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Patient's Health Monitoring System in Real Time using Raspberry pi board

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ABSTRACT: Proposed implementation entitled "Patient's Health Monitoring System in Real Time Using Raspberry Pi" is the implemented system which will be beneficial not only to the village side patient's but also for anywhere in emergency situation and remote located patient for monitoring of health conditions using health parameter measuring electronics sensors for the different health parameters. The sensors which are used in proposed implemented system reads the health parameter readings when sensor connects to the patient's body and for the monitoring through eye by doctor to patient's condition in real time camera can helps to doctor for monitoring to patient in real time through live video scene on doctors computer just by using IP address with port number of patient's side. By using the system doctor can give prescription and any emergency treatment just by seating in chamber which may be at remote located place. Here, I am using electronic sensors for the body parameters measurement like temperature, pulse rate and seeing of patient using camera. These sensors will reads the temperature, pulse rate reading and capture live scene of patient's view will transmits to the Raspberry pi for the sensed readings and suppose to send it to doctor's side through the internet medium. So, the doctor can be able to see the patient, patient's real time condition along with temperature reading and pulse reading just by using patient's side IP address.

KEYWORDS: Raspberry pi, Temperature sensor, pulse rate sensor, camera, monitor, keyboard, mouse, Wi-Fi (internet) connection, doctor side computer or laptop with internet connection.

I. INTRODUCTION

Proposed system entitled patient's health monitoring system in real time using raspberry pi introduces, system helpful in medical era approach mostly beneficial for the village era peoples. Proposed system includes health parameter sensors such as temperature sensor and pulse rate sensor which gives respective health parameter measurement. Camera provision in the proposed system is the innovating part of the proposed work which interacts with the doctor in real time so that doctor can come to know the real time condition by seeing on respective doctor's computer with the help internet connection and IP address.

Electronic sensors when applied to the patient's body part , will reads the particular health parameter reading processed by the processing unit which is raspberry pi board in proposed implemented system. This processed signal results particular output in numeric form which is reading of proposed health parameters of patient's body.

- **DS18B20 digital thermometer**
  - 1-wire (DS18B20) is digital thermometer when applies to the body gets the temperature value.

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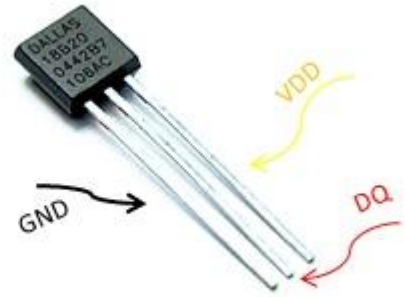

Fig 1:DS18B20 digital thermometer

- Semicircular portion of the sensor in black colour will sense the temperature so it needs to apply this semicircular part to patient's body for getting the temperature.
- The DS18B20 Digital Thermometer provides 9 to 12-bit (configurable) temperature readings which indicate the temperature of the device.
- Can be powered from data line. Power supply range is 3.0V to 5.5V.
- Measures temperatures from -55°C to +125°C. Fahrenheit equivalent is -67°F to +257°F.
- ±0.5°C accuracy from -10°C to +85°C.
- Needed power for reading, writing, and performing temperature conversions can be derived from the data line itself no need of an external power source.
- Information transfer in DS18B20 over a 1-Wire interface, so that only one wire (and ground) needs to be connected from a processor i.e. RPI to a DS18B20.
- In 1-Wire sensor, sensed data is sent down one wire, which makes it great for processing unit which is Raspberry Pi, as it only requires one GPIO pin for sensing.
- The resistor of 4.7kΩ needs in this setup, used as a 'pull-up' for the data-line, and should be connected between the DQ and VDD line.
- 1-Wire data line is at a defined logic level, and limits interference from electrical noise if pin left floating.
- GPIO as driver pin for sensing the thermometer output. This is the dedicated pin for 1-Wire GPIO sensing.
- Input command needs for getting the temperature reading from Linux terminal.

