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# IoT in Health Monitoring System.

Deepika R Thawre[1], Priti Subramanium[2], Dinesh D Patil[3]

[1]*ME Scholar, Department of Computer Science, SSGB College of Engineering and Technology, Bhusawal, Maharashtra, India*
[2]*Professor, Department of Computer Science, SSGB College of Engineering and Technology, Bhusawal, Maharashtra, India*
[3]*Professor, Department of Computer Science, SSGB College of Engineering and Technology, Bhusawal, Maharashtra, India*

## ABSTRACT

***Generally it is very hard to find the abnormalities in the heart beat count of a patient. The average count of 25 years old ranges from 140 to 170 beats/minute, whereas in 60 years old people, it ranges from 115 to 140 beats /minute. Patients are not satisfied with the treatment which doctors normally use for finding the heartbeat count. So there should be a device to track the internal changes in the human body. There are different types of instruments are available in the market to track internal body changes, but there are some limitations due to their heavy cost, maintenance, instrument size and the patient's mobility Here is a device namely wireless health monitoring system used to overcome this problem like easy to use, small in size, light weight and portable. This device uses a heartbeat sensor to track the patient's heart beat count and also abnormalities. The healthcare industry is in a state of great despair. Healthcare services are costlier than ever, global population is aging and the number of chronic diseases are on a rise.***

***Medical diagnostic consumes a large part of hospital bills. Technology can move the routines of medical checks from a hospital (hospital-centric) to the patient's home (home-centric). The right diagnosis will also lessen the need of hospitalization. A new paradigm, known as the Internet of Things (IoT), has an extensive applicability in numerous areas, including healthcare. The full application of this paradigm in healthcare area is a mutual hope because it allows medical centers to function more competently and patients to obtain better treatment. With the use of this technology-based healthcare method, there are unparalleled benefits which could improve the quality and efficiency of treatments and accordingly improve the health of the patients.***

***Keyword – IoT, Health Care, Arduino, Home centric and Blood Pressure Sensor.***

## 1. Introduction

The advantage of today's rapidly growing technology and innovation should be adopted to improve access to quality health care services for patients in their local health centers. Health care service delivery is the management and delivery of health services for comprehensive preventive and curative services, according to the needs of individuals over time and across various levels of health system. Quality health care services are important for increasing everyone's quality of health, gaining quick access into a health care system, preventing disease and disability, detecting and treating health conditions, and thus preventing death due to negligence. Access to health care services comprises of coverage, services, timeliness and workforce. This paper focuses on patients' health care, which is to improve the health and wellbeing of patients through the use of IoT and e-Health solutions.

### 1.1 Objective

Developing a system for the users to achieve the following objectives:

- To develop gathering patient medical data that was never before available for analysis and delivering care to people for whom care wasn't previously accessible.

- To develop IoT-driven systems for making it possible to radically reduce costs and improve health by increasing the availability and quality of care.
- To develop and manufacture embedded technologies for use throughout IoT-driven healthcare systems, including:
  • Sensors that collect patient data.
  • Microcontrollers that process, analyzed and wirelessly communicate the data.
  • Microprocessors that enable rich graphical user interfaces.
- To develop Healthcare-specific gateways through which sensor data is further analyzed and sent to the cloud.
- To execute queries that can arrange data of tables in the form ascending order and descending order. related your research work Introduction related your research work Introduction related your research work Introduction related your research work Introduction related your research work.

### 1.2 System Designing:

We have designed a system that will take help of GSM cellular network for wireless communication. GSM modem SIM800C has interfaced with Arduino Mini-Pro board which will act as a heart of system, the Arduino board will be responsible to communicate with GSM modem, DHT11 (Temperature and Humidity Sensor), Blood Pressure sensor and 16x2 LCD. For power management purpose system can be powered from Power Bank.

## 2. CIRCUIT DIAGRAM

Arduino is open source hardware and software this is the reason for popularity of Arduino hardware and software. When system will power up Arduino will initialize LCD for debugging purposed, everything that is happening inside the controller can be monitored on LCD. Almost all GSM modems works on AT command, so to check weather GSM modem is connected to controller or not controller send AT command Serial to modem and if in response to AT command modem reply with OK that means modem is now ready to accept further commands. Then after connecting to modem system creates HTTP connect with server using GPRS Technology and AT commands. If it gets successfully connected to server system will check readings from Blood Pressure Sensor and DHT11 (Temperature & Humidity) Sensor. System upload provide reading to webserver with the help of HTTP connecting and PHP scripting on server side using INSERT Query on MySQL database.

