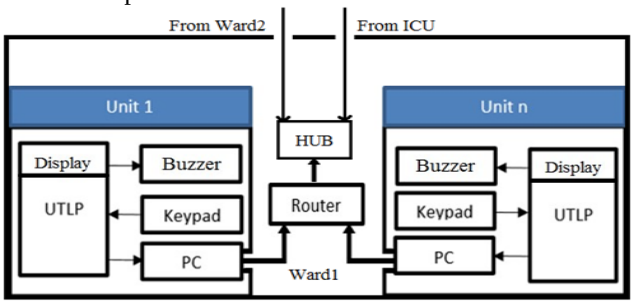

Fig. 2: Implementation of the Proposed System

In figure1.2 the router establishes LAN connection after connecting with HUB switch. More than 50 systems can be connected with router and more number of routers can be connected to the Hub switch. Hence it is possible to cover entire hospital and monitoring the patient from anywhere in the hospital. Flowchart of the proposed system is shown in figure1.3.

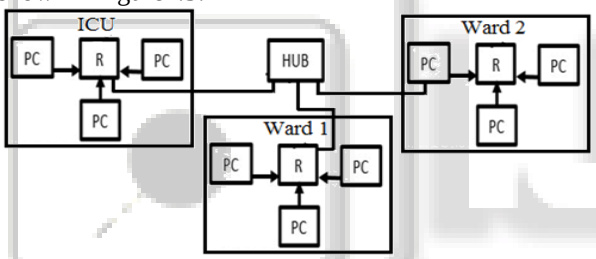

Fig. 3: WAN Connection using Star Topology

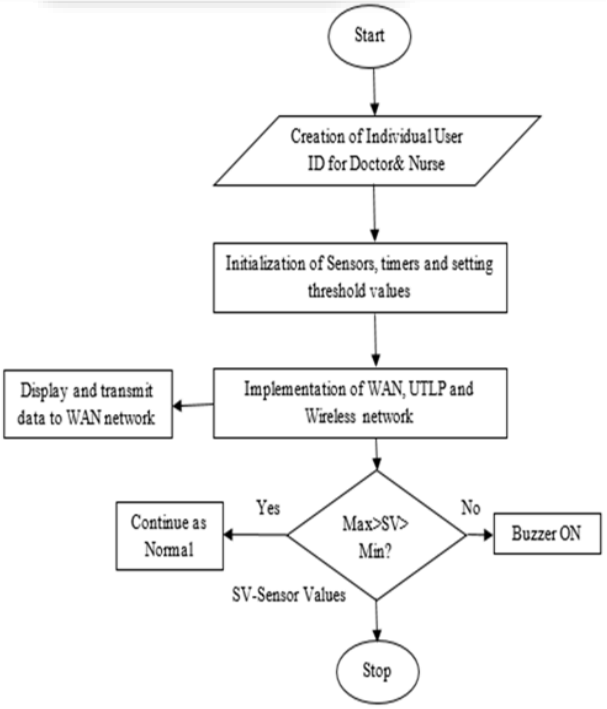

Fig. 4: Flowchart

V. Simulation Results

The tasks involving implementation of wireless network, WAN connection, bio-sensor connections and working has been evaluated by means of using eclipse software and UTLP. Instead of connecting real sensors sample values were given and output results were tested. Thershold values have been set and test values have been given to UTLP using ECLIPSE software. UTLP compares both values and gives output as programed. Few of the simulation results were added below.

