iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 8 **Issue:** VII **Month of publication:** July 2020

DOI: http://doi.org/10.22214/ijraset.2020.7035

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue VII July 2020- Available at www.ijraset.com

A Multi-Disciplinary approach for Real Time Health Monitoring using Internet-of-Things (IoT)

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Abstract: ***This paper presents a literature survey on FPGA/RASPBERRY-PI/ARDUINO and MATLAB based patient health monitoring system, proposed system is a health care monitoring and patient data acquisition through FPGA/RASPBERRY-PI/ARDUINO and data processing through MATLAB. This type of system is very advantageous for the patients under the critical situations, some patients need to be monitored carefully in time to time and also need to be monitored continuously to keep a track on their condition. MATLAB is the best tool for biomedical signals (sensor data) processing, MATLAB R2020a is having the add-ons such as Matlab supporting package for FPGA/FPGA/Raspberry-pi/Arduino/Raspberry-pi, Simulink supporting package for FPGA/Raspberry-pi/Arduino hardware. The proposed system can be interfaced with wi-fi for data sharing through the internet or to store in cloud so that any doctor can access the patients data from anywhere to continuously keep a track on their condition without being present nearby the patient.***

Keywords: FPGA/Raspberry-pi/Arduino, Bio-Medical Sensors, Health monitoring system, Sensors, IOT, MATLAB.

I. INTRODUCTION

The fast development of Internet of Things (IoT) technology makes it possible for connecting different smart objects together through the use of Internet and providing more data interoperability methods for application purpose. Recent research shows more potential applications of IoT in information intensive industrial sectors such as health care services. Nowadays health care industry is to provide better health care to people anytime and anywhere in the world in a more economic and patient friendly manner. IoT based health care technologies allow the users to perform biometric and medical applications where body monitoring is needed by using different sensors. This information can be used to monitor in real time the state of a patient from anywhere around the world using FPGA/Raspberry-pi/Arduino Board. The FPGA/Raspberry-pi/Arduino analyses the data in real time and determines whether the person needs external help. When anomalies are detected or a threshold is reached, the monitoring system automatically transmits the information to the doctor's workstation[1].

In hospitals patient's body temperature ,blood pressure, ECG, EEG, EMG and all other parameters are need to be constantly monitored, is usually done by doctor or other paramedical staff by constantly observing the temperature and maintaining a record of it. It is very tedious method. In this proposed system, it works as a brain of the IOT module continuously reads patient's body parameters through some sensors connected to FPGA/Raspberry-pi/Arduino based data acquisition and processing through matlab, FPGA/Raspberry-pi/Arduino is interfaced with wi-fi so that the data is directly sent through Wi-Fi or Ethernet modem interfaced to gateway under TCP IP protocol to a dedicated IP on the cloud via networked wireless modem environment which can be monitored or controlled in mobile app or laptop via internet by doctor.

The organization of the present paper is as fallows, Section I gives the Introduction, Section II gives the Literature survey of previously published articles, Section III presents the proposed system and block diagrams with working flow, Section IV will conclude the paper.

II. LITERATURE SURVEY

In paper [1] the authors proposed a IoT based health care system for patient body monitoring using different sensors. This information can be used to monitor in real time the state of a patient from anywhere around the world using Arduino Board. The proposed system analyses the data in real time and determines whether the person needs external help.

In paper [2] the author proposed a "Thingspeak Based Sensing and Monitoring System for IoT with Matlab Analysis". which deals with The IoT 'Thingspeak' web service which is a generous open API service that act as a host for the variety of sensors to monitor the sensed data at cloud level and composite a special feature of porting the sensed data to the MATLAB R2016a using a channel ID and read API key that is assigned by services and able to track data value at picky sample at particular intervals. This project also uses an Arduino UNO board, ESP8266 Wi-Fi Module that helps to process and transfer the sensed data to the Thingspeak Cloud.

In paper [3] the authors presented the design and implementation of wireless biomedical parameters monitoring system based on different biomedical sensors and microcontroller unit Arduino UNO with Zigbee. The system can be used to measure physiological parameters, such as Blood pressure (Systolic and Diastolic), Pulse rate, ECG monitoring, Temperature of a human subject. Using several sensors to measure different vital signs, the person is wirelessly monitored within his own home. There are number of techniques available for the ICU patient's health monitoring system with wired communication technology. In the novel system the patient health is continuously monitored using wireless sensor networks and the acquired data is transmitted to a microcontroller unit Arduino UNO and then to Zigbee. At the receiver side the data is collected with Zigbee and Arduino and the data is to be displayed on relevant displays.

