

A REVIEW ON ASH (Advance Smart Healthcare) SYSTEM WITH ADVANCEMENT OF THYROMETER

K. SRIKANTH

Asst. Professor, Department of ECE
ISL Engineering College
Hyderabad, India
sirkalvala@gmail.com

MOHD ALI

Department of ECE
ISL Engineering College
Hyderabad, India
mohdalikhan995@gmail.com

NOMAAN PARVEZ

Department of ECE
ISL Engineering College
Hyderabad, India
nomaanparvez759@gmail.com

MOHD ABDUL IBRAHIM

Department of ECE
ISL Engineering College
Hyderabad, India
noumankhan43@gmail.com

MISBAHUDDIN FARAAZ

Department of ECE
ISL Engineering College
Hyderabad, India
misbahuddinfaraz1999@gmail.com

Abstract— The current research used health data from 10,318 Rotterdam adults aged 45 and up. The data was gathered from 1990 to 1993, 2000 to 2001, and 2006 to 2008, and provided information about each person's thyroid and heart health. As the improper level of thyroid in the body leads to the various diseases mainly thyroid cancer. At the present scenario of the world. The WHO (World Health Organization) has state that the millions of peoples are expired annually due to the cardiac attack or cardiovascular disease (CVD). The analysis of CVD in the earlier stages of the effected patient will be helpful for treatment of the disease. The ASH is a smart medical based IoT (Internet of Thing) health care system. Now a days IoT plays a significant job within the area of Bio-Medical. The ASH is a combination of multiple bio-medical modules as Thyroid level indicator, ECG (Electrocardiogram), pulse rate, systolic body pressure and diastolic body pressure, BT (Body Temperature), level of oxygen in the blood etc., in a single device. The main work of this paper is the study on smart healthcare system using IoT, implementation, feature extraction, level indicator of thyroid of a human body, algorithm of ECG, types of modules used in ASH and technologies used in field of bio-medical.

Keywords—ASH, Thyrometer, CVD, ECG, IoT, BT, BP.

I. INTRODUCTION

The Global Hearts is a branch of WHO (World Health Organization) which aims to fight with the cardiovascular diseases and provide proper medical to the patients who are living in the countries with less-income, poverty and limited resources. The Coronary artery disease, cardiac dysrhythmia, heart attack and congestive heart failure are some types of cardiovascular diseases. The high blood pressure, high fever leads to many major diseases and some time it may cause death as in [7,8].

The thyroid disorder is also becoming a common issue in humans mainly in females. The thyroid gland as shown in Figure 0. It is placed below Adam's apple wrapped around the shaped gland inside the front of the neck. The thyroid has vital roles to modify severa metabolic tactics throughout the frame. The iodine is used by thyroid to generate the vital hormones such as thyroxin/tetraiodothyronine (T4) which is

The foremost hormone after blood streaming it a small amount of T4 is converted to triiodothyronine (T3) which effect highly in human body. Due to the imbalance level of thyroid hormones, it causes many diseases like Hyperthyroidism, Hypothyroidism, Goiter, thyroid cancer. The thyroid level can be calculated by the test called Thyroid Stimulating Hormone (TSH) which is a time taking process, very costly and requires around (5-10) ml of blood as in [16].



Fig. 0. The thyroid gland of human body.

The peoples who are visiting to the doctors or GP (general practitioner) for the medication of their diseases after realizing the symptoms of the diseases or a particular disease, but something has gone bad till the time of diagnosis. To diagnose the cardiovascular disease an ECG (electrocardiogram) machine was invented in the year of 1901 by Willem Einthoven. With this machine a waveform will generate based on the action of heart in the electrical medium. By the perfectly investigation of ECG waveform the diseases related to the heart may be determined successfully. By observing the resulted wave form of electrocardiogram, we can state that the patient is normal or abnormal (suffering from cardiovascular diseases) as in [7, 15].

