Available Online at www.ijcsmc.com

International Journal of Computer Science and Mobile Computing

A Monthly Journal of Computer Science and Information Technology

ISSN 2320–088X
IMPACT FACTOR: 5.258

IJCSMC, Vol. 5, Issue. 5, May 2016, pg.549 – 554

IOT Based Vitality Measurement System

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Abstract- Wireless technology is ruling worldwide and has invaded the medical area with wide range of scope and capabilities. To monitor continuous medicare conditions of patient using existing wireless technologies were quite convoluted. To overcome this, we have introduced a change in wireless sensor technology by designing a biomedical monitoring device comprised of different sensors to acquire the information regarding human body temperature, heart rate, blood pressure, lung capacity which is sent to a personal vitality measurement system and further transmit this information on an IOT server which is user accessible over the internet. An online database of patient is created which can be monitored remotely and analysed to know about patient's health history, so there is no need for a doctor to visit the patient periodically. The data is saved on the server permanently which is later on beneficial too. Hence the device can be used by doctors to monitor the data being sent regularly and analyzing the patterns to alert the patient in case of any predicted anomaly.

Keywords- Vitality, real time, wireless sensor network, ECG, BP, temperature, heart rate, IOT, medicare, dependability

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I. INTRODUCTION

In today's scenario, health care problems are increasing at a very high pace like coronary heart diseases, obesity, lung failures causing death rate of 7.2 million people per year hence it is the need of the hour to overcome from all such problems[1]. Our health care providers have developed an intelligent and low cost health monitoring system to provide more comfortable life for people suffering from such chronic diseases using advanced technologies like wireless communications, embedded computations, wearable and portable remote health monitoring system. As a result need for repetitive doctor visits are decreased as the information reaches from everywhere. Implementation of wireless communication technologies in monitoring systems is now easier because of its patient friendly manner.

The project proposes a real time monitoring system which is capable of extracting medical information regarding multiple vitals such as blood pressure, temperature, lung capacity and heart rate periodically and the information is further transmitted on an IOT server through GSM technology via 2G /3G. Also the proposed system has an ability to generate alerts which are automatically sent to doctors, emergency services and family members in case of any abnormal activity is detected.

So an online database of patient is created which can be monitored remotely by anyone to predict health problems and the data sent to cloud server of Thingspeak.com can be downloaded in an excel file and retrieved as per requirements. Therefore, plotting done is real time and changes are also observed in real time manner with entire medical history on cloud and data is stored on server permanently unless deleted. Also AD8232 ECG sensor is used for remote ECG monitoring by connecting ECG electrodes to the recording unit with cables. Blood pressure sensor (4118) is used to measure systolic and diastolic pressure and pulse rate for few seconds. LM35 temperature sensor is used to measure skin surface temperature as it is more accurate than a thermister and lung capacity is measured using an arrangement of fan with motor like spirometry.

II. RELATED WORK

Multi parameter monitoring is done in intensive care system since early 1960's such as glucose, heart rate, temperature and ECG but did not support remote monitoring. The medical devices started developing in 1970's when microprocessor technologies were introduced. Networked wireless micro sensors are playing a scientific role in research and technological fields supporting contact with body to improve quality of life.

Also wireless Healthcare system is introduced using Zigbee technology but with a drawback of monitoring range. It could monitor patients within 100 metres range only [2].

Pandian et all gives a wearable conceptual design of wireless monitoring using sensor network to monitor parameters like ECG, EEG, EMG, Blood Pressure, SaO_2, Body Temperature, wearer movement, respiratory rate GSR. At each node, pre-processing of acquired signals are done at sensor level and further transmit the data for processing at wearable sink node. It is then transmitted to remote station for monitoring wirelessly [3].

Jun et all reports continuous monitoring using remote ECG monitoring system which is wearable and location independent. Sensors transmit the signals using Bluetooth in its area to the Smartphone and send the signals to destined location via internet [4].

Xin Liu et all presents an area and power efficient ECG system and sensor node that provides signal processing for WBAN(Wireless Body Area Network) which can record ECG waveforms accurately with noise suppression at high frequency. Therefore the node is convenient to monitor the patient's cardiovascular conditions for long term [5].