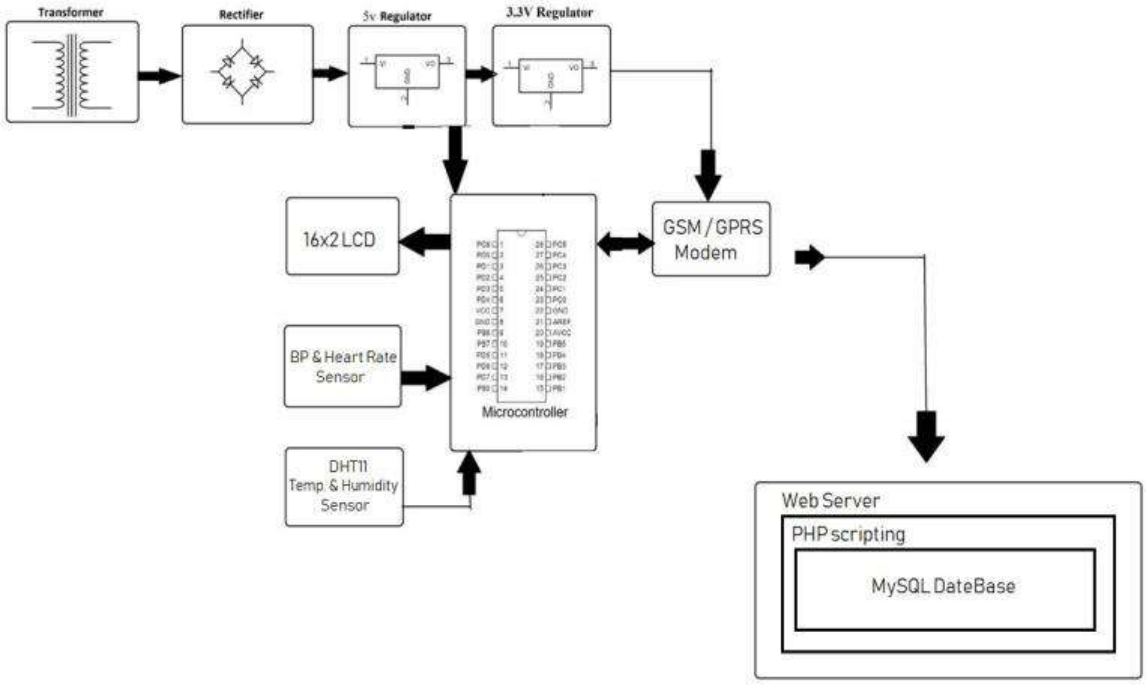


**Fig -1**: Circuit Diagram of System.

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On browser side we are going to request for the PHP page that will connect to MySQL database and generate table view with the help of CSS and Twitters Bootstrap Library. In browser view we have provided two tabs, one for recent reading and another is for historical reading. By using historical reading we can track historical medical permanents of person to with system is connected. We have also provided live view of parameters using AJAX call and JavaScript.