The ECG is regularly done in the medical practice. The monitoring of the patient for ECG is very hard/difficult and the resultant waveform in short-term. So, for the better accuracy of electrocardiogram output waveform it should be record in long-term for cardiovascular disease patient. The ECG machine is nothing but a string galvanometer and the alphabets such as P, Q, R, S and T are assigned for the

Waveform of ECG as appeared in Figure 1. And the cardiovascular diseases can be detected by the implementation of real-time algorithms to ECG waveform as in [8].

- P-wave: Atrial depolarization is prior.
- Q-wave: Activation of Ventricular myocardium in anteroseptal region.
- R-wave: Deactivation of Ventricular myocardium in anteroseptal region.
- S-wave: Activation of Posterobasal portion in ventricular.
- T-wave: Ventricular repolarization is prior.
- PQ-interval: The time interval between initial depolarization of atrial and Ventricular.
- QRS-complex: ECG with the portion of largest amplitude
- QT-interval: The time interval between initial depolarization of Ventricular to end of Ventricular repolarization.
- ST-interval: The time interval between ends of S-wave to the initialization of T-wave as in [9].

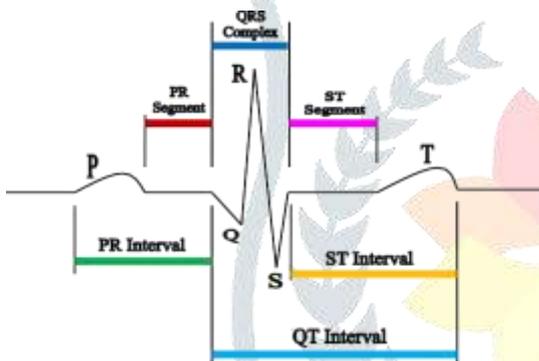


Fig. 1. The example waveform of electrocardiogram signal

Now a days the information is exchanged via internet, telecommunication, Bluetooth/WIFI etc., under the present modern medical field. The emerging technology is IoT (internet of thing) which transmits the data/information of patient throughout the globe. The ECG or smart medical based on IoT healthcare (ASH) system and it is very helpful for GP/doctors to diagnose the patient throughout the globe as in [10].

Further the extension of this paper includes literature survey as section-II, methodology as section-III, future scope & discussion as section-IV and conclusion as section-V.

II. LITERATURE SURVEY

The identification of abnormal functioning of heart can be done by the exact/accurate electrocardiogram and heart rate. The reduction of BLS (base line shift), HFN (high frequency noise) in ECG can be achieved by the development/implementation of an algorithms. By removing some artifacts, we detect the peak of the electrocardiogram waveform without loss of any information. The algorithm consists of removal of BLS by the polynomial filtering curve which is order of 6 and digital filtering techniques was applied to overcome with high frequency noise and artifacts.

The time interval in all ECG wave is fixed and the specific disease or deficiency of heart is represented by the small variation in the interval of wave. For example, the heart rate may be calculated by the time width between R-to-R intervals of electrocardiogram wave in BPM (beats per minute) as shown below.

$$HR \text{ (in BPM)} = 60 / \text{time width between R-to-R.}$$

The ECG signal is simply display on the connected screen as in [11].

Computerized Signal Processing (DSP) and Digital Analysis (DA) are the methods which are used in bio-medical field. The digital signal filtering is a strategy used to design a filter for the reduction of supply n/w filtering and artifacts. The raw signal is carried out to the filter which has the ability to reduce the noise of the input signal and a signal with reduced noise is achieved. The flow of operation of the system as appeared in Figure 2. As in [12].

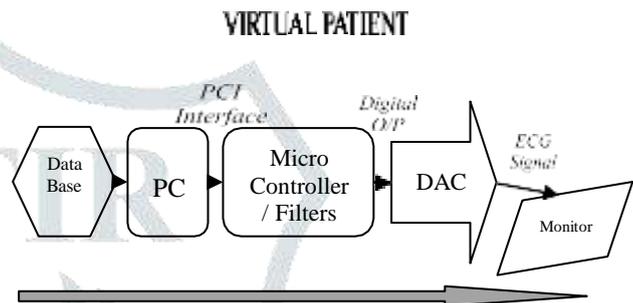


Fig. 2. The transferring of data between blocks of a system and passing via filters.