- **Pulse rate measurement:**
  - Pulse Sensor, is a plug-and-play pulse-rate sensor.
  - It can be used to easily incorporate live heart-rate data.
  - Pulse sensor consists of an integrated optical amplifying circuit and a noise eliminating circuit.
  - There is need to convert these sensed signal with great resolution and accuracy through the 4-channel ADC breakouts

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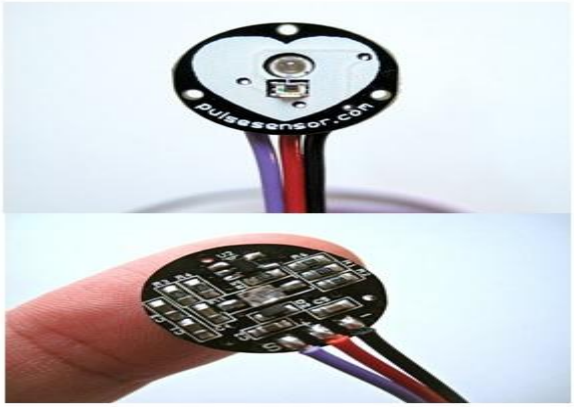

Fig 2: Pulse rate sensor

- **4-channel ADC breakout:**
  - For adding high resolution analog to digital conversion to any processor 4-channel breakout boards are perfect.
  - They need power in range of 2V-5V.
  - As many of 4 of these boards can be controlled from the same 2-wire I2C bus, giving you up to 16 single-ended or 8 differential channels.
  - For small signals provides up to x16 gain by programmable gain amplifier.
  - These two boards are very similar, differing only in resolution and speed.

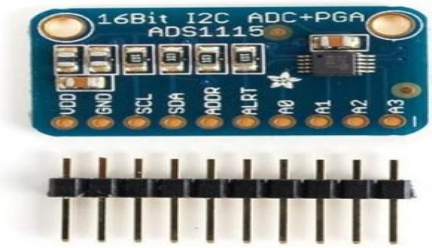

Fig 3:4-channel ADC breakouts

- **Real time monitoring using Camera:**
  - Logitech USB camera used in proposed system.
  - This camera is basically a webcam for PC.
  - It is ideal for the staying in digital touch with remote end.
  - Its weight is around 204g.

Fig 4: Logitech USB camera

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- Camera module can directly access from a python script (without using OS script or executing sub process).
- Set up a TV with a pi by using (HDMI to VGA converter) and camera plug in to pi through USB for the viewing the live scene.

- **Raspberry pi:**

  - Things can do with Raspberry Pi, from controlling hardware with Python, to using it as a media centre, or building games in Scratch.
  - The beauty of the Raspberry Pi is that it's just a very tiny general-purpose computer (which may be a little slower than you're used to for some desktop applications, but much better at some other stuff than a regular PC), so you can do anything you could do on a regular computer with it.
  - In addition, the Raspberry Pi has powerful multimedia and 3Dgraphicscapabilities, so it has the potential to be used as a games platform, and we very much hope to see people starting to write games for it.

