Patient Monitoring System

PROF. MEGHA
Assistant Professor, IEEE, Guru Nanak Dev Engineering College, Bidar/VTU, Belgaum

Abstract— The increased use of mobile technologies and smart devices in the health zone has brought on extraordinary effect on the world's critical care. Health specialists and doctors are using these technologies to create critical change in medicinal services during clinical settings. Likewise, many users are being served from the upsides of the M-Health (Mobile Health) applications and E-Health (social insurance upheld by ICT) to enhance, help and assist their well-being. The Internet of things is progressively permitting to coordinate gadgets fit for associating with the Internet and gives data on the condition of health of patients and give data continuously to specialists who help. The main aim of this 'Patient Monitoring System' is to build up a system fit for observing vital body signs, for example, body temperature, heart rate, pulse oximetry. The System is additionally equipped for fall detection and sleep pattern analysis. To accomplish this, the system involves many sensors to screen fundamental signs that can be interfaced to the doctor's mobile or the web. The gadget will exchange the readings from the sensor to cloud remotely and the information gathered will be accessible for analysis progressively. It has the capacity of reading and transmitting emergency signs to the cloud and then to doctor's web portal or to Doctor's Smartphone. These readings can be utilized to recognize the health state of the patient and as an alert system against the emergency health condition.

Indexed Terms— IOT, Raspberry pi, AWT cloud, Patient Monitoring.

I. INTRODUCTION

The main objective is to design a Patient Monitoring System to diagnose the health condition of the patients. Giving care and health assistance to the bed ridden patients at critical stages with advanced medical facilities have become one of the major problems in the modern hectic world. In hospitals where a large number of patients whose physical conditions have to be monitored frequently as a part of diagnostic procedure, the need for a cost effective and fast responding alert mechanism is inevitable. Proper implementation of such systems can provide timely warnings to the medical staffs and doctors and their service can be activated in case of medical emergencies. Present-day systems use sensors that are hardwired to a PC next to the bed. The use of sensors detects the conditions of the patient and the data is collected and transferred using a microcontroller. Doctors and nurses need to visit the patient frequently to examine his/her current condition. In addition to this, use of multiple microcontrollers based intelligent system provide high level applicability in hospitals where a large number of patients have to be frequently monitored. For this, here we use the idea of network technology with wireless applicability, providing each patient a unique ID by which the doctor can easily identify the patient and his/her current status of health parameters. Using the proposed system, data can be sent wirelessly to the

Central Patient Monitoring System (CPMS), allowing continuous monitoring of the patient. Contributing accuracy in measurements and providing security in proper alert mechanism give this system a higher level of customer satisfaction and low-cost implementation in hospitals. Thus, the patient can engage in his daily activities in a comfortable atmosphere where distractions of hardwired sensors are not present. Physiological monitoring hardware can be easily implemented using simple interfaces of the sensors with a Microcontroller and can effectively be used for healthcare monitoring. This will allow development of such low-cost devices based on natural human-computer interfaces. The system we proposed here is efficient in monitoring the different physical parameters of many numbers bedridden patients and then in alerting the concerned medical authorities if these parameters bounce above its predefined critical values. Thus, remote monitoring and control refers to a field of industrial automation that is entering a new era with the development of wireless sensing device.

II. IMPLEMENTATION METHODOLOGY

In one embodiment the system has a first patient monitoring subsystem including a plurality of sensors and sensor modules; and a processor-transceiver in communication with the plurality of sensors and sensor modules; and a first clinician display subsystem including a microcontroller and GSM modem. The microcontroller and GSM modem of the first clinician display subsystem broadcasts.
Here we are tacking the input parameters as heart beat this is sensed by frontend electronics circuit and then the heart beat is calculated with real-time clock, if the heart beat is greater than the predefined level the information is send to the concerned person with required details.

III. CLASSES OF PATIENT MONITORING SYSTEM

In the past, the dominant products manufactured by medical device manufacturers are mainly those for single parameter measurement. Nowadays however, a multi-parameter patient monitor is commonly used. Now in current industry the patient monitoring systems is available in two classes.

i. Single-Parameters Monitoring Systems
ii. Multi-Parameter Patient Monitoring Systems

- Single-Parameters Monitoring Systems:

The single parameter monitoring system is available for measuring blood pressure of a human body, ECG (Electrocardiograph) monitor, SpO2 (Oxygen Saturation in Blood) monitor etc.,

- Multi-Parameter Patient Monitoring System:

A multi-parameter Patient Monitoring System (PMS) is used for multiple critical physiological signs of the patient to transmit the vital information like Electrocardiograph, Respiration Rate and Blood Pressure etc. Therefore, multi parameter PMS has always been occupying a very significant position in the field of medical devices.

Most diseases of the heart and of the circulatory system, referred to as cardiovascular diseases, strike without warning and prompt treatment is required if death is to be averted. Such treatment is best provided in a specialized area of hospital referred to as "Intensive Care Unit" (ICU). These specialized hospital units provide constant observation of the subject, constant monitoring of the subject's physiological condition and provide immediate emergency treatment whenever it is required.

