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An Portable Health Monitoring Device using Internet of Things (BLYNK APP)

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ABSTRACT

COVID 19 has pushed to a non-touch situation paving way for many state-of-the-art technologies. The current standard clinical diagnostic practice involves more manpower, manual handling and multiple machines to check out vital parameters such as oxygen saturation (SpO2), Heart Rate and BPM. The Internet of Things (IoT) is an inter communication of embedded devices using networking technologies. The IoT will be one of the important trends in future can affect the networking, business and communication. In this research, proposing a remote sensing parameter of the human body which consists of BPM, Heart Rate & SpO2. The parameters that are used for sensing and monitoring will send the data through wireless sensors, with the help of internet to keep track of the regular health status of a patient. The sensing data will be continuously collected in a database and will be used to inform patient to any unseen problems to undergo possible diagnosis. Experimental results prove this system is user friendly, reliable, economical.

Key words: BPM, SpO2, Blynk app

1.Introduction

Blood pressure (BP) is the pressure exerted by circulating blood upon the walls of blood vessels and Blood pressure (BP) is measurement of the force applied on the walls of artery vessels as heart pumps blood through the body. Moreover, blood pressure measurement is known as one of the vital signs and is widely used to monitor the physiological condition of human beings along with other vital signs such as heart rate, breathing rate, oxygen saturation and temperature [1] .Blood pressure can be seen a two variance first one is a systolic Blood pressure (SBP) and second one is diastolic Blood pressure (DBP), and systolic is the higher amplitude pressure on the walls of the arteries which happens when the ventricles of the heart are contacting [2] .

While, diastolic is the lower amplitude pressure in the arteries, which happens near the end of the cardiac cycle when the ventricles are filled with blood and measured values for a healthy, resting adult or normal value are 115 to 120mmHg (millimeter of mercury) systolic and 75 to 80mmHg (millimeter of mercury) diastolic [3].Systolic and diastolic blood pressure measurements are not always constant and blood pressure does tend to change during the day. They are also change in response to stress nutrition, way of standard of living, illness drugs, and exercise . The BP measurements are of great importance because it is used for detection of hypertension (high blood pressure). Blood pressure is low means the value is below 114mmHg is called as low blood pressure, and the value of the blood pressure is high means the value is above 130mmHg is called as the high blood pressure and the normal resting blood pressure for adult is approximately 120/80 mmHg [4].

Hypertension is continues, consistent and independent risk factor for developing cardiovascular disease. Hypertension can cause the blood supply to the brain, heart and other tissues to be too low, and hypertension is strongly correlated with higher risk for cerebral stroke and heart infarct. Blood Pressure Measurement is also important for particular disease patients, and hemodialysis patients. Hence, in the daily life, Blood Pressure Measurement and management is very useful for handling health situation and plays a preventive function [5] .Basically the blood pressure measure in two way Invasive blood pressure (IBP) and Non-invasive blood pressure (NIBP) in invasive measures the BP internally by using a sensitive IV catheter inserted into an superficial arty. Non- invasive method divided two way Auscultation/ Auscultatory (Manual Cuff) and Oscillometry[6] .

These two non-invasive method are generally accepted and widely used but they severely restrain patient's mobility, they require uncomfortable cuffs; they are not suitable for home to measure the BP and cannot be used for continuous long-time monitoring applications. Continuous measurement of BP for homecare requires an accurate and inexpensive method that is independent form patient movement and does not require continuous care by a practitioner [7] .

2.LITERATURE REVIEW

SouleymanHassan , [a]ElijahMwangi [2022]," IoT based monitoring system for epileptic patients aims to monitor symptoms of epileptic disease" Behaviour signals in humans and prevent it at its early stage of illness. The fuzzy logic algorithm that has been used to assess specified data set of diseased patients' parameters allows the classification into diverse types of seizures such as heart rate, body temperature, muscles spasm and falls. A prototype of an epileptic monitoring system has been successfully built and tested.

Prasun Biswas, Shreyashi Haldar [2020], developed an "Remote Health Monitoring System using Internet of Things"**,** in these E-Health Monitoring System using internet of things , comprising of a Wi-Fi module enabled microcontroller ESP8266 and wearable sensor networks which will measure different health parameters such as heart rate, the oxygen level in the blood, body temperature and ECG with reliable data and uploading them to cloud which can be remotely accessed or visualized by medical professionals on a user-friendly application from any location at any time.