III. PROBLEM DESCRIPTION

Medical science is expanding by leaps and bounds in the last couple of decades for their considerable aim towards wireless and e-health monitoring systems providing remote monitoring of patients. Health care sensors functions as a life preserving role in hospitality. But the tools used to deal with health conditions are tedious to maintain and limited to specific number of parameters. The systems being complex and laborious to operate also raise the cost of health care services and hospital expenses which is not affordable to economically challenged community. So they lack in their treatment which call forth death toll. Based on our study we reckoned to bring such issues into effective action and find a solution by designing a dependable wireless vitality measurement system to extend the reach of healthcare and improving doctor-patient efficiency. This system embraces the following characteristics:

- Real-time remote monitoring.
- Real-time health information, support and reminders.
- Warning mechanism in case of any predicted abnormality.
- Embedded and IOT technology to easily monitor patient's condition.

- Easy to operate and multipurpose.
- Provides user accessible data over internet which is permanently saved.

IV. PROPOSED SOLUTION

The expansion of e-Health monitoring and wireless sensor network has fabricated a meaningful belief towards better health analysis. More than millions of people face high risk of chronic diseases, etc. Thus to overcome such problems, the next generation is assumed to establish an enormous growth in e-health study. Our project directs towards the intention of achieving high level of dependability on vitality measurement. In addition, the system is economic as it is available at reasonable price. The health care delivery cost is decreased and access to care is increased. To attain our target, we should follow the collaboration of arranged techniques in order to come up with desired results and conclusions.
The approach we have proposed is based on picking out a new method of achieving real time monitoring and uploading of data to protect health and save life.