IV. INTENSIVE CARE UNITS (ICU)

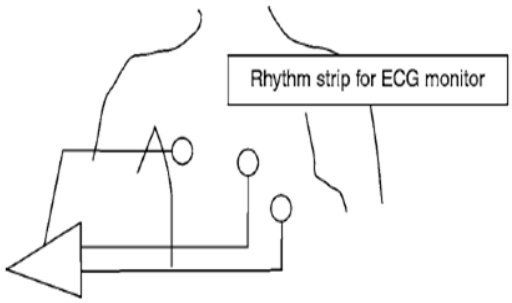
There are three important Intensive Care Units.

i. Coronary Intensive Care Units: Coronary Intensive Care Units are used for treatment of diseases of the heart such as the heart attacks
ii. Stroke Intensive Care Units: Stroke Intensive Care Units are used for treatment of diseases of the circulatory system such as stroke.
iii. Pulmonary Intensive Care Units: Pulmonary Intensive Care Units are used for treatment of respiratory diseases.

PHYSIOLOGICAL FUNCTIONS TO BE MONITORED DURING INTENSIVE CARE UNIT:

i. ECG Monitoring
ii. Blood pressure Monitoring
iii. Respiration
iv. Body temperature

i. ECG MONITORING:



- The principal physiological signal monitored in an intensive care unit is often the electrocardiogram. The electrocardiogram is usually monitored in the lead-II configuration with two active electrodes. These two electrodes are placed approximately 12 inches apart along the maximum potential axis of the subject's heart. A third electrode (ground) should be located elsewhere on the chest. This electrocardiogram monitoring configuration is referred to as three-lead chest cluster.

- The electrodes used for ECG monitoring during intensive care must be suited for long term monitoring applications.
- The set of leads used for monitoring purpose is called 'rhythm' strip and its purpose is just to note the heart beat and not for analysing it.

- A non-fading LCD display monitor for ICU use:

The bedside non fading display type ECG monitor for use in such ICUs can use either the TV type raster scan display with microprocessor board and memory or else use a graphics LCD display.

Fig. 1 A non-fading LCD display monitor for ICU use

ii. BLOOD PRESSURE MONITORING:

The second physiological parameter often of prime importance in intensive care monitoring is blood pressure.

KOROTKOFF system-RIVA-ROCCI Method:

Blood pressure can be monitored using the automatic cuff pump and Korotkoff microphone blood- pressure measurement system this system is occasionally used in intensive care units. , it also possesses the disadvantage of it does not provide a continuous record of the subject's blood pressure. Thus, if for some reason the subject's blood pressure were to suddenly drop, this system may take some minutes or so to detect this pressure, drop.

PLETHYSMOGRAPH:

Blood pressure monitoring with plethysmograph offers the least discomfort to the subject; however, it provides only a relative indication of the well-being of the circulatory system rather than providing absolute values for diastolic and systolic pressure. Digital blood pressure monitors are now-a-days often used in many intensive care units. Any intensive care unit may employ one or more of these techniques and indeed all three may be available if required.

iii. RESPIRATION MONITORING:

It is often desirable to monitor the subject's respiratory activity during intensive care; this may be accomplished with a thermistor pneumography placed in the subject's nostril.

iv. BODY TEMPERATURE:

It is often also desirable to monitor body temperature in intensive care subjects via a rectal or armpit thermistor probe.

V. CENTRAL NURSE'S STATION

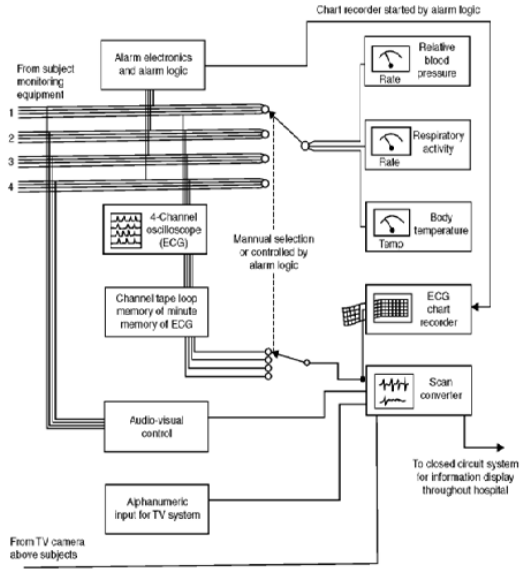


Fig. 2: Central Nurse's Station

- Multi connector cable connects the output from the four subject- monitoring sites located beside each intensive care bed to the central nurse's station.
- Each subject's ECG is continuously displayed via a four channel CRT display. And also these signals are being recorded continuously on a memory loop tape recorder.
- This tape recorder contains the previous one-minute ECG history for each subject by recording the ECG on a tape loop "one minute" in length
- Some central stations duplicate physiological indicators for relative blood pressure, respiratory activity and body temperature.

- These indicators can be manually switched between the four beds or the switching may be activated by the alarm system with the monitors being automatically switched to the bed providing the alarm signal.
- When an alarm is received at the central nurse's station, it may also be used to connect the appropriate ECG signal to a scan converter and ECG chart recorder and to start the chart recorder.