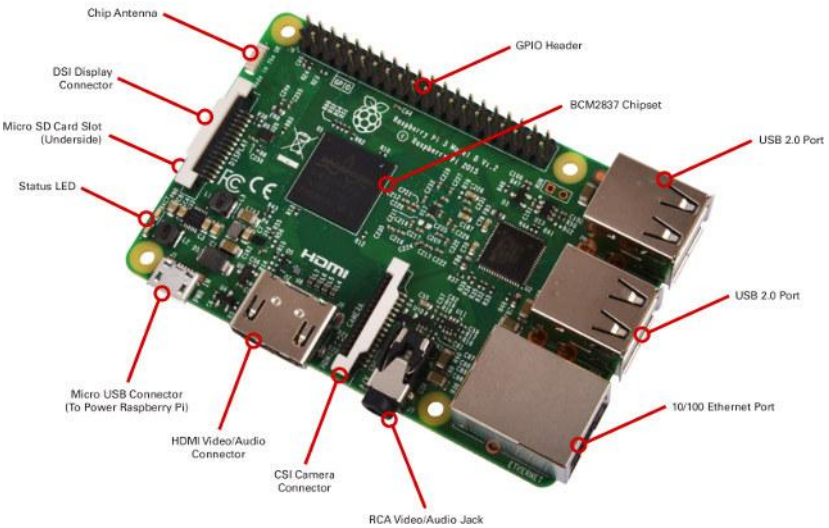

Fig 5: Raspberry pi -3 board

- Physical computing building systems using sensors, motors, and lights and microcontrollers—is something that gets overlooked in favour of pure software projects in a lot of instances, and its shame, because physical computing is massive fun. To the extent that there's any children's computing movement at the moment, it's a physical computing movement.
- However, the lack of General Purpose Input/output (GPIO) on home PCs is a real handicap for many people getting started with robotics projects. The Raspberry Pi exposes GPIO so you can get to work straightaway.
- The heart of the RPI is the ARM processor or Broadcom processor. Every processing activity is carried out by at ARM processor only.
- Broadcom processor is processor chip including ARM 11 processor.
- ARM11 processor software is compatible with all previous generations of ARM processors, and introduces 32-bit SIMD for media processing, physically tagged caches to improve OS context switch performance, Trust Zone for hardware-enforced security, and tightly coupled memories for real-time applications.

II. RELATED WORK

According to Abhilasha ingole's research work presented in IEEE in 2016, explained that in this type of technology same area network is shared by multiple users which helps in monitoring. Wireless communication is done through Wi-

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Fi which provides flexibility and extendibility. In this paper basic parameters like body temperature is monitored and is transferred on webpage to make it locally visible for users [1].

According to implemented system by Mendrela Biswas presented at International Research Journal of Engineering and Technology (IRJET) in Apr2016, explained the monitoring of the patient is done by the doctor continuously without actually visiting the patient. Here, we are using various sensors to sense the physiological parameters like temperature, blood pressure [3] ECG and the level of saline. These sensed signals are transmitted to the Raspberry pi to update the data continuously via ADC which will convert these analog signals into digital signals. Through RF transmitter, the data is sent wirelessly to the monitor screen of the doctor. So, the doctor can visualize the patient's data just by sitting in his cabin. When a critical condition occurs, the visual indications will be sent onto the screen [2].

According to implemented system by Pooja Navdeti presented at International Journal of Engineering and Computer Science in Mar-2016, explained the system is designed to be used in hospitals for measuring and monitoring various parameters like temperature, ECG, heart beat etc. The results can be recorded using Raspberry Pi displayed on a LCD display. Also the results can be sent to server using GSM module [3]. Doctors can login to a website and view those results.

According to implemented system by Nikita Patni presented at International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE) inApr-2015, explained the proposed system implemented ZigBee interface for wireless communication and GSM for mobile based remote monitoring along with wired web interface [4]. It is observed that, wired interface provides reliability in communication while wireless interface gives flexibility in patient movement whereas cellular interface provides solution for emergency situations.

According to implemented system by Harshavardhan B. Patil at Int. Journal of Engineering Research and Applications in apr-2015, explained system can be used to monitor physiological parameters, such as Blood pressure (Systolic and Diastolic), Pulse rate, Temperature of a human subject. Using several sensors to measure different vital signs, the person is wirelessly monitored within his own home. Impact sensor has been used to detect falls. The device detects if person is medically distressed and sends an alarm to a receiver unit that is connected to a computer. This sets off an alarm allowing help to be provided to the user. The device is battery powered for used outdoors [5].

According to implemented system by Aung Soe Phyo at international journal of scientific & technology research in june2015, explained system is designed to be used in hospitals for measuring and monitoring various parameters like temperature, ECG, heart beat etc. The results can be recorded using Raspberry Pi displayed on a LCD display. Also the results can be sent to server using GSM module. Doctors can login to a website and view those results.

