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A Survey on Medical Remote Monitoring of Multiple Physiological Parameters Based on Wireless EmbeddedInternet

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Abstract: ***In rural areas the medical assessment methods have not improved enough to meet the needs and physiological parameter monitoring is been done by local monitoring system and also it has become an urgent need for the people especially for elder people and this technology enables users to concern about their personalized ,networked real time health monitor.The main resolution of this paper is that to design a global architecture with specification for medical policies which are applicable to design and implementation of an alert based medical system.so in the proposed system we are going to combine an ARM based embedded technology and a mobile technology i.e. embedded computer system and human computer interaction interface module and helps to transmit the local detection data to servers at the hospital through an internet network. Our proposed system collects the data with the help of particular sensor and display the multiple physiological parameters like body temperature , blood pressure ,blood oxygen pulse rates and also ECG signals for particular individuals in real time and Whenever the person encountered with dangerous or emergency situations we are going to get the led alarm signals. wireless technology expansion has been accelerated due to its suitability and cost effectiveness, compared with wired technology.the experimental results shows that the system has good data collection effect so that the effect of medical index collection on family health population service can be achieved]. Hence the system is easy to develop, stable in data sharing therefore its an ideal model for hospitals and public health centers.***

Keywords: Physiological parameter, Medical index, Embedded technology, mobile technology, wirelesstechnology.

I. INTRODUCTION

Human physiological parameters are the key sources for judging individual health which is an important part of human life , we all require periodic monitoring of vital parameters and appropriate treatments based on our medical records and health status.at present in our country the normal age of population is expected to be increasing rapidly leading to a very significant growth in health care cost[2]..Single function monitoring system has been introduced since 1970's and this hasgradually become more common in clinical monitoring but due to its own limitations, it can no longer be used for clinical purposes, later in 1990's monitors have continued to move from single parameters to multiparameters.[3] Over the past several decades, many European telemedicine projects have been developed, most of which focus on heart failure diseases. Monitoring physiological parameters has shown a trend of development with the improvement of medical measurement technology, sensor technology, and telecommunications technology[3].The united states, japan and some European republics have done work on this medical monitoring system but most of them are executed with low grade single chip microcomputers and also have simple jobs [1]. So in such systems we can only collect the data but we can not realize the data in real time.In recent years the wireless technology have been widely used and promoted in the medical field [4], with the advancement of microelectronic technology the application of embedded system has developedso quickly mainly in distant monitoring scheme which can give remote monitoring and network communication capabilities[5].the powerfull processing capacity of embedded computer sytem can be easily accessed with the help of ZigBee, GPRS and Internet[5]. Therefore, it is of practical importance to use an embedded computer system with a remote medical monitoring system.

In the proposed system an arm based(Raspberrypi3b+) computer embedded system is designed to implement a new type of physiological parameter monitoring system with distant data communication function which communicates with the help of internet network[1],[3].so our proposed system is employed for different purpose such as finding patients health information quickly and proficiently for the periodic monitoring and also alerting in case of any emergencies which is better for the aged or disabled persons that are able to provide consistent information about the patient. hence oursystem is simple, easy to develope , steady in data communication , better in reliability and also a suitable system for remote monitoring so it's a ideal system in medical field.

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II. OVERVIEW OF EMBEDDED SYSTEM

An embedded system is a grouping of computer software and hardware intended for a specific purpose. Embedded systems may also have a function within a larger system. The systems can be programmable or have a fixed functionality . It has its own capability in particular arenas and can be implanted in several products[8].The embedded sytem can be basically said as a special computer sytem embedded in the object sytem[8],[9]. The embedded system is mainly having three portions hardware platform, operating system, and application software, Hardware contains devices like microprocessors, input/output interfaces, application software can control the things that essential to be controlled[7],[8]. So the new resolution of embedded system is to control the device and also permit the operator to interrelate with it. They also have one or a partial number of functions that they can achieve[10].

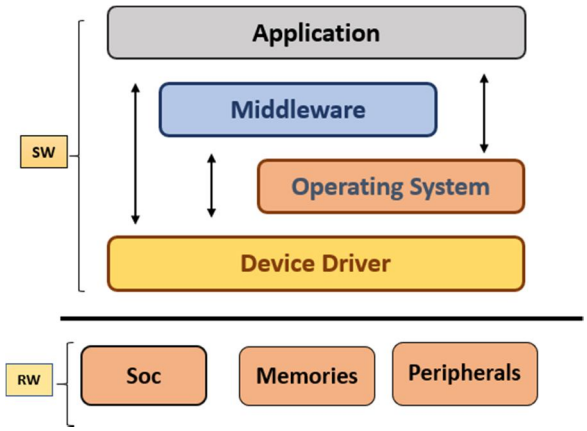


Fig1 : Architecture of Embedded System.