VI. FUTURE TRENDS IN PATIENT MONITORING SYSTEM

- Blood Gas Analyzer
- Drug Dosage calculator
- Drug Management System
- RFID in PMS
- Real Time Patient Location System
- Wearable PMS
- Telemetry / Telemedicine

WEARABLE PMS

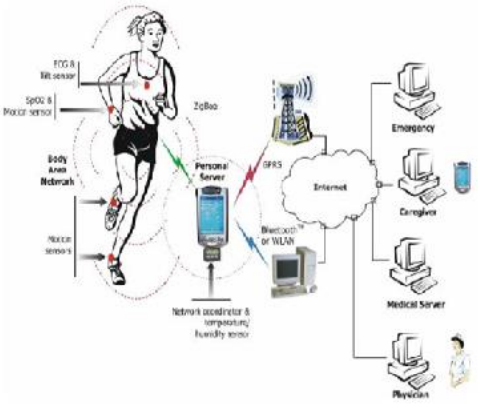


Fig. 4: Wearable PMS

VII. ADVANTAGES AND LIMITATIONS

- ADVANTAGES:

i. Zigbee technology enables doctor to monitor the patients' conditions even sitting in his room.
ii. Doctor will get call when patients body temperature and heart beat rises so that he can take precautionary measures even though he will be in remote place.
iii. Patient care takers can monitor the equipment easily.

- LIMITATIONS:

i. Bitter Expensive.
ii. Accumulation of noise with ECG signal.
iii. Communication for longer distance is quite difficult through Zigbee technology
iv. Interference of noise in GSM modem due to high Radio frequency signals.
v. Accuracy will be less.

VIII. FUTURE SCOPE

Monitoring the patient's condition can be done by using biomedical telemetry method where there is a mobile communication between microcontrollers. The temperature, heart beat and blood pressure are all sensed by using the appropriate sensors which are placed near the patient's body that is under investigation. The biomedical telemetry system consists of temperature sensor, heart beat sensor, pressure sensor, A/D converter, signal conditioning circuit, microcontroller, data cable, mobile phone, LCD display. The temperature sensor is used to sense the temperature value of the patient's body. The sensed output is given to A/D converter where the analog signal is converted to digital signal. The digital output is given to microcontroller. The microcontroller delivers the signal for mobile phone through data cable. Then the signal is transmitted to other mobile through GSM network. The receiver mobile receives the signal and it is given for a PC. The signal from data cable is given to PC and the value gets displayed using monitor. The pressure sensor is used to sense the pressure value of the patient's body. The sensed output is given to A/D converter where the analog signal is converted to digital signal. The digital output is given to microcontroller.

CONCLUSION

We presented the design and implementation of a Remote Patient Monitoring system based on wireless technology using a cellular phone, to send an SMS (Short Message Service) to the medical staff. The proposed system combines two commonly used technologies namely, Global System for Mobile (GSM) and Zigbee technology. This indeed is an easy, practical, inexpensive and yet very effective way for transmitting vital information to the healthcare staff and healthcare providers. The system monitors

patient's health status, such as ECG, heart rate, and temperature. In case, the value for any of these parameters exceeds preset critical values, the position parameters, from the attached GPS module, are transmitted to pre-defined phone number in form of SMS using a GSM module.

ACKNOWLEDGEMENT

I would like to express my sincere gratitude to Dr Neelshetty K, Head of the Department Electrical and Electronics Engineering, Guru Nanak Dev Engineering College Bidar, for his valuable guidance and whole hearted cooperation and continuous encouragement throughout the work.

REFERENCES

[1] S. M. Riazul Islam, Daehan Kwak, MD. Humaun Kabir , “The Internet of Things for Health Care: A Comprehensive Survey”, Date of publication June 1, 2015, DOI 10.1109/ACCESS.2015.2437951.

[2] Vandana Milind Rohokale, Neeli Rashmi Prasad, Ramjee Prasad, “A Cooperative Internet of Things (IoT) for Rural Healthcare Monitoring and Control”, 978-1-4577-0787-2/11/ ©2011 IEEE.

[3] Alexandros Pantelopoulos, Nikolaos G. Bourbakis,” A Survey on Wearable Sensor-Based Systems for Health Monitoring and Prognosis”, Publisher: IEEE DOI: 10.1109/TSMCC.2009.2032660

[4] A.K. Bourke, J.V. O’Brien, G.M. Lyons A.K. Bourke et al. Gait & Posture,” Evaluation of a threshold-based tri-axial accelerometer fall detection algorithm”, 26 (2007) 194–199.

[5] Qiang Li, John A. Stankovic, Mark Hanson, Adam Barth, John Lach,” Accurate, Fast Fall Detection Using Gyroscopes and Accelerometer-Derived Posture Information”, DOI: 10.1109/BSN.2009.46, Sixth International Workshop on Wearable and Implantable Body Sensor networks, BSN 2009, Berkeley, CA, USA, 3-5 June 2009.

[6] J. Chen, K. Kwong, D. Chang,” Wearable Sensors for Reliable Fall Detection”, Publisher: IEEE, DOI: 10.1109/IEMBS.2005.1617246.