### 2.1 **System Flow Chart**

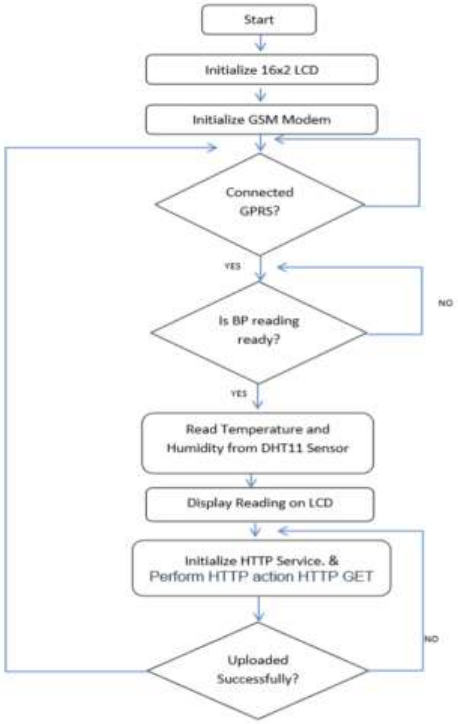



Fig-2 Hardware side flowchart

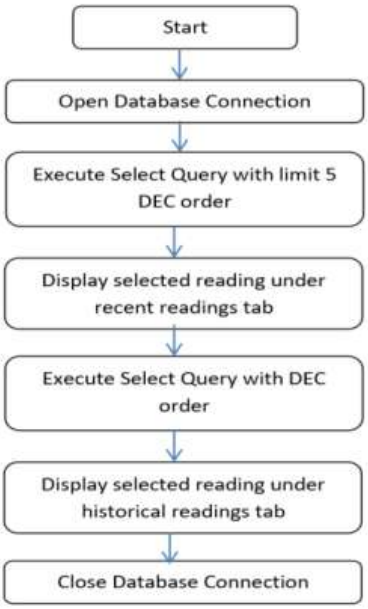



Fig-3 Browser side flowchart

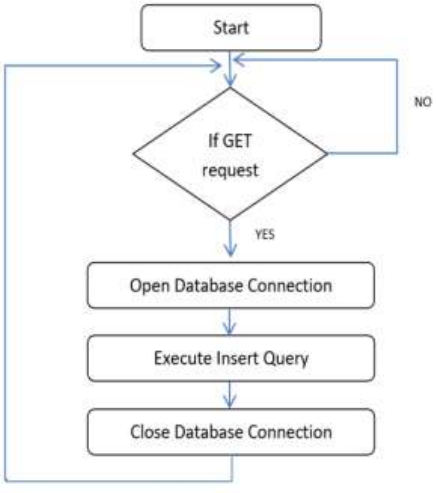



Fig-4 Server side flowchart

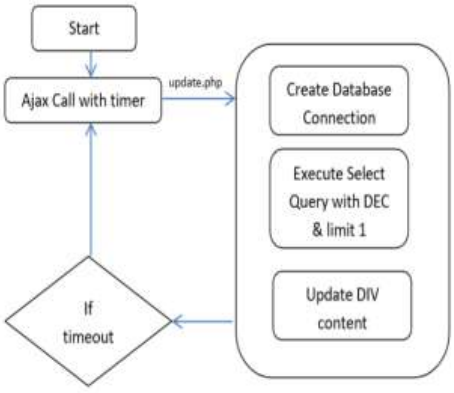
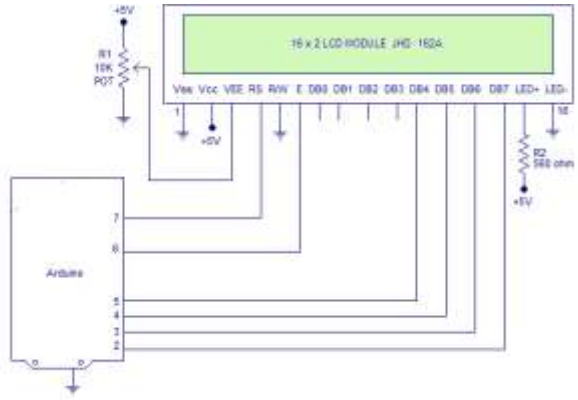



Fig-3 Live Reading flowchart

**2.2 LCD interfacing with Arduino**



16x2 LCD has interface with Arduino mini-pro, 16x2 LCD have 16 pins 8-data pins, 3-control pins, 3-power & contrast control pins and 2-for LED backlight. Arduino gives facility to interface LCD in 4-bit or 8-bit mode. In our system we interfacing LCD in 4-bit mode as show in above fig.

**2.3 SIM800C GSM Modem with Arduino**

SIM800C GSM/GPRS modem has interface with Arduino using serial protocol, Arduino mini pro has one full duplex serial port with UART hardware inside. Arduino and modem communicates with each other at baud rate of 9600 that is standard and preferable baud rate for serial communication. Whenever Arduino want to get some work done using modem it send required AT commands. GPRS stands for General Packet Radio Services which is a packet based wireless communication service that works with data rate of 56-114kbps and provides a connection to the internet. There are many AT commands already mentioned in the datasheet of SIMCOM SIM800C GSM module.