Technologies related to embedded systems are rapidly developing. There are embedded systems in many types of machinery, instrumentation and vehicles. They are an integral part and play a very important role. By accessing the internet embedded systems can truly understand the wireless remote transmission and control of data [10]

III. DESIGN OF PROPOSED SYSTEM

Embedded systems are used to monitor multiple physiological parameters of the human body in medical monitoring systems. Figure 2 illustrates the principal block diagram of a multiparameter embedded computer system using an arm processor. Multi-parameter monitors are primarily composed of a multi-parameter exposure and arm-based procurement circuit and also embedded computer system. The multi-physiological parameter detection and collection circuit is mainly comprise of sensor circuits like electrocardiogram sensor, blood pressure sensor, blood oxygen sensor and body temperature sensor in order to collect particular parameter data of human body.so these sensor circuits are collectively connected to a microprocessor(arm processor) and here the collected data transmits to the embedded computer system through optically isolated RS232 serial port [3],[4]. In parallel, the embedded computer system displays and stores the collected data in a database. An analysis of multiple physiological parameters is based on requirements of the users, allowing users to monitor data on-site. and remote multi-parameter monitoring can be accomplished by communicating collected data over the Internet or through Cloud server and IOT applications.

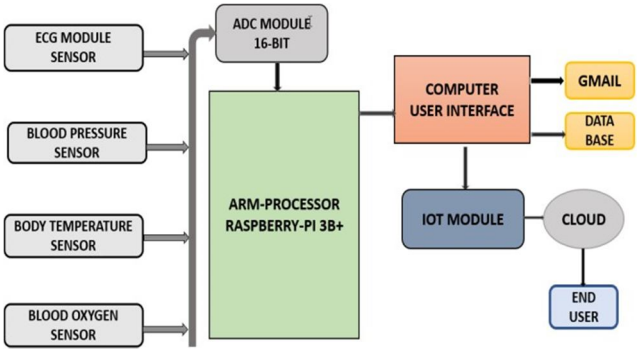


Fig 2. Medical Monitoring System Design.

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A. Structure of Embedded Linux Operating System.

Embedded Linux is a type of Linux operating system/kernel that is designed to be installed and used within embedded devices and appliances. It is a compact version of Linux that offers features and services in line with the operating and application requirement of the embedded system[11]. It is presently the most commonly used effective system for embedded system development .This object concludes the creation of an embedded Linux operating system on a hardware platform with an ARM microprocessor as the control core so as to develop a small-sized, low-power, and powerful-performance embedded system[10]. The boot loader, Linux kernel, and source file system are all required components of the embedded Linux operational environment [11]. The accomplishment of the embedded Linux system's functioning environment is a need for user applications to run normally. Due to the restricted embedded system's hardware resources, the "host machine-target machine" development model is commonly used[10]. The Ubuntu 16.04 operating system is installed on the system's host PC. The boot loader Ubuntu transplantation, Linux kernel replacement, and file structure construction were all finished with the ARM hardware development platform,on the basis of this idea the user can develop the physiological parameter monitoring software

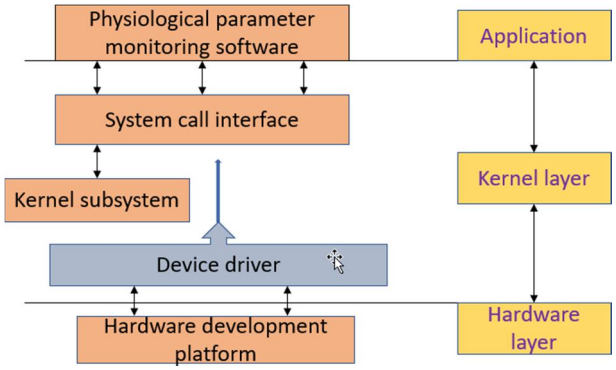


Fig 3 :Embedded Linux Operating Platform.

B. Application of Embedded Internet Technology.

Embedded internet technology will enable billions of intelligent devices to be connected to larger computing systems and each other without requiring human interaction in a network environment [12]. The embedded Internet system is separated into two parts. They are fieldbus devices and gateways exchanging data. These embedded systems depends on wired or wireless networks and communication with web servers for output generation[11],[12].

Through the integration of embedded systems and Internet technology, people can better share resources, communicate conveniently and control their equipment remotely. In our system we are using possible mobile applications like thingspeak ,VNC viewer, whichis a graphical desktop distribution system that is used to control another computer remotely and also iot cloud server like adafruit.io so by making use of these we can access the patients information remotely .

There are two main ways for embedded internet access[11],[12].