In paper [4] the author describes a new concept for wireless and portable electrocardiogram (ECG) sensor transmitting signals to a monitoring station at the remote location within specific range, and this concept is intended for monitoring people with impairments in their cardiac activity , And proposed a system in which a portable ECG device which capture ECG of patient and monitor it on mobile platform. This report goes over low power Arduino, mobile platform Panda board and Zigbee technology to couple ECG over mobile board.

In paper [5] the author presented a system to monitor the patient's body and display the vital stats of patient to the doctor on their mobile or laptop through internet.

III. PROPOSED SYSTEM

Recently wireless sensors and sensor networks plays a vital role in the research, technological community. But there are different from traditional wireless networks as well as computer networks, today the progress in science and technology offers miniature, speed, intelligence, sophistication, and new materials at lower cost, resulting in the development of various high-performance smart sensing system. Many new researches is focused at improving quality of human life in terms of health by designing and fabricating sensors which are either in direct contact with the human body (invasive) or indirectly (noninvasive)[3].

The proposed system consist of four stages they are

1) Data Acquisition
2) Data Processing
3) Data storage Retrieving & Monitoring.

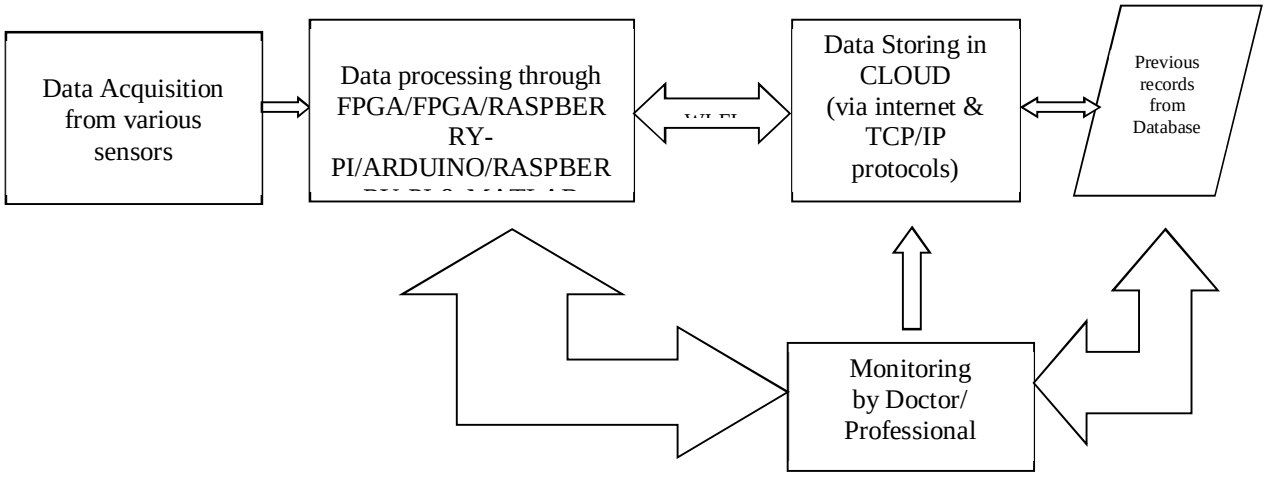

Figure 1: Proposed System

A. Data Acquisition

The patient data acquisition is done by various sensors, As the advancement in electronic sensors there are huge sensors available for data acquisition . These are the some of biomedical sensors listed in section 3.1.1, Those are interfaced with FPGA/Raspberry-pi/Arduino hardware and controlled through software GUI of FPGA/Raspberry-pi/Arduino/ MATLAB/Simulink. After dumping the program from FPGA/Raspberry-pi/Arduino/simulink the kit can work standalone.