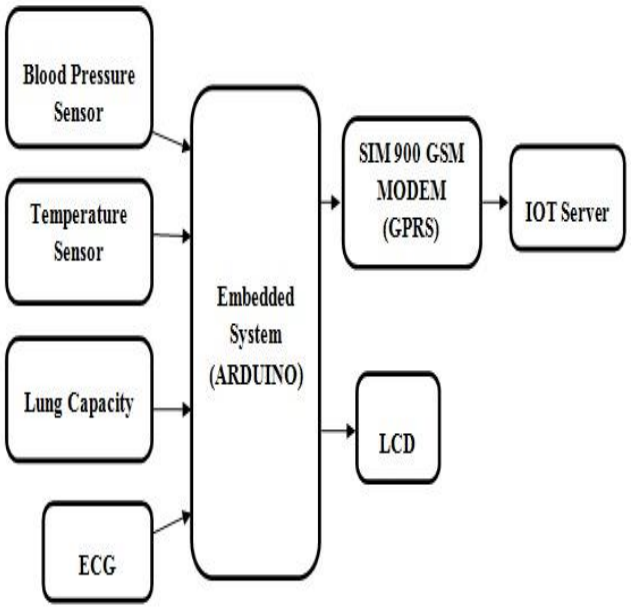

Fig 1: Block diagram of Vitality Measurement System

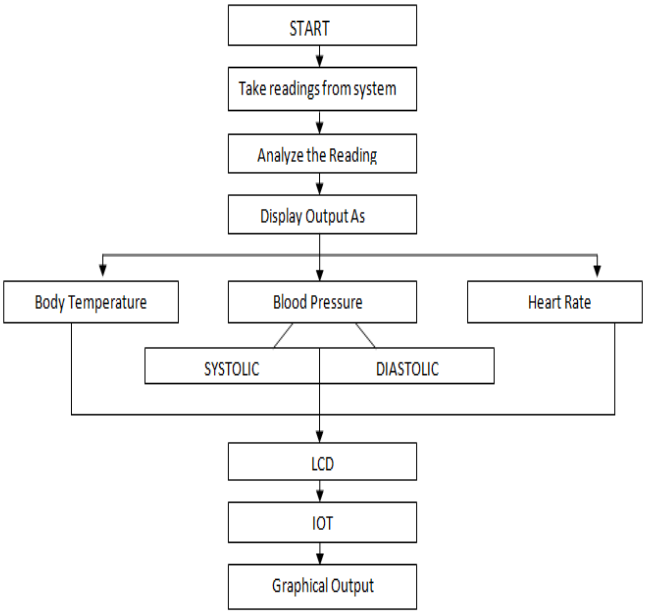

Fig 2: Flow chart of Vitality Measurement System

The whole system is mobile, clinically accurate and reliable. The proposed approach extracts medical information regarding several parameters such as blood pressure, temperature, lung capacity, heart rate and then digitally displayed on LCD. Further the information is transmitted over IOT server via 2G/3G GSM based access for uploading and updating the medical status of patient which is graphically displayed to doctors or distant experts in order to get their directation and opinion. This improves coordination in emergency and plays a vital role in hospitality. The embedded technology used can monitor the patient's condition easily. The approach helps the patient to be careful and aware of the self medical status in real-time mode to follow the statement- Prevention is better than cure which avoids mushrooming of problems.

V. RESULTS

Biomedical sensors such as LM35, the temperature sensor are used in the project to measure the skin surface temperature which is better to use than a thermister. Also AD 8232, ECG sensor is used to measure ECG using processing software for the graphical representation of ECG signals or waveforms.

Table-I
Blood Pressure for adults(18 years and older)

CATEGORY	SYSTOLIC(mm Hg)	DIASTOLIC(mm Hg)
Hypotension	<90	<60
Desired	90-119	60-79
Hypertension	120-180	80-110
Hypertensive Crisis	>= 180	>=110

Table-II
Classification of Heart Rate

CATEGORY	HEART RATE (bpm)
Bradycardia	<60
Desired	60-100
Tachycardia	>100

4118 Blood Pressure (BP) sensor is used to measure pressure of blood against blood vessel walls or arteries. Not being same all the time, BP changes meeting the body's needs because of factors such as exercise, breathing, body position, sleep or emotional state. High BP can lead to chronic diseases. Also Heart rate is measure of pulse rate which normally lies between 60-100 beats per minute (bpm). If the rate crosses 100 bpm, there is production of rapid electrical signals causing abnormality. If the rate drops below 60 bpm, it may cause dizziness, fatigue, weakness etc. Therefore, the classification charts of Blood Pressure and Heart Rate are given above in Table-I and II. Also there is a sample of observations taken of an anonymous person in hospital by our proposed VMS for different days and time.

Table- III
Observation Table of Patient

No. of Observations	Date	Time	Blood Pressure (mm Hg)		Heart Rate (bpm)	Temperature (mV/deg. Celsius)	Lung Capacity (%)
			Systolic	Diastolic			
1	May7,2016	16:40:20	90	69	106	27.86	28
2	May10,2016	22:57:28	109	72	90	28.84	33
3	May11,2016	12:48:39	185	123	86	31.28	35
4	May11,2016	16:00:14	136	81	104	27.37	54
5	May11,2016	16:21:03	110	79	102	27.86	61

The several number of changes were observed in data of systolic pressure, diastolic pressure, heart rate and temperature given in Table-III. Then the information is sent to IOT server for the graphical representation in the form of different uploaded and updated field charts in Fig. 3.

