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Multi-Parameter Measurement of ICU Patient Using GSM and Embedded Technology

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Abstract: *GSM technology is used to monitor the different parameters of an ICU patient remotely and also control over medicine dosage is provided. Measurements of vital signs and behavioral patterns can be translated into accurate predictors of health risk ,even at an early stage and can be combined with alarm triggering systems in order to initiate the appropriate actions. The conventional methods including wet adhesive Ag/AgCl electrodes for HR and HRV, the capnograph device for respiratory status and pulse oximetry for oxyhemoglobin saturation provide excellent signals but are expensive, troublesome and inconvenient. A method to monitor physiological information based on GSM offers a new means for health monitoring. In this paper, we review the latest developments in monitoring and discuss the challenges and future directions for this field.*

Index terms: *saturated percentage of Oxygen (SPO2), electro-Cardiograph(ECG), GSM (Global System for Mobile Communications), Hart Rate(HR), and Intensive care unit(ICU).*

I. INTRODUCTION

Patient Monitoring System is a process where a surgeon can continuously monitor more than one patient, for more than one parameter at a time in a remote place. The advances in information and communication technologies enable technically, the continuous monitoring of health related parameters with wireless sensors, wherever the user happens to be. They provide valuable real time information enabling the physicians to monitor and analyze a patient's current and previous state of health.

II. Litrature Survey

There are various technologies for patient monitoring; advancement can be done in pre-existing technology. As per the paper presented on "embedded mobile deductive system for low cost health monitoring system" 2011 by Natasha Cibera,a wireless system for remotely monitoring patient's oxygen saturation ,pulse is described. The data is continuously measured using a pulse oximeter and transfer to central monitoring station via IEEE 802.15.4 wireless sensor network for storage and display.

Further advancement is discussed in "real time monitoring system for In patient based on zigbee, 2008 by Ping Wang. In which the system is made up of two subsystem. The data from can be displayed as a graph then doctor can diagnosis the patient according to the data. In the reference paper a wireless physiological multiparameter monitoring system based on mobile communication network is proposed which are made up of front end mobile monitoring equipment, mobile monitoring center and hospital central management system. Accessing the information offered by mobile monitoring center or hospital central management system, the authorized medical staff can give diagnostic conclusion in time.

Another technology discussed in paper "telecare assessment by android OS smart phone" described that measurement of vital signs and behavioral patterns can be translated in to accurate predictors of health risk, even at early stage and can be combined with alarm triggering system in order to initiate an appropriate actions. Patient monitor or multiparameter monitor or also referred to as physiological monitor is a clinical use electronic machine designed to display and minimally interprets a person's vital signs. Some monitors can warn of pending fatal cardiac conditions before visible signs are noticeable to clinical staff. The parameters (or measurements) usually consist of Pulse Oximetry (measurement of the saturated percentage of Oxygen in the blood referred to as SPO2), ECG (electro-Cardiograph of the P-QRS-T wave of the heart, Blood pressure (either invasively through an inserted blood Pressure-to-transducer assembly or non-invasively with an Inflatable blood pressure cuff), and temperature (usually Skin temperature through an adhesive pad). There are more parameters such as cardiac output, CO2 measurement, respiration etc. 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 proposed system. The system even facilitates the doctor to monitor the patient's previous history from the memory inbuilt in the monitoring device. Also provision is made to send message to other physicians in case the first doctor does not respond in the stipulated time period.

III. GENERAL REPRESENTATION OF BEDSIDE MONITORING SYSTEM

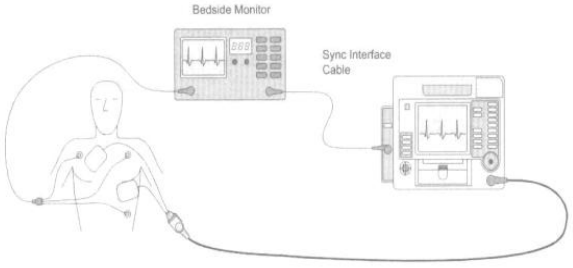

Fig. 1. General patient bedside monitoring.

IV. DRAWBACKS OF THE ABOVE SYSTEM

The above figure shows the current bedside monitors available in the hospitals. These bedside monitors are local to the room in which they are installed. Here the doctor or the central nurse who is in charge of the ward has to visit every patient to check his/her health status and verify the parameter values frequently.

A medical monitor or physiological monitor or display, is an electronic medical device used in medical monitoring that displays the monitored data, and may or may not have the ability to transmit the data on a monitoring network. Physiological data are displayed continuously on a CRT or LCD screen as data channels along the time axis, They may be accompanied by numerical readouts of computed parameters on the original data, such as maximum, minimum and average values, pulse and respiratory frequencies. These machines were widely used and saved many lives, but they had several restrictions, including sensitivity to electrical interference, base level fluctuations, and absence of numeric readouts and alarms.

Fig.2 Current Bed side Monitoring System.

V. Necessity Of Patient Monitoring

The need of patient monitoring is apparent in situation where the patient is unstable physiological regulatory system, for example regulation of drug overdose or anesthesia a life threatening condition, for example where there are indication of heart attack. In risk of developing a life threatening condition. In critical physiological state. The problem found in most hospital is that the physician has to frequently visit ICU(intensive care unit) patient and access condition by measuring parameters such as temperature, blood pressure etc.in case of emergencies the nurse intimates the doctor through means of communication but meaningful communication and decision support also needed for both patients and clinicians. Many times needs arises, that doctor simply needs the last few status information of patient's reading and can remotely take action on it. Insted of personally visiting the patients and manually change the medicine dosage.