SAMIKSHA MIRJHA, KUNAL GAURAV, K. RICHA [2020], "Wearable Health Monitoring Smart Gloves" the proposed system is also connected via IoT platform named Blynk, which assists the caretaker in remote monitoring. The data collected can be stored for future diagnostic purposes. It is equipped with buttons to enable the patient to communicate with the family members and doctors as well. Further advances can be made by real time camera setup to guard the patient's activity.

Prajoona Valsalan1, Tariq Ahmed, Barham Baomar [2020], "IoT Based Health Monitoring System" the increase in use of wearable sensors and the smart phones, these remote health care monitoring has evolved in such a pace, . In this paper, a portable physiological checking framework is displayed, which can constantly screen the patient's heartbeat, temperature and other basic parameters of the room, A remote health monitoring system using IoT is proposed where the authorized personal can access these data stored using any IoT platform and based on these values received, IoT monitoring of health helps in preventing the spread of disease as well as to get a proper diagnosis of the state of health, even if the doctor is at far distance.

3. COMPARATIVE STUDY

S.NO	BRAND NAME	SPECIFICATION	PARAMETERS	RATE
1.	Apple watch series 7	SIZE: 41mm,45mm BATTERY LIFE: 18hrs GPS: yes LTE: yes	HEART RATE: yes MOBILE PAYMENTS: yes	53,900
2.	Samsung galaxy watch 4	SIZE: 40mm,46mm BATTERY LIFE: 40hrs GPS: yes	Body composition analysis MOBILE PAYMENTS: yes Step count and calories count	26,999
3.	Fitbit Sense	SIZE: 40mm BATTERY LIFE: 6 days	HEART RATE MONITOR: yes MOBILE PAYMENTS: yes	22,999

		GPS: yes		
4.	Fossil Gen 5 LTE	SIZE: 44mm BATTERY LIFE: 18 hrs GPS: yes	HEART RATE MONITOR: yes MOBILE PAYMENTS: google pay Consists Calories count	22,995
5.	Redmi smart Band Pro	SIZE :42mm BATTERY LIFE: upto 14 days	HEART RATE: yes stress monitoring sleep monitoring	3,999
6.	Fire Bolt Max	SIZE: 42mm BETTERY LIFE: 10 days	HEART RATE: yes Step count, Continues heart count, SPO2 monitoring	4,499
7.	Boat wave pro	SIZE: 42mm BATTERY: upto 7 days	HEART RATE: yes SPO2 monitoring Temperature monitoring	2,899
8.	Dizo watch 2	SIZE:43mm BATTERY LIFE: upto 10 days	Blood rate monitoring Heart rate monitoring Blood oxygen saturation level	2,499

4. COMPONENTS DESCRIPTION

4.1 HEART RATE SENSOR (BPM)

As the heart forces blood through the blood vessels in the ear lobe, the amount of blood in the ear changes with time. The sensor shines a light lobe (small incandescent lamp) through the ear and measures the light that is transmitted. The clip can also be used on a fingertip or on the web of skin between the thumb and index finger. The signal is amplified, inverted and filtered, in the box. By graphing this signal, the heart rate can be determined, and some details of the pumping action of the heart can be seen below.

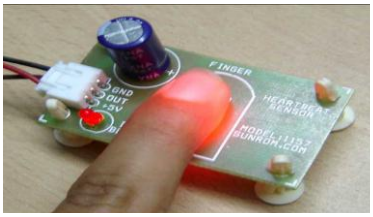


Fig 4.1 BPM SENSOR

4.2 PULSE OXIMETER SENSOR (SpO2)

SpO2 and heartbeat measurements were performed from the index finger, forehead and temporal bone. During measurements, a constant value of 50ma applied to the infrared led in the sensor while the current value for the red led was changed between 4,4ma and 20,8ma in discrete time intervals. Reference measurements were taken with a pulse oximeter from the right index finger simultaneously during all measurements. The findings show that the

14.2ma red led current value provides similar results with the reference device. The measurements taken from the forehead and temporal bones are acceptable when compared to the measurements taken with the reference device. We plan to develop a wearable device equipped with max30100 sensor that will automatically determine the most suitable red led current value depending on the skin color and thickness and that can perform measurements during basic daily activities.