1) *Direct access method:* This method is mainly implemented for embedded systems with high-end MCUs operating on RTOS and realizing TCP/IP. The direct access model connects directly to the internet using network interface hardware evolving high sensitivity microcontrollers is costly and it takes more time, and the complication is high, which requires high skills from developers.
2) *Indirect access method*: Indirect access methods can be used for 8/16-bit MCU embedded systems. These systems connect to the Internet through an embedded gateway. Connecting to the Internet via the gateway allows the embedded system and the Internet to share information. The Internet can then be connected to 8/16-bit low-end MCUs. The system allows users to interact with 8/16-bit single-chip microcomputers remotely.

C. Collection of Data From Sensor Module.

The sensor module mainly consists of respective sensor circuits which is used to measure and monitor ECG, heart rate , non - invasive blood pressure including systolic and diastolic pressure, blood oxygen saturation ,body temperature. Generally, the ECG is armed with electrodes (ECG sensors) which can be attached to lower/upper chest in order to measure the cardiac action based on short samples of the electrical activity of heart between the different electrode pairs[5],[6]. But wireless ECG monitoring is considered the most active method for distinct/continuous personal health inspection.

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So in the proposed system we are going to collect the data through particular sensor circuits or data acquisition module from ECG sensor , Body temperature sensor, blood pressure sensor, blood oxygen sensor respectively and with the help of an arm based hardware system Raspberrypi3b+ by connecting these particular sensor circuits to arm embedded system we can check the patients health information through some wireless communication standards like Zigbee, Bluetooth and wifi. Some wearable devices like smartcuffs contains sensors also measures the biological parameters that facilitates the computer patients data and continuously inspect the patients health condition via Bluetooth modem system[5],[6]. So the wireless sensors are responsible for data acquisition preliminary processing , serial communication and other functions based on the realisation of wireless data transmission and receiving functions.

D. Human Computer Interaction Interface Module.

A human-computer interaction interface facilitates information transfers between the monitor and the user. There are fivedifferent interfaces intended by the system: the main interface, the system-setting interface, the PCA-setting interface, the patients information interface, and the ECG-setting interface[11],[12]. The main interface is switched to the system- setting and PCA setting interfaces. System settings include the patient information setting interface and the ECG setting interface[12]. They can both be changed within the system settings interface. In our system we design user interface module with the help of Matlab tools.in that user interface we display like person's information like name, age, weight along with that we also display person's health information like body temperature, blood pressure, pulse rate, ECG signals , blood oxygen correspondingly and additionally we have provided with led's as alarm signal in order to display abnormal and normal conditions of the patients health status. In this user interface we can also send as well as fetch the patients health information to and from the data base as shown in below.

