



## ICU MONITORING SYSTEM USING RASPBERRY PI

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### Abstract-

The aim of this project is to have a quantitative assessment of the important physiological variables of patient using "Raspberry Pi". This system is used for measuring continuously automatically the values of patient's physiological parameters such as body temperature, blood pressure, heart activity and humidity content present in the ICU room. This unit may be inserted in a bedside display unit to display the physiological conditions of the patients. The device detects vital parameters of the patient by the use of sensors and displays result on an monitor screen mounted on the gadget. If this values are not within the safe limit, then corresponding LED indicator will glow and alarm will start ringing.

### Keywords-

*Raspberry pi, Heart rate, Blood pressure, ICU monitoring.*

### I. INTRODUCTION

Patient monitoring refers to the continuous observations of important physiological characteristics of patient with the help of life support equipments.

Generally, ICU monitoring consists of monitoring of physiological characteristics of patient such as Blood Pressure, Heart Rate, Body Temperature, SPO<sub>2</sub>, ECG, Respiration Rate & humidity content present in the ICU room. The parameters such as heart rate & ECG needs continuous monitoring. Because sudden stoppage of heart causes sudden death. So, the patient must be treated within 15-20 seconds after detecting the heart problem. The ICU monitoring systems that are presently being used are very much expensive that costs around 2-2.5 lakhs. Also there are some chances of accidents at the night due to human deficiencies such as lack of observations, behavior of the human at night called as Dementia.

The aim of this project is to have a quantitative assessment of the important physiological variables of patient using "Raspberry Pi". This system is used for measuring continuously & automatically the values of patient's physiological parameters such as body temperature, blood pressure, heart activity and humidity content present in the ICU room. This unit may be inserted in a bedside display unit to display the physiological conditions of the patients. The device detects vital parameters of the patient by the use of sensors and displays result on the

monitor screen mounted on the gadget. If these values are not within the safe limit, then corresponding LED indicator will glow and alarm will start ringing.

The proposed system will continuously monitor the patients physiological behavior, providing real time monitoring system. But to interpret the results to the human eye, the monitor display will update at regular time intervals. The proposed system will reduce the staff requirement in the ICU. The major reasons for the development of this system is to reduce product size, power consumption & cost of the system and overall the greatest advantage of the system is Raspberry pi can handle monitoring of all these parameters more effectively.

### II. SYSTEM MODULE:

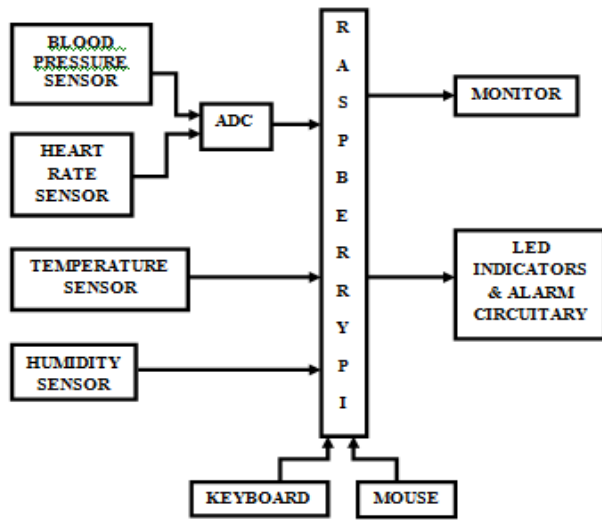


Figure 1. Block diagram of proposed work

#### A. GENERAL EXPLANATION OF BLOCK DIAGRAM:

Fig. shows the block diagram of ICU monitoring system using Raspberry Pi. Various physiological signals such as body temperature, blood pressure, heart activity and humidity (presence of moisture content in air) are continuously monitored with this system. Various types of sensors are used to sense this bioelectric signals. The signals obtained from temperature and humidity sensor(DHT11) are in digital form which are directly fed to the microcontroller. But the signals obtained from heart rate and blood pressure sensors are in analog form which are converted into digital form using Analog to Digital Converter (ADC).The ADC output is fed to the microcontroller. Microcontroller receives digital form of variables. These variables are compared with desired values stored in the processor and displays it on the monitor display. If this are not within the safe limit, then it is indicated by using LED indicators and alarm system. Processor continuously does this work, providing a real time monitoring of these variables.

The microcontroller preferred for this proposed system is Raspberry Pi. The Raspberry Pi is a low cost, credit - card sized computer that plugs

into a computer monitor or TV and uses a standard keyboard and mouse. It is a little computer capable of being used in electronics projects and for many of things that your desktop PC does, like spreadsheets, word-processing, browsing the internet and games. It allows the users to learn how to program in languages like Scratch and Python.