By the reference with all of the research papers which I have mention above, I want to implement, the system which will overcome the drawbacks and also the proposed system is applicable in real time interaction between patient side and doctor side using raspberry pi, communication medium, also a camera unit which is new idea beyond existing system. The already mentioned systems done with health monitoring system using raspberry pi, zigbee, GSM etc. The referenced system doesn't have real time interaction between patient and doctor but proposed system will overcome this drawback. The proposed system will most useful for the village side patient, who didn't get on time treatment with proper prescription, no doubt village side doctors also knows prescription but still they refer the patient to specialized doctor. At this time system will be very useful.

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III. PROPOSED SYSTEM

A. *Block diagram of proposed system:*

Proposed system involves temperature sensor, pulse rate sensor with 4channel ADC breakouts, camera and raspberry pi.

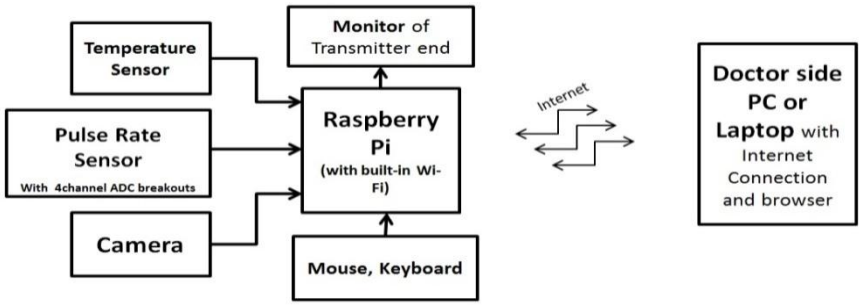

Fig.6: Block diagram of the proposed system

B. *Block diagram explanation:*

Block diagram includes temperature sensor, pulse rate sensor, camera, keyboard, mouse raspberry pi, monitor of patient side, internet network through Wi-Fi and doctor side computer either laptop or PC.

- Temperature sensor will sense the temperature of patient's body.
- Pulse rate sensor will sense the pulse rating of human body when sensor connects to the patient's body at the tip of finger.
- These sensed value applied to raspberry pi through 4 channel ADC breakouts which high resolution ADC which processed pulses with great resolution.
- Raspberry pi processed with these signal and these signal send to doctor's browser chat web page by refreshing can gets runtime changing values so that doctors comes to know the condition and able to send the prescription by writing it on input box and submitting it will send to patient side chatting web page by refreshing it from patient side and even patient can write any query or any important message wants to send to the doctor.
- Camera unit is USB based camera used for observing to patient and patient's condition by the doctor from remote location using internet connection with IP address port through which can get live streaming of patient side.
- Raspberry pi is the heart of the proposed system all processing carried out through raspberry pi board only.
- Patient side monitor TV needs in order to start the process of proposed work by writing the commands for getting sensing signals and camera captured live streaming only possible by running source code with executing python commands.
- Mouse and keyboard is very essential part which are the input source without which impossible to complete the process.
- Also raspberry pi board needs internet connection through as board in proposed system has features with inbuilt Wi-Fi.

C. *Working of system:*

- By applying temperature sensor to patient body gets current temperature of patient.
- By applying pulse rate sensor to patient body gets the pulse rate of the patient.
- Camera is medium through which doctor can be able to see the patient in real time along with different parameters which can't be measure using sensor such as blood pressure measurement, sugar level etc.

Connection of proposed system:

- Take raspberry pi-3 module.