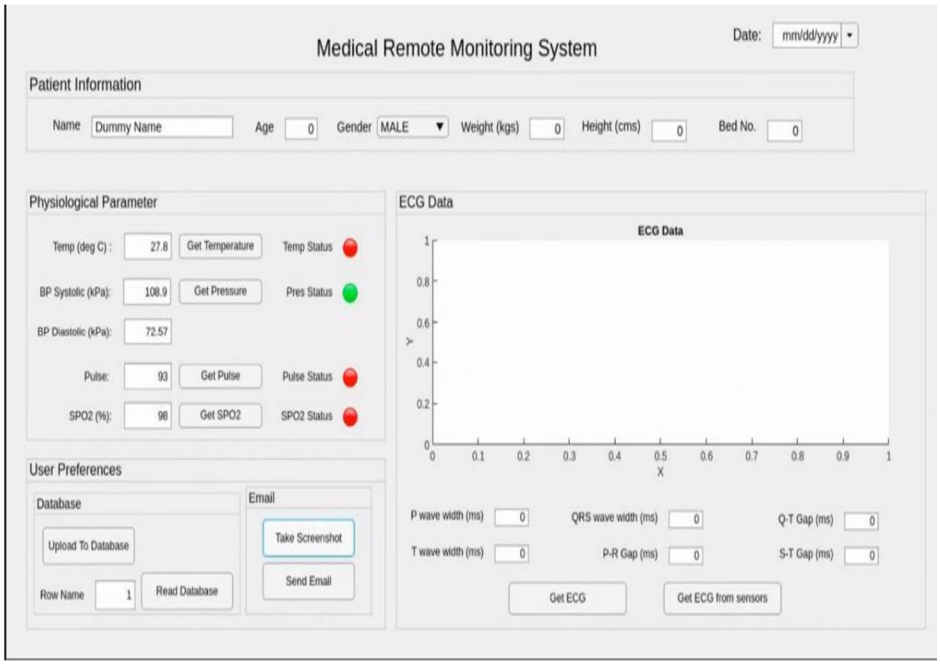


Fig 4 Medical Monitoring System User Interface

IV. CONCLUSION

In medical field technologies have evolved with the advent of new ones and also growth in the human population the medical surveillance systems have supreme importance[3].so an embedded computer system can analyze and judge the patient's physiological information in real time in telemedicine, and also transfer these information to the monitoring center over the internet network. In such case, doctors are able to realize a patient's health position in a timely manner, thus protecting their lives. which meets the urgent needs of people for remote real – time monitoring of health indicators and protection[2]. In order to detect and treat diseases earlier, multi-parameter monitors should be used to monitor and detect multiple physiological parameters in healthy individuals.so this system has ability to monitor the patient at anytime and possible to get fast and user friendly assesments in normal day-to-day life conditions[1]. The proposed system will provide new functionalities that will definitely improve a quality of life for those patients or elderly individuals who will get monitor under this system.

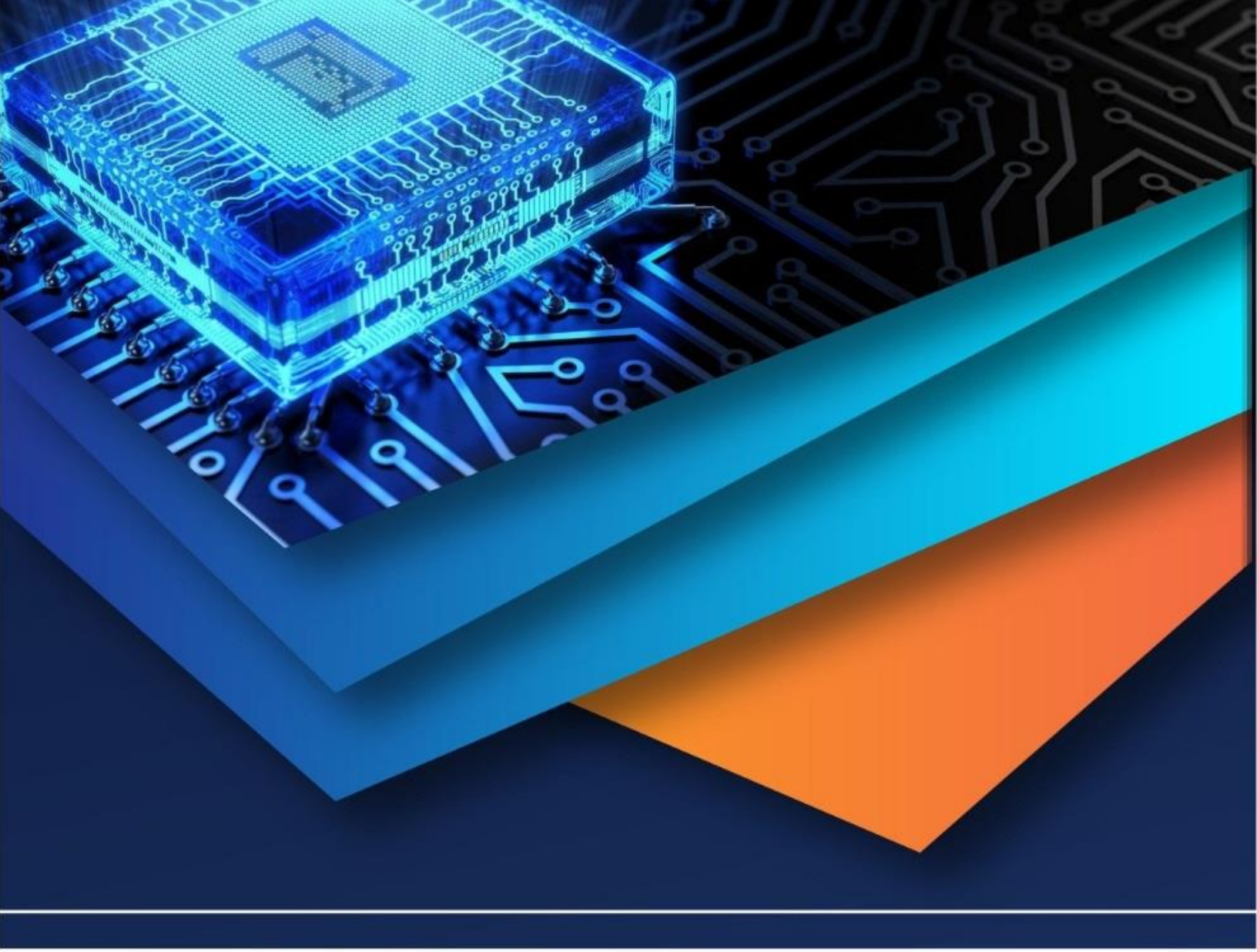
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