### III. RELATED WORK RESULTS

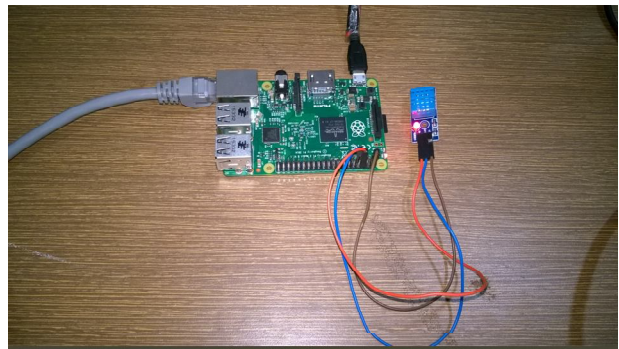


Figure 1. Experimental setup

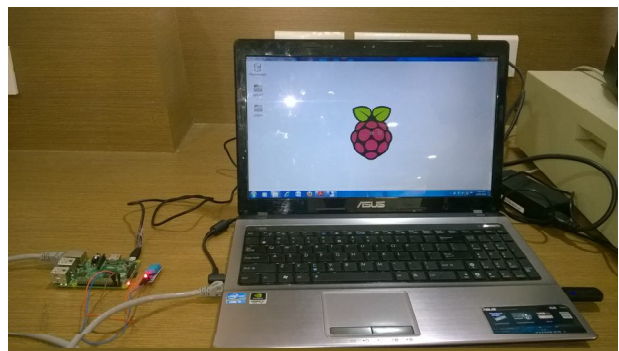


Figure 2. Installation of OS

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import os
import time
import sys
import Adafruit_DHT as dht

import RPi.GPIO as GPIO ## Import GPIO Library

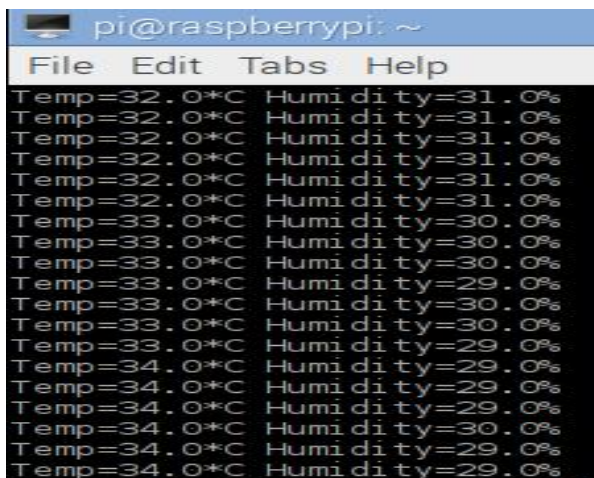
pin = 4                                ## We're working with gpio 4
GPIO.setmode(GPIO.BCM)                ## Use BCM pin numbering
GPIO.setup(pin, GPIO.OUT)              ## Set gpio 4 to OUTPUT

while True:
    h,t=dht.read_retry(dht.DHT11, pin)
    print 'Temp={0:0.1f}*C Humidity={1:0.1f}%'.format(t, h)
    # temp={0:0}.format(t)
    # hum={1:0}.format(h)
    # message = {'temperature': temp, 'humidity': hum}
    # print 'Temp={0:0.1f}*C Humidity={1:0.1f}%'.format(t, h)
    time.sleep(1)                      ## Wait 1 second

GPIO.cleanup()                         ## Cleanup
  
```

Figure 3. Source code(Temperature & Humidity)

Figure 4.Result



```

pi@raspberrypi: ~
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Temp=32.0*C Humidity=31.0%
Temp=32.0*C Humidity=31.0%
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#### IV. CONCLUSION:

We have described the application of “Raspberry Pi” in medical field for ICU patients monitoring. The system will continuously monitor the important physiological parameters of the patient such as blood pressure, heart rate, body temperature & humidity content present in the ICU room, thus providing real time monitoring system. The proposed system will overcome the chances of accidents at night hours due to the human deficiencies such as lack of observations, behavior of the human at night called as Dementia.

The results obtained from blood pressure, heart rate, body temperature and humidity sensors

using Raspberry Pi proves better solution due to its advantages such as better accuracy, design security, productivity, speed and flexibility. The system gives better performance in cases where staff available in the ICU is less. In such situations, the system will eliminate staff requirement in the ICU and the nurses will devote more time for the patients care which is in critical situation.

In future, we can extend monitoring system capacity by including respiration rate and ECG. Here, we have considered only four parameters due to the cost limitation. We can also inform the doctor by SMS when the patient is in critical condition. Also the output of the proposed system can be fed to the life support equipments which are used to normalize the parameters if they exceed the permissible limits.

#### V. REFERENCES:

##### Books:

- Introduction to Biomedical Equipment Technology- Carr Brown.
- Biomedical Instruments- Cromwell
- Hand book of Medical Instruments- R.S. Khandpur
- Introduction to Biomedical Electronics- Edward J. Bukstein
- Medical Instrumentation- John G. Webster, John Wiley

##### Web Resources:

- [www.raspberrypi.org](http://www.raspberrypi.org)
- [www.embeddedarm.com](http://www.embeddedarm.com)
- <http://rasp.io/portsplus>
- [www.national.com](http://www.national.com)
- [www.diodes.com](http://www.diodes.com)
- <http://www.sunrom.com>
- [www.datasheets.com](http://www.datasheets.com)