A. Program Coding:

```
#include "macros.h"
#include <stdio.h>
#include <ulk.h>
int main(void) PROGRAM_ENTRY;
  ulk_fpga_clcd_init();
ulk_proc_keypad_init();    ulk_fpga_clcd_diplay_on();
 void login();  // to login into their account
void registration();//to create individual login for doctor and
nurse
void nurse();//login into nurse account
void create();  //create new patient account
void display(); // display recorded values
void add();  //enable addition of new biosensor
void patient(); //stores patient details like name, age etc.
void blood();  //blood donars details will be displayed
void organ(); //organ donars
data will be displayed
static int i,j,k,ch1,ch2,pwd,und[5], unn[5],bp,pr,sugar;
static char name[20], problem[20], data[10][20];
int main()
  {      ulk_cpanel_printf("\twelcome\n");
registration();
  return 0;  }
 void registration()
 {
  xxxxxxxxx
  xxxxxxxxx
  xxxxxxxxx
  xxxxxxxxx
  xxxxxxxxx
 }
 void login()
{
  xxxxxxxxx
  xxxxxxxxx
  xxxxxxxxx
  xxxxxxxxx
  xxxxxxxxx
}
void nurse()
{
  xxxxxxxxx
  xxxxxxxxx
  xxxxxxxxx
  xxxxxxxxx
  xxxxxxxxx
}
void patient()
{
  xxxxxxxxx
```



```
 xxxxxxxxx
 xxxxxxxxx
 xxxxxxxxx
 xxxxxxxxx
}
void display()
{
 xxxxxxxxx
 xxxxxxxxx
 xxxxxxxxx
 xxxxxxxxx
 xxxxxxxxx
}
```

B. Simulation Output:

Few of the simulation results are shown below.

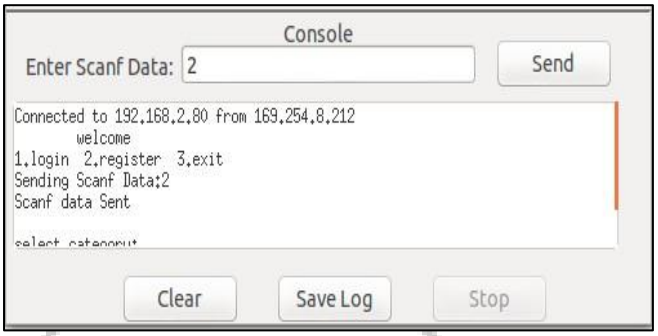

Fig. 5: shows home page of the application as in simulation

Fig. 6: shows welcome page inside the user account

Fig. 7: shows options available inside patient details

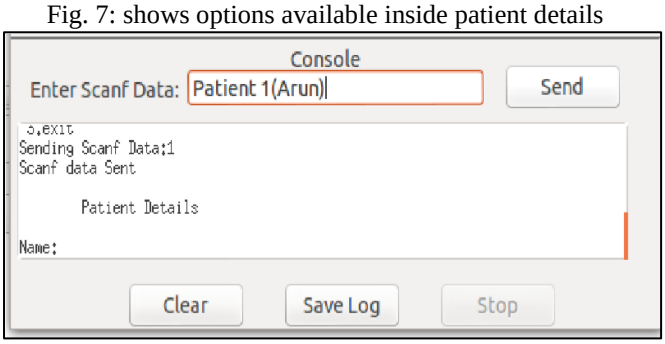

Fig. 8: shows creation of new patient record

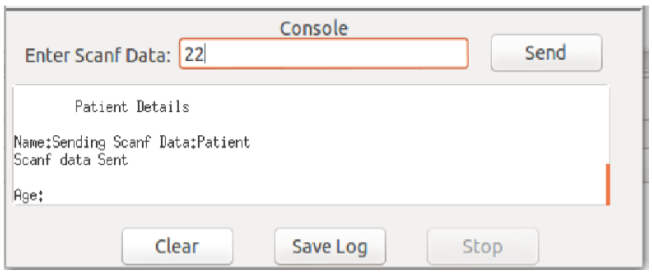

Fig. 9: shows creation of new patient record

VI. CONCLUSION

Patient care system and report maintenance are the major complex and time consuming process where more details are to be reviewed and more attention has to be given to create report. The implementation of the proposed system will provide enhanced monitoring and database maintenance system. Patient status can be monitored from anywhere in the hospital which avoids the requirement of doctor's presence near to the patient. This helps to monitor more than a patient at a time. Other than patient details, blood donar's details and organ donar's details can also be viewed by using individual login given for doctor and nurse. It will reduce human errors, time consumption and manual work and avoid presence of doctor. Further development of this system using Tele-presence concept will provide the possibility of monitoring and controlling parameters of patient from anywhere in the world and all hospital's details like blood donars, organ donars can be interlinked. This will be very helpful and reduce search times during emergency situations.

VII. ACKNOWLEDGEMENT

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