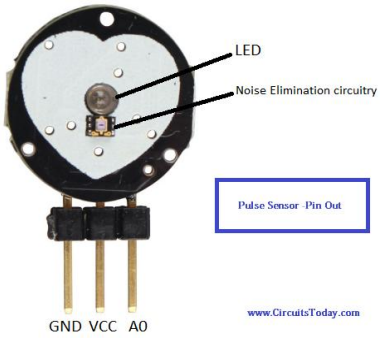


Fig 4.2 Pulse Oximeter Sensor

4.3 MICROCONTROLLER

A Micro controller consists of a powerful CPU tightly coupled with memory RAM, ROM or EPROM), various I / O features such as Serial ports, Parallel Ports, Timer/Counters, Interrupt Controller, Data Acquisition interfaces-Analog to Digital Converter (ADC), Digital to Analog Converter (ADC), everything integrated onto a single Silicon Chip.

It does not mean that any micro controller should have all the above said features on chip, depending on the need and area of application for which it is designed, the on-chip features present in it may or may not include all the individual section said above. Any microcomputer system requires memory to store a sequence of instructions making up a program, parallel port or serial port for communicating with an external system, timer / counter for control purposes like generating time delays, Baud rate for the serial port, apart from the controlling unit called the Central Processing Unit .

4.4 ARDUINO NANO

Arduino Nano is a small, compatible, flexible and breadboard friendly Microcontroller board, developed by Arduino.cc in Italy, based on ATmega328p (Arduino Nano V3.x) / Atmega168 (Arduino Nano V3.x). Arduino Nano is simply a smaller version of Arduino UNO; thus, both has almost same functionalities. It comes with an operating voltage of 5V.

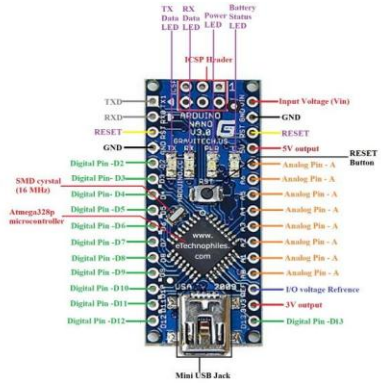


Fig 4.4 Arduino Nano board

4.5 ARDUINO IDE

In this paper, we will learn about the different components on the Arduino board. We will study the Arduino UNO board because it is the most popular board in the Arduino board family. In addition, it is the best board to get started with electronics and coding. Some boards look a bit different from the one given below, but most Arduinos have majority of these components in common.

Various kinds of Arduino boards are available depending on different microcontrollers used. However, all Arduino boards have one thing in common: they are programmed through the Arduino IDE. The differences are based on the number of inputs and outputs (the number of sensors, LEDs, and buttons you

can use on a single board), speed, operating voltage, form factor etc. Some boards are designed to be embedded and have no programming interface (hardware), which you would need to buy separately. Some can run directly from a 3.7V battery, others need at least 5V.

Fig 4.5 Arduino IDE

4.6. Wi-fi Module

The ESP8266 Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor .

Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much Wi-Fi-ability as a Wi-Fi Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost-effective board with a huge, and ever growing, community.

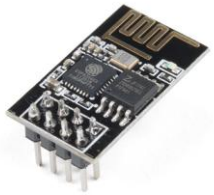


Fig 4.6 wifi Module

4.7 BLYNK APP

Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, it can store data, vizualize it and do many other cool things.

There are three major components in the platform:

- **Blynk App** - allows to you create amazing interfaces for your projects using various widgets we provide.
- **Blynk Server** - responsible for all the communications between the smartphone and hardware. You can use our Blynk Cloud or run your private Blynk server locally. It’s open-source, could easily handle thousands of devices and can even be launched on a Raspberry Pi.

Blynk Libraries - for all the popular hardware platforms - enable communication with the server and process all the incoming and outcoming commands.