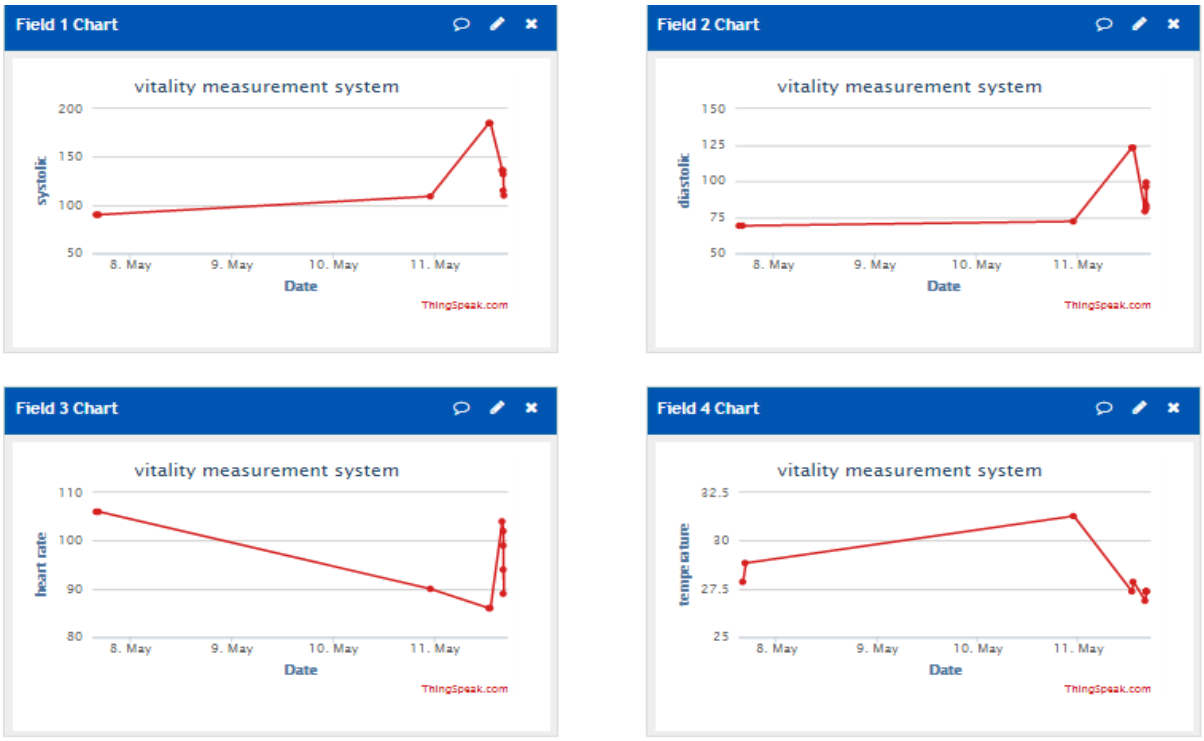

Fig.3 Graphical Representation of the obtained information on IOT server

Different deflections by each portion of heartbeat are produced on ECG which are recorded as positive and negative wave series. Five waveforms are normally visible on ECG as P, Q, R, S and T wave. The ECG waveform of the patient received is represented in Fig. 4.

Fig. 4 ECG waveform generated by Vitality Measurement System

VI. FUTURE PROSPECTS

- This project is the great solution to advancement of existing wireless health monitoring systems for its portability, flexibility and interoperability and real time monitoring. The project can be reconsidered for its check points.
- Computing ECG with IOT as IOT has a current limitation to receive each value per 30 sec time slot and ECG produces continuous waveforms which is impossible to be showcased on server.
- Multiple patients can be monitored using single system.
- System can be upgraded with Wi-Fi Technology and wireless power supply.

VII. CONCLUSION

A wireless vitality measurement system is introduced in this study. Using this system, health care professionals can diagnose, monitor and prescribe the patients with treatment in real time manner from remote location. The system is simple, power efficient, user friendly and bridges gap between doctor and patients. Also it is reliable, accurate, fast and safe. The data is permanently stored on the server for future references. Therefore, the proposed system decreases intervention time and medical emergencies for patient and also multiple patients can be monitored simultaneously by the doctor. Practical application of the system is superfine in rural areas as there would be no need for the patients to get their continuous follow-ups and checkups done in urban areas which in turn reduces their transportation and hospitalization fee. Also it can be utilized by old age homes for health checkups of sick persons so they need not to visit the doctor and hospital on a regular basis.

ACKNOWLEDGEMENT

We feel deeply honoured to express our thanks and appreciation to our guide Mr. Rajat Butola (Asst. Prof.) and co guide Ms. Shruti Karkra (Asst. Prof.) as we are amazingly fortunate for their motivation, support and exemplary guidance in the real time project. Also we are extremely grateful to Dr. Sapan Kumar Ghosh and Asst. Krishan Kumar for their benign patience and valuable help in diagnosis of patients by our system and acknowledging us with its clinical accuracy to proceed successfully towards the completion of project.

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