A Review Paper on Patient Monitoring System

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Abstract- **This paper presents the various development that has taken place in the field of patient monitoring system over the years . The paper describes the implementation of the system by using smart bio-sensors to detect and record the human physiological characteristics and interfacing these data to a computer with the system using wireless protocols to alarm the doctors about the health condition of the patient. The combination of these technologies will improve the quality of health care by making it more efficient and reducing costs and medical error.**

Index Terms- **smart bio-sensors; wireless protocol**

1. INTRODUCTION

Patient monitoring system (PMS) is primarily implemented to have a quantitative evaluation of the crucial physiological parameters of patients during critical periods of biological functions. This system is used for measuring continuously automatically the values of the patients' important physiological parameters such as blood pressure, body temperature, ECG, EMG, heart rate etc. This system detects the various parameters of the patient using the bio-sensors. A biosensor is a chemical sensing device in which a biologically derived recognition entity is coupled to a transducer, to allow the quantitative development of some complex biochemical parameter [1].The main objective of patient monitoring system is to standardize everything from medical terminology to networking protocols so that medical records can be stored electronically and be instantly sent to the doctor.

PMS monitors the physiological parameters and informs the surgeon about the present status of the patient's condition. With this system, the risk that surgery involves has been considerably reduced since it is possible to detect the complications before they prone dangerous as suitable measures can be taken in time [2]. Patient monitors are the most important diagnostic devices in the critical care units (CCUs) of hospitals, providing continuous display and interpretation of the patient's vital functions. The rapid evolution of electronics and information technology is resulting in more powerful bedside patient monitors capable of complex bio-signal processing and interpretation and usually equipped with some specialized communication interface [3].

2. THEORETICAL BACKGROUND

2.1. Patient Monitoring System (PMS):

Continuous or repetition of observations or measurements of the patients' physiological parameter and the function of life support equipment, for the purpose of guiding management decisions, including when to make therapeutic interventions, and evalution of those interventions.

2.2. Use of PMS:

A patient monitor not only alert doctors and medical staffs about potentially life-threatening events but also provide physiologic input data used to control directly connected life-support devices. PMS is used in--

- Patients with unstable physiologic regulatory systems. Example: a patient whose respiratory system is suppressed by a drug overdose or anesthesia.
- Patients with a suspected life-threatening condition. It may provide warnings when stress levels signs are rising before human can notice it and provide alerts and suggestions Example: a patient who has findings indicating an acute myocardial infarction (heart attack).
- Patients at high risk of developing a life-threatening condition. Example: patients immediately post open-heart surgery, or a premature infant whose heart and lungs are not fully developed.
- Patients in a critical physiological state. Example: patients with multiple trauma or septic shock.

- Smart biosensors may detect toxic materials such mercury and lead and provide alerts
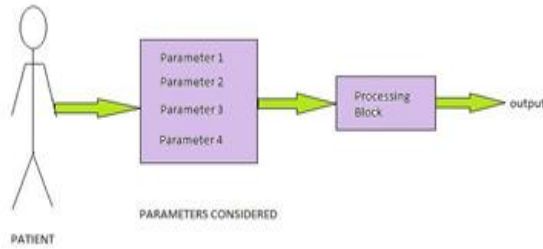
2.3. Block Diagram:

Figure 1: Block Diagram of PMS

3. GENERATION

The journals of 1980s discusses about critically ill patients recovering from serious illness which are often placed in special intensive-care units(ICUs) where their vital signs can be diagnosed constantly and life-protecting and lifesaving therapy can be appropriately applied.The patient information centre(PIC) helps the hospital authority in three ways. First, it generates audible alarms if limits are exceeded. The second function of the patient information centre is to display the data received from the PIC. By observing these data, the authority can detect abnormalities before they reach the critical stage. The central station's third function is to keep record of the physiological parameters. Patient monitoring systems usually consist of two types of monitors - bedside monitors and central station monitors. Bedside monitors are connected to various transducers that measure the physiological status of the patient. As the health of the patient progresses, the number of monitored variables is decreased for patient's comfort. In 1980s patient monitoring data is achieved by the design of two basic versions of the new HP 78500 Series PICs (HP 78501 and HP 78502 Series). Ambulatory systems used paper- based documentation that was later transferred to computer .Modern systems have direct input with little free text capacity [4].