As we study the problems for test called TSH which is used to identify the thyroid level in a human body. But we can solve the problems by digitalizing it on the bases of few other body parameter from that we can state that weather the level of thyroid is high, low and normal. With the help of this the test will be rapid, the cost will also be reduced etc., for stating the level of thyroid in a body we are considering some relations between the thyroid and other parameters of a human body such as ECG, BP, BPM, BT etc., as in [17, 18, 19, 20].

The PDA (individual computerized colleague) work as a personal assistant of patient which transmit data of a patient health to the GP/doctor through the Wi-Fi and Bluetooth in a limited range. If the ECG frequency became higher as compared to the standard ranges the alarm will be initiated for an emergency. The system is very helpful for the patient as well as doctor. The gadget consists of a patient unit, control unit and monitoring unit by the GP and the square outline of the framework as appeared in Figure 3. As in [13].

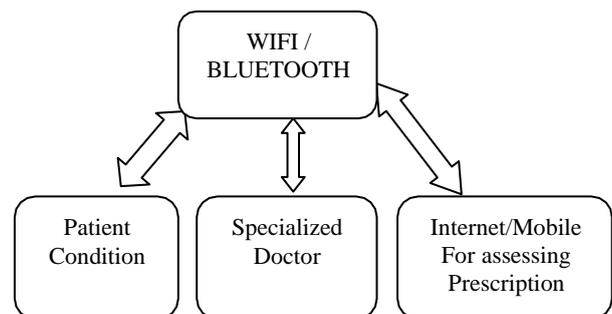


Fig. 3. The flow of operation of the system.

The hospital has one of the important tasks as to monitor the remote patient continuously in ICU, CCU etc., for such requirements a portable device is used which send the information of the patient health to the GP/doctor who is taking care of the patient in a real-time situation. The operation of device is divided in two types. In first type the device is directly connected to the doctor via cable, Wi-Fi, Bluetooth etc., for a shorter range. In case if the doctor is away from the range then the device operates in second type in which the device operates based on IoT (internet of thing) through which the data of the patient is transferred to the cloud/data base by the connectivity of internet and Wi-Fi and the doctor/GP can monitor the patient health by taking the data from the cloud/data base. The square outline of the framework is shown in Figure 4. As in [14].

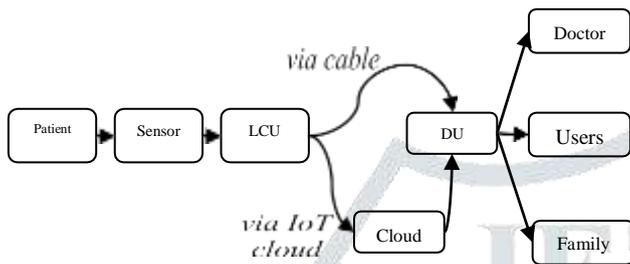


Fig. 4. Structure of line of action.

III. METHODOLOGY

A. Structure of the system process

The structure of the ASH system consist of 4 panels as appeared in Figure 5. Which include sensors, promulgation cloud and monitoring modules. The sensors include in 1st panel as blood pressure sensor, pulse sensor, body temperature sensor (DS18B20), ECG sensor (AD8232), humidity & temperature sensor (DHT11) etc., which get the data of the patient health by sensing. The second panel includes coding/decoding and computing modules as Arduino UNO/NANO, NodeMCU etc. It receives the information/data of patient health from the first panel and send the computed data to the next panel. The next panel is the 3rd panel which include the IoT cloud. The IoT cloud is a data bank which stores the data which receives the data from 2nd panel and it req internet connection for the communication take place b/w system and cloud. The 4th panel consist of doctor, patient’s family or any user observing framework which screens the condition of the patient by getting the data from the cloud as in [8].