1) Available sensors for monitoring the patient

a) Temperature Sensor
b) ECG Sensor
c) EMG Sensor
d) Heart Beat Sensor
e) Blood Pressure Sensor
f) Body Position Sensor
g) Glucometer Sensor
h) Airflow Sensor And Air Quality Sensor
i) GSR Sensor
j) Barometric Pressure Sensor

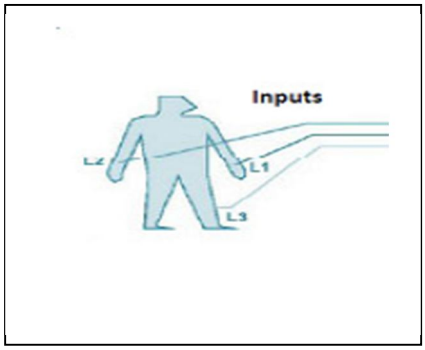

Figure 2: Patient Data acquisition from sensors

B. Data Processing

Data collected from various sensors are given as the input to MATLAB/MATLAB simulink through FPGA/Raspberry-pi/Arduino, matlab is a very rich resources available tool in which many algorithms and processing techniques are available for signal processings. The data which is to be displayed will send to display units and the data which is to be processed by matlab for math operations are sent to matlab.

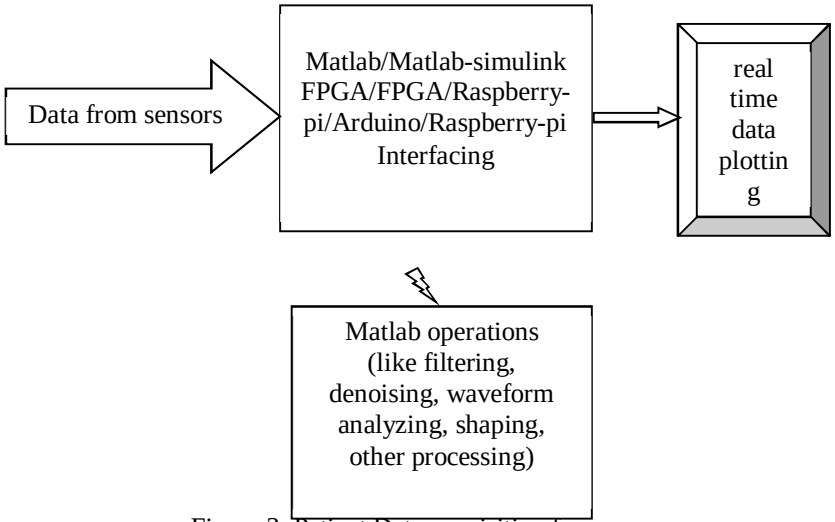

Figure 3: Patient Data acquisition from sensors

MATLAB R2020a is having rich set of features

C. Data Transmission

For data transmission and to store and retrieve the data wifi interfacing can be made, which is having lot of advantages such as high speed and wireless data link. The complete operation of the proposed system is illustrated in below fig.

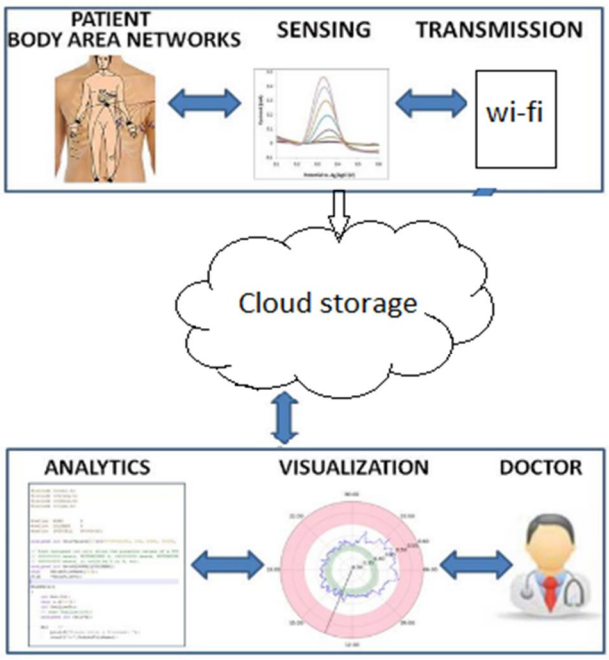

Figure 4: Proposed Data acquisition storing monitoring system

IV. CONCLUSION

In this paper I have presented a literature survey on previously published articles on IOT based health monitoring system, Proposed a multidisciplinary concept such as patient health monitoring by patient data acquisition through sensors connected to FPGA/Raspberry-pi/Arduino, data processing by matlab(real time sensor data plotting, denoising, filtering etc.,), Data Transmission through Wi-fi. Which is very useful for the monitoring of patients by any doctor(access permission allotted doctor) from anywhere through internet with computer/laptop/Mobile etc,. As the advancement in IOT & Cloud Computing technologies this could be the alternative of patient monitoring by nurses or manual recording.