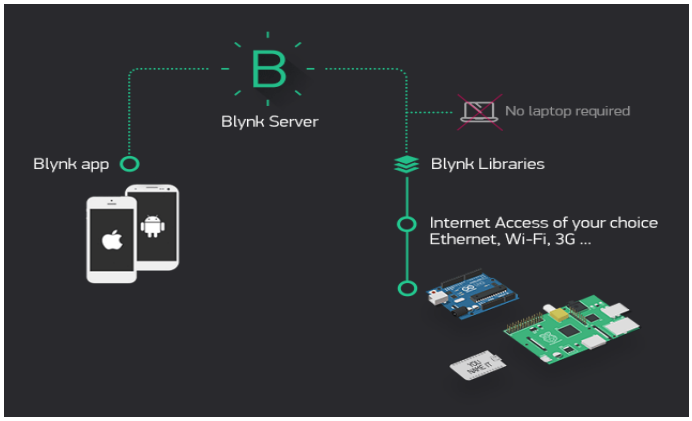
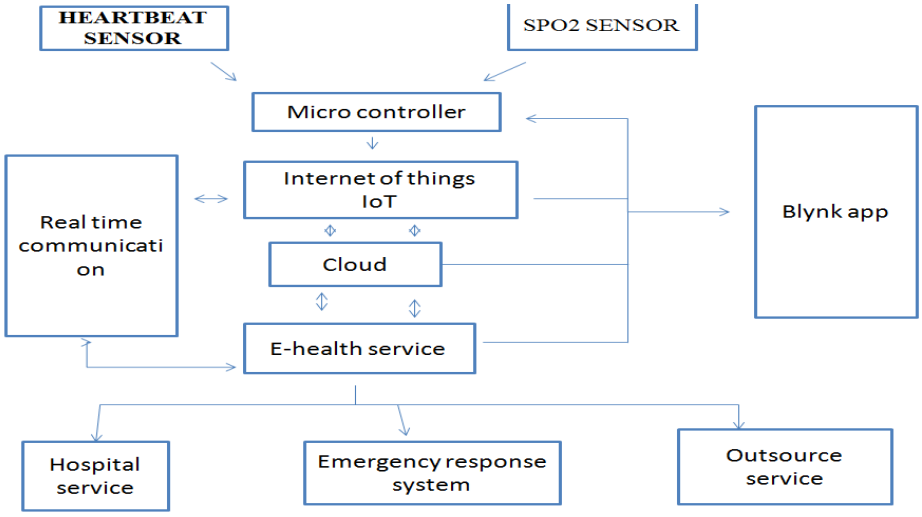


Fig-4.7 Blynk app

5. METHODOLOGY

5.1 SYSTEM ARCHITECTURE

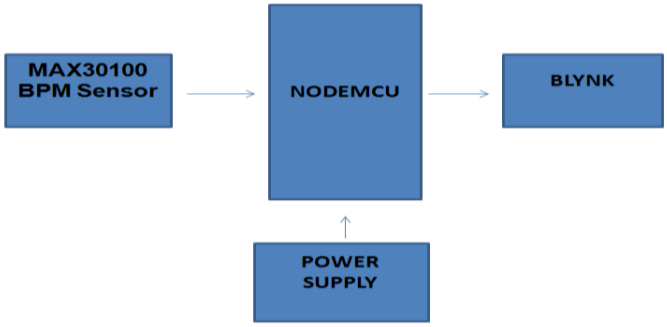
The Block diagram of the System architecture is shown in figure



5.2 BLOCK DIAGRAM

The software configuration shows that, all the four stages are connected in a manner that data is captured or processed at once stage and yields the value to the next stage.

With these integrated device will be developed with universal API integrated software in mobile and it is stored in a secured cloud storage and provides the data when it is required.



5.3 STEPS INVOLVED

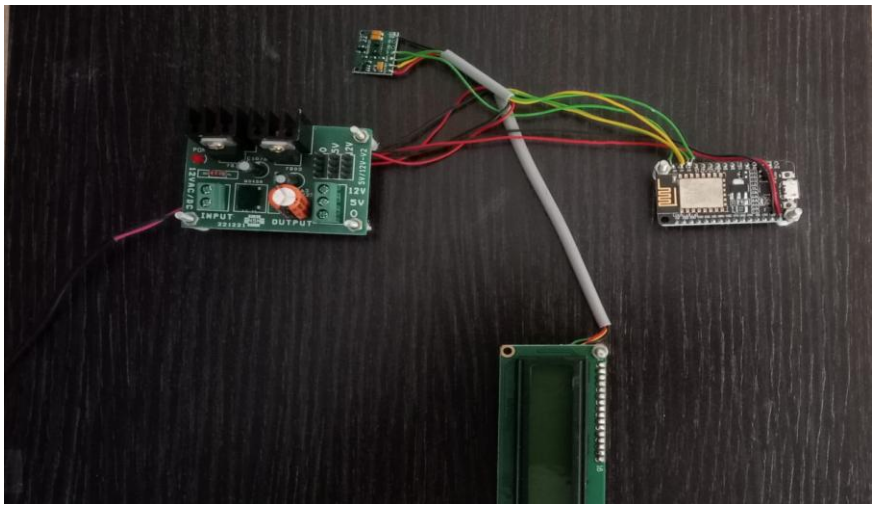
Step 1: First step consists of deployment of interconnected devices that includes sensors, actuators, monitors, detectors, PC systems etc. These devices collect the data.