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- Take micro SD card and format the card using sd card formatting software.
- Write OS to sd card.
- Insert the micro sd card into memory card slot on raspberry pi board which acts as hard disk.
- Connects the HDMI-VGA converter at HDMI socket of RPI board.
- Connects VGA of converter to the VGA socket of TV monitor which supports HDMI-VGA communication.
- Connects Mouse & keyboards trough USB port on RPI board.
- Connects the proposed sensors with GPIO pins along with voltage and GND signal with respective pins of raspberry pi and camera through the USB port of raspberry pi.
  i. Temperature sensor is connected to one of the GPIO pin
  ii. Pulse rate sensor is connected with GPIO pins through 4-Channel ADC Breakouts.
- Connect power adapter (5.1V-550mA) with micro USB jack to power socket of micro USB on RPI board.
- Validate the connection as per proposed connection.
- Then enter the login &password.
- Executes the commands for temperature and pulse rate measurement.
- Executes the command for camera monitoring.
- Includes the internet connection.

1. *Temperature measurement:*
   - 1-wire (DS18B20) is digital thermometer when applies to the body gets the temperature value.
   - In 1-Wire sensors, all data is sent down one wire, which makes it great for processing unit which is Raspberry Pi, as it only requires one GPIO pin for sensing.
   - The resistor of 10kΩ needs in this setup, used as a 'pull-up' for the data-line, and should be connected between the DQ and VDD line.
   - 1-Wire data line is at a defined logic level, and limits interference from electrical noise if pin left floating.
2. *Pulse rate measurement:*
   - Pulse Sensor, is a plug-and-play pulse-rate sensor.
   - Pulse sensor consists of an integrated optical amplifying circuit and a noise eliminating circuit.
   - Plug the respective leads into RPI board and clip the pulse sensor to finger's tip and will gets the pulse rate reading.
3. *Real time monitoring using Camera:*
   - Camera module can directly access from a python script (without using OS script or executing sub process).
   - Set up a TV with a pi by using (HDMI to VGA converter) and camera plug in to pi through USB for the viewing the live scene.

- Makes attention of doctor either by calling to doctor's number or by sending the SMS to doctor's mobile number from patient's side mobile number.
- Mobile phone which are at doctor and patient side are not the part of proposed hardware because nowadays most of the peoples having their phones and also easy to get doctor's number for making the attention of doctor for attending the real time interaction with patient's by using doctors PC or laptop with internet connection.
- Open the browser tabs on doctor's side computer.
- Enter the valid IP address of patient's side which provided during doctors attention by patients side.
- By refreshing the page doctors can gets real time temperature and pulse rate values from 1st IP address.
- Doctor can gets the message or readings like sugar value, blood pressure, health parameters whose sensors not easily available etc. using traditional measurement unit values written from the patients side input box, by refreshing webpage and also doctor can send the prescriptions to the patients side through writing prescriptions in input box on webpage by using browser of patient's side patient's side can gets prescription written from doctor by refreshing the webpage.

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- Observation of the patient and patient's real time health condition also possible simultaneously.
- Camera helps doctor to know the real time condition of patient so that any important instructions needs helpful for the patient can be given by doctor through writing it in input box of webpage.
- By getting doctor comes to be able to gives prescription accordingly and can guide with helpful suggestions to the patient's side for patient to be healthy.

IV. RESULTS

The implemented system results the temperature & pulse rate measured reading of patient's health which may be at remote place from doctor's place. Through the internet medium these health parameters measured reading can be easily accessible by doctor from remote location just by using patient's side IP address by the doctor which is provided by patient's side during getting the attention of doctor's towards the patient's.

Fig.7: Snapshot showing result of temperature & pulse rate measured reading

By using the input box provision on chatting web page in implemented system doctor can send prescription to the patient which may be at remote place and similarly by using patient side computer with chatting web page patient can send any type message to the doctor e.g. Blood pressure reading, sugar level by using traditional instruments of measurement and also can send any message patient side wish to send.