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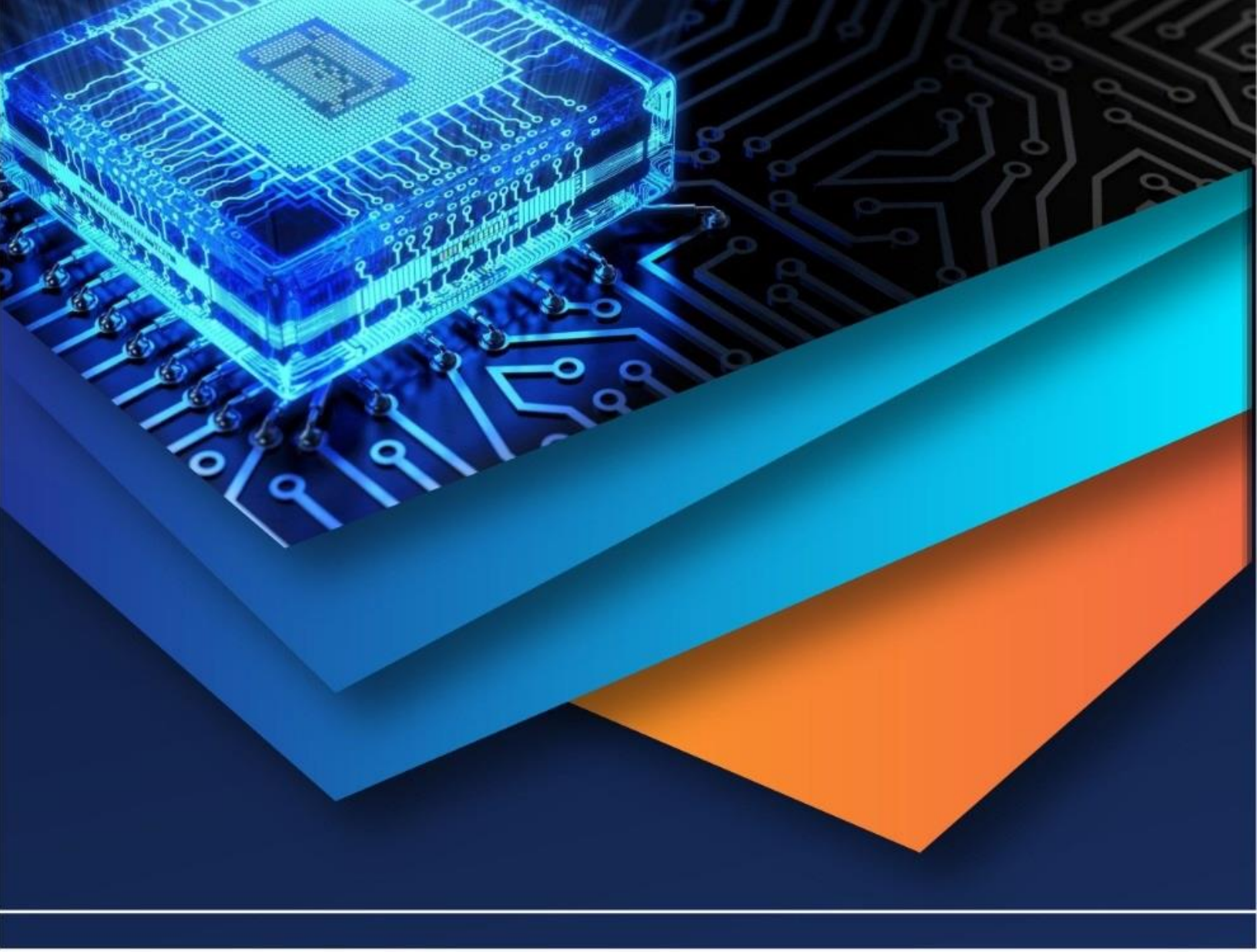

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