Step 2: Usually, data received from sensors and other devices are in analog form, which need to be aggregated and converted to the digital form for further data processing.

Step 3: Once the data is digitized and aggregated, this is pre-processed, standardized and moved to the data center or Cloud.

Step 4: Final data is managed and analyzed at the required level. Advanced Analytics, applied to this data, brings actionable business insights for effective decision-making.

5.4 DEVELOPED PROTOTYPE/DESIGN



This built prototype enables the patient to use themselves and massive amount of data can be obtained and stored in the online database. Even the results can be made to be accessed from PC. A cost effective market ready SMART IOT integrated basic diagnostic medical device will be the deliverable from this prototype leading to improved health and wellbeing of all during this pandemic.

6. VALIDATED OUTPUTS/RESULTS

The developed Human-Wellbeing checking/watching system includes patients, Human-Wellbeing observing units, cloud for information maintenance and secure has been validated with the assistance of some equipment units, different sensors and gadgets with web association.

6.1 PATIENT MONITORING

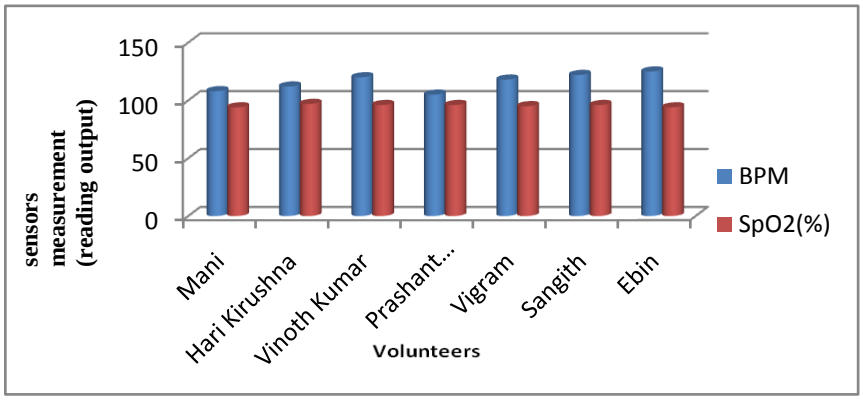


Fig: 6.1 graphical representation on Patient Monitoring

6.2 BY CONVENTIONAL METHOD

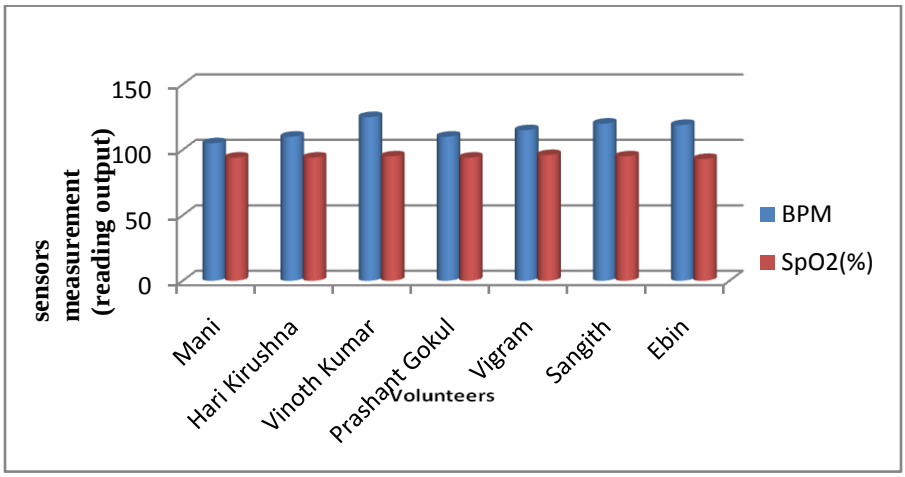


Fig: 6.2 Graphical Representation on Conventional method

7. CONCLUSION

Developed a system that measures and detect Human Heartbeat, SpO_2 sends the data to user or server end by using microcontroller with reasonable cost and great effect. Using two different sensors and these are mainly under the control of microcontroller. For Human Heartbeat measurement and SPO2 use MAX30100, it's in BPM (beats per minute). These calculated rates will have stored in cloud storage and it has been used to display the calculated human heart beat rate, SpO2 and temperature values. Finally, the stored data in JAVA server which is configured in cloud, will be displayed for further analysis by physician or specialist to provide better aid. From our experimental results, the proposed system is user friendly, reliable, economical.

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