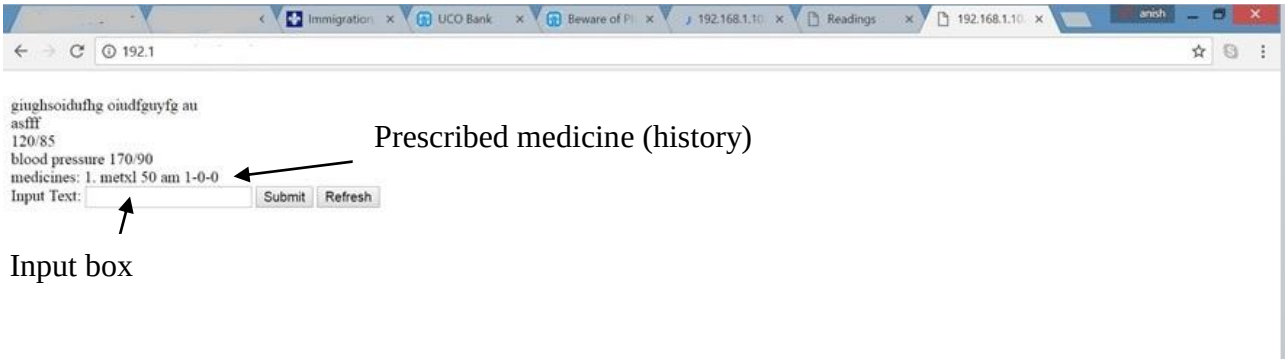

Fig.8: Snapshot of doctor's side chatting web page with medicines by doctor & health parameter reading manually from patient's side

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Innovating part in the implemented system of live monitoring in the form of video is results successfully; in order to view the live streaming at patient's side doctor needs to use IP address along with port address.

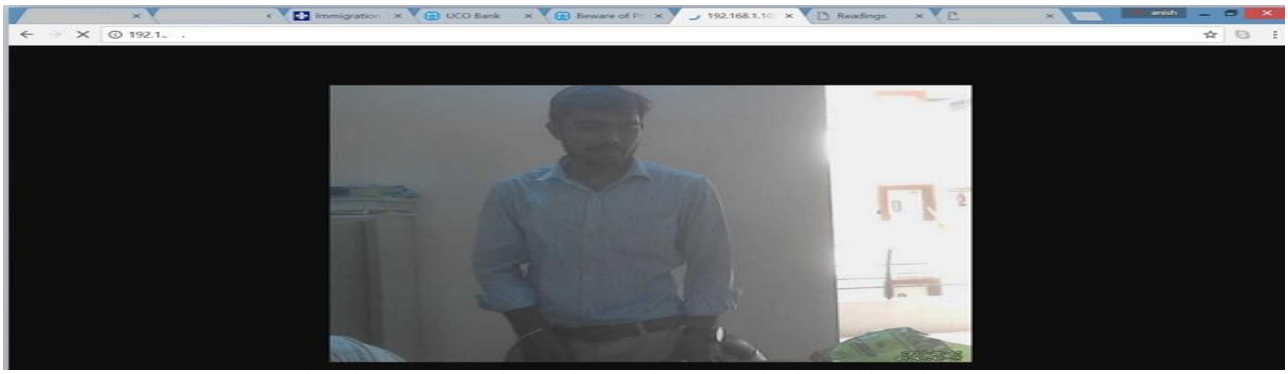

Fig.9: Snapshot which showing such type of output video scene of patient's side on doctor's computer

V. CONCLUSION AND FUTURE WORK

From the implemented system I want to conclude that the system is very beneficial in order to get treatment in emergency situation. At village side in emergency patient needs to refer to city place due to lack of resources available, suppose such type of system made available to such place with basic requirements for avoiding risk, then village side patient can be healthy and can get proper treatment and guideline on right time. The new idea which I am using in the system, camera which can helps to doctor for observing the patient in the form of video is just like visiting to patient which may be at remotely located place in order to get the patient's real time condition so that doctor can suggest any type of suggestion if any requires by doctor's observation.

By making some improvement in implemented system such as by inclusion of other few sensors may be easily available as because of day by day technology updating. And by some improvement in internet networking (i.e. registering to the server for system's improvement result) of implemented system then system can results the best system in future.

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BIOGRAPHY

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