1990s researchers gave more attention to the patient perception of the quality of health services provided by the health policy-makers and managers. In those years, the patient satisfaction studies have increased. Anna Maria Murante[5] focuses on the role of patient satisfaction in health services management as a strategic measure of health organizations' performance. This thesis mostly refers to the patient experience surveys conducted in Tuscany Region systematically. To meet the patients' needs and to achieve the main goals of a public health care system, the determinants of patient satisfaction and their changes across organizations have to be investigated. In the year 2000, Peter Varady, Zoltan Benyo, and Balazs Benyo [3] discusses a patient monitoring system that was developed and implemented based on an existing industry standard communication network by using standard hardware components and software technologies. The open architecture system design offers scalability, standard interfaces, and flexibility of the signal interpretation. The emergence of Internet technologies and telemedicine also opens new scales and makes new demands on patient monitoring system. Home-care monitoring offers faster, more effective and cost-saving rehabilitation and mobilization of patients.

In another paper [1] an Intelligent Mobile Health Monitoring System (IMHMS) is discussed where wearable body sensors network (WBSN) is used for collecting data, mining data, intelligently predicts patients' health status and provides feedback to patient through the personal computer or mobile devices.

The flow diagram of the implementation is shown in the Figure 2. WBSN collect patient data and send the data to the patient personal home server (PPHS). PPHS receives the data and processed the data to reduce the transmission of unnecessary data to the intelligent medical server (IMS).
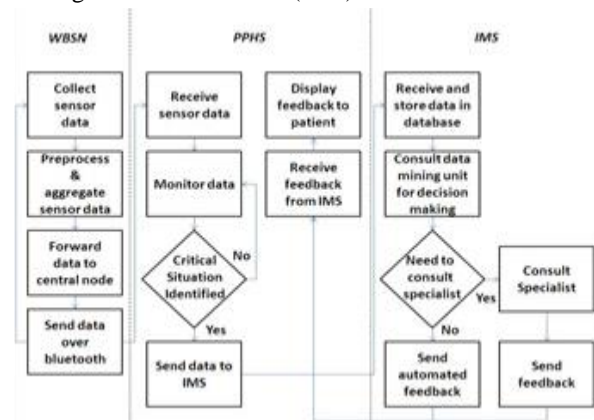

Figure 2: Flow Diagram of PMS.

In recent times, Patient monitoring systems is found to be more user-friendly, convenient and effective for

both patients and healthcare professionals. Approximately 2.8 million patients worldwide used home-based remote monitoring services from dedicated devices in 2012. There is a rapid increase in diseases such as congestive heart disease and diabetes of the aging population as well as the cost of treating those conditions as a result of which sales of these devices is increasing. The paper [6] aims at both healthcare professionals and computer professionals. These systems can be used by healthcare professionals to determine healthcare related needs. Computer professionals are expected to be benefitted by gaining an understanding of the latest developments in the important evolving application area of mobile patient monitoring systems.

5. DISCUSSION

After going through various papers of different times, we came to know that PMS was developed during 1920s and with the advancement in technologies we are moving towards an age where mobile Health solutions is becoming a part of standard care pathways. According to new research from analyst firm, the researchers forecasted that the number of patient monitoring systems with integrated communication capabilities would grow at a compound annual growth rate (CAGR) of 26.9 percent between 2011 and 2017 to reach 9.4 million connections worldwide. In addition, the number of devices with integrated cellular connectivity increased from 0.73 million in 2011 to about 1.03 million in 2012, and is projected to grow at a CAGR rate of 46.3 percent to 7.1 million in 2017 and the reason behind increasing use of PMS is due to it's simplicity, low cost, security and the flexibility of communication protocol.

6. CONCLUSION

Patient Monitoring System using wireless technology strengthens the capabilities of doctors and medical authorities to track patient's vital parameters and determine their health condition. Patient monitors are the most important diagnostic devices in the critical care units of hospitals, providing continuous display and interpretation of the patient's vital parameters. Patient monitoring system measure physiological condition either continuously or at regular interval

over time. The patient monitoring requirements include periodic detection of routine vital parameters and transmission of alerting signals when vital parameters indicate any kind of threats or danger. PMS has resulted in more powerful bedside patient monitors capable of complex bio-signal processing and interpretation and it is usually equipped with some specialized communication interface.

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