VI. PROPOSED SYSTEM

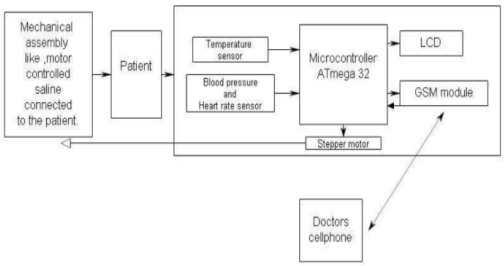

Fig. 3. Block Diagram Representation of the System

In the proposed system an idea is put forward to develop a reliable, efficient and easily deployable remote patient monitoring system that can play a vital role in providing basic health services to the patients.

This system enables expert doctors to monitor patients in remote areas of hospital as well as 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 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 proposed system. The system even facilitates the doctor to monitor the patient's previous history from the memory inbuilt in the monitoring device. Also provision is made to send message to other physicians in case the first doctor does not respond in the stipulated time period.

VII. Hardware and Physiological Parameter

The patient's all 3 biomedical parameter's viz blood pressure, heart rate and temperature are measured at a fixed time interval and stored in memory if they are within limits. Mean while the system will also continuously measure temperature using RTD and feed to ADC .It compares the measured temperature with the predefined value, and checks if the value is above a set range. Microcontrollers are small controller can be used in systems to function as processing and controlling unit. The GSM (Global System for Mobile Communications) module with SIM can be used to send alert to the doctor and also to revert message from the doctor.

The GSM module is incorporated and programmed in such way that it send SMS to and from the monitoring module to the doctor. The message will be send at the end of day as well as when parameter crosses threshold in between.

Further the stepper motor is to be interfaced to the microcontroller, which upon receiving signal from GSM module will move either in clockwise or anticlockwise direction to change the medicine dosage.

VIII. Results

The module designed till now was tested for several conditions. It was observed that the system was working as per the design. A few results have been captured during the testing and put down below.

Figure 3: Test Picture1

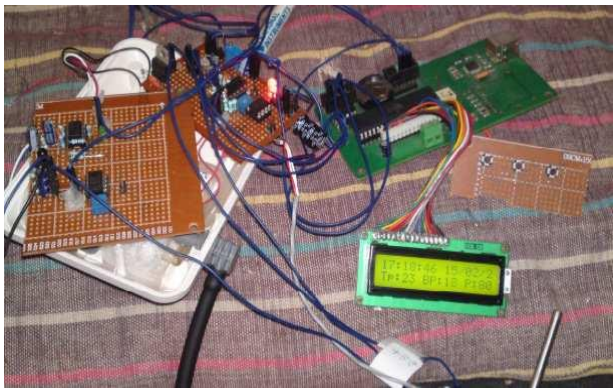

Figure 4: Test picture2.

Figure 5 : Test picture3

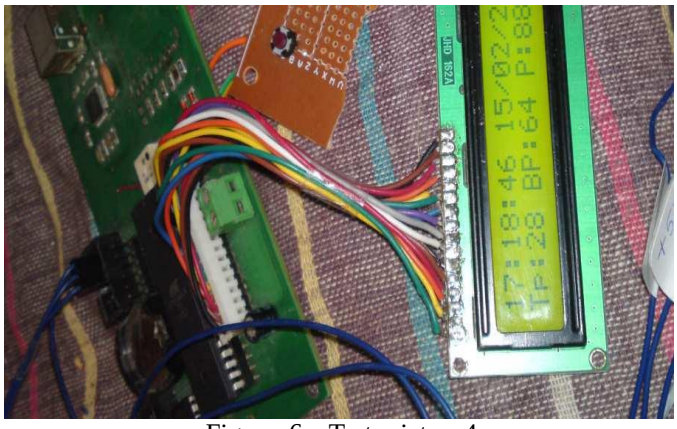

Figure 6 : Test picture4.

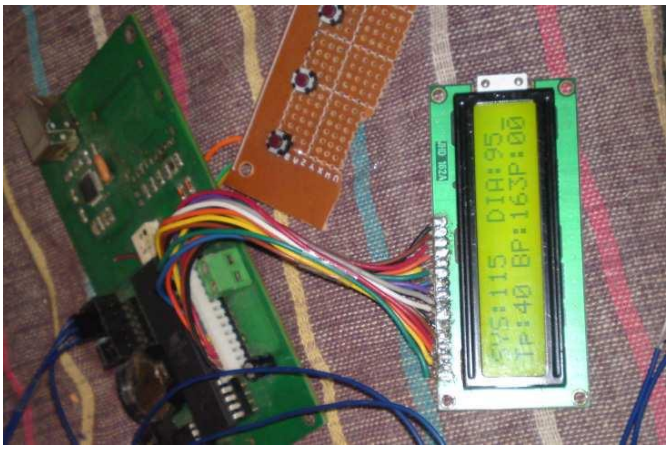

Figure 7 : Test picture5.

IX. Conclusion

In this paper, we review physiological information measurements based on embedded system using GSM module. The pulse oximeter has become one of the most common physiological monitors used in hospitals today, in addition to traditional vital sign measurements of HR, respiration rate, and oxygen saturation from the dynamics in a pulse oximeter signal.We have shown that current GSM technology extends beyond simply monitoring and measuring with ease for a patient; it could also be used to relay the information to medical professionals. This gives a doctor the ability to carry an accurate physiological monitor anywhere, and to initiate appropriate action. The technology has an advantage of being inexpensive, It is suited for Intensive care unit patients and particularly for telemedicine.

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