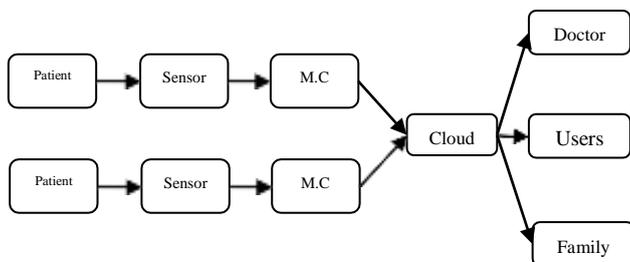


Fig. 5. Structure of system process.

B. Hardware equipments

i) Microcontroller

Arduino UNO/NANO is a microcontroller which is mainly based on the 8-bit AVR Atmega328 Atmel microcontroller. The main function of this device is to compute, store the data of the patient and transmit it to next level through wired/wireless media as in [1].



Fig. 6. Arduino UNO or Nano.

ii) NodeMCU

The NodeMCU is also one of the microcontrollers which compute the data and store it. It also includes the Wi-Fi (ESP32/ESP8266) module so that the data present in module will be transmitted through internet by the connectivity of Wi-Fi as in [2].



Fig. 7. NodeMCU (ESP-32).

iii) AD8232

The AD8232 is an ECG sensor which senses the patient health and send it in the form of analog output mainly in the form of graph. It uses three electrodes to senses the patient condition as in [3].

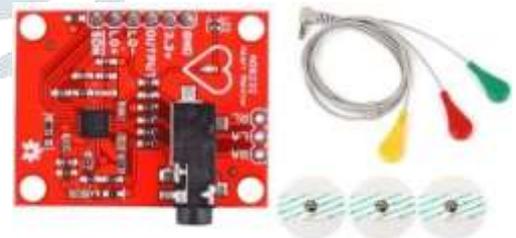


Fig. 8. AD8232 ECG Sensor.

iv) Pulse sensor

Pulse sensor is a device that gives the pulse rate of the patient, it is a 3-pin (GND, VCC, Signal) device which gives output in analog form by which we can calculate the pulse rate of patient in BPM (beats per minute) as in [4].



Fig. 9. Pulse Sensor

v) Blood pressure sensor

The BP of the patient can be extract by the blood pressure sensor in the form of systolic pressure and diastolic pressure as in [5].



Fig. 10. Blood Pressure (BP) Sensor

vi) DS18B20

The DS18B20 is a temperature sensor ranging from -55°C to $+125^{\circ}\text{C}$ and it has the accuracy of $\pm 5\%$. The functioning of DS18B20 is based on one wire protocol by which we can operate multiple device through single pin as in [6].



Fig. 11. DS18B20 Body Temperature Sensor.

C. Platform of Software

The software's used to compute, code, and decode etc., Are Arduino IDE, MATLAB etc., which takes the sensor data and compute according to the logics present in the program written in the software's. The platforms for the clouds are ubidots, adafruit, thinkspeak etc., which receives the computed/calculated information of the patient health and displays in the multiple forms as in [10, 11, 15].

IV. FUTURE SCOPE AND DISCUSSION

This paper is the study of implementation the number of modules of healthcare in a single unit by the use of latest technologies. About the feature scope the implemented system can be re-implemented by the use of advance filters so the noise of the system will eliminate, hardware which consumes less energy with high accuracy and compatible with harsh environment and the software which increases the wireless security and reduce the time of compiling the code or increases the operational speed.

V. CONCLUSION

In this paper we have overview on smart medical base on internet of thing healthcare system which is the combination of many modules which are equipped in modern medical field in a single unit and operates simultaneously. Death rate cause by thyroid imbalance, cardiovascular diseases, low/high BP etc., can be reduce all over the globe. By use of this device the treatment of the patient needs to be possible at proper time so that the rate of death can be decrease which is cause by the lack of proper treatment for patient in time.

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