***2.3.1Commands for initializing GSM:***

AT :- this command is used to check whether GSM module is responding or not.
AT+CPIN? :- this command is used to check whether SIM card is inserted in GSM Module or not.
ATE0 :- is used for disabling echo
ATE1 :- is used for enabling echo

***2.3.2Commands for initializing GPRS internet connection:***

AT+CIPSHUT :- to close TCP Port Explicitly means disconnect connection if any
AT+CGATT? :- Checking SIM card has internet connection or not
AT+CSTT = "APN","userName","Pass" :- connect to internet
(ex; AT+CSTT="airtelgprs.com","","")
AT+CIICR :- bring up with the wireless network. Checking SIM card has data pack or balance
AT+CIFSR :- get IP (sometimes without this command GSM do not work so use this command)
AT+CIPSTART = ”TCP”,”SERVER IP”,”PORT” :- is used for creating TCP connection with the server that we provide in place of SERVER IP
AT+CIPSEND :- this command is used for sending data to the server. After input, this command server asks for data.

**2.4 Blood Pressure Sensor**

Arduino has only one Serial port and Blood Pressure sensor also needs Serial port for communication to solve the issue we are using Arduino software serial library to create software Serial port. Blood Pressure & Pulse reading are shown on display with serial out for external projects of embedded circuit processing and display. Shows Systolic, Diastolic and Pulse Readings. Compact design fits over your wrist like a watch. Easy to use wrist style eliminates pumping.

Blood pressure is the pressure of the blood in the arteries as it is pumped around the body by the heart. When your heart beats, it contracts and pushes blood through the arteries to the rest of your body. This force creates

pressure on the arteries. Blood pressure is recorded as two numbers— the systolic pressure (as the heart beats) over the diastolic pressure (as the heart relaxes between beats). The unit which measures this is called Sphygmomanometer.

Monitoring blood pressure at home is important for many people, especially if you have high blood pressure. Blood pressure does not stay the same all the time. It changes to meet your body's needs. It is affected by various factors including body position, breathing or emotional state, exercise and sleep. It is best to measure blood pressure when you are relaxed and sitting or lying down.

| Age | Min | Normal | Max |
|---|---|---|---|
| 1 to 12 months | 75 / 50 | 90 / 60 | 100 / 75 |
| 1 to 5 years | 80 / 55 | 95 / 65 | 110 / 79 |
| 6 to 13 years | 90 / 60 | 105 / 70 | 115 / 80 |
| 14 to 19 years | 105 / 73 | 117 / 77 | 120 / 81 |
| 20 to 24 years | 108 / 75 | 120 / 79 | 132 / 83 |
| 25 to 29 years | 109 / 76 | 121 / 80 | 133 / 84 |
| 30 to 34 years | 110 / 77 | 122 / 81 | 134 / 85 |
| 35 to 39 years | 111 / 78 | 123 / 82 | 135 / 86 |
| 40 to 44 years | 112 / 79 | 125 / 83 | 137 / 87 |
| 45 to 49 years | 115 / 80 | 127 / 84 | 139 / 88 |
| 50 to 54 years | 116 / 81 | 129 / 85 | 142 / 89 |
| 55 to 59 years | 118 / 82 | 131 / 86 | 144 / 90 |
| 60 to 64 years | 121 / 83 | 134 / 87 | 147 / 91 |

Table-1: Classification of blood pressure

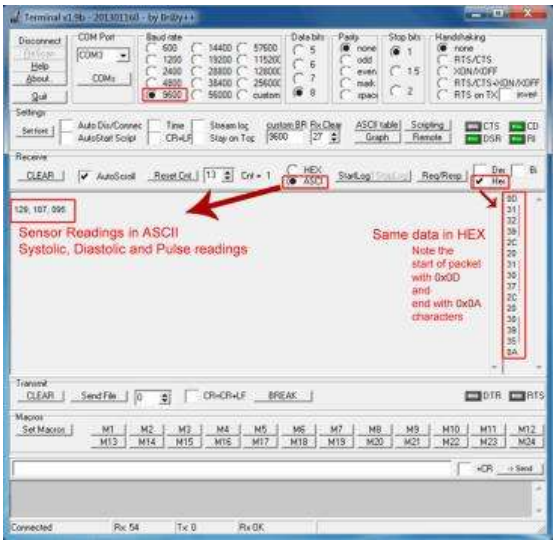



Fig 2.3 - Output Window for Blood pressure sensor

## 3. CLIENT SIDE PROGRAMMING


Fig3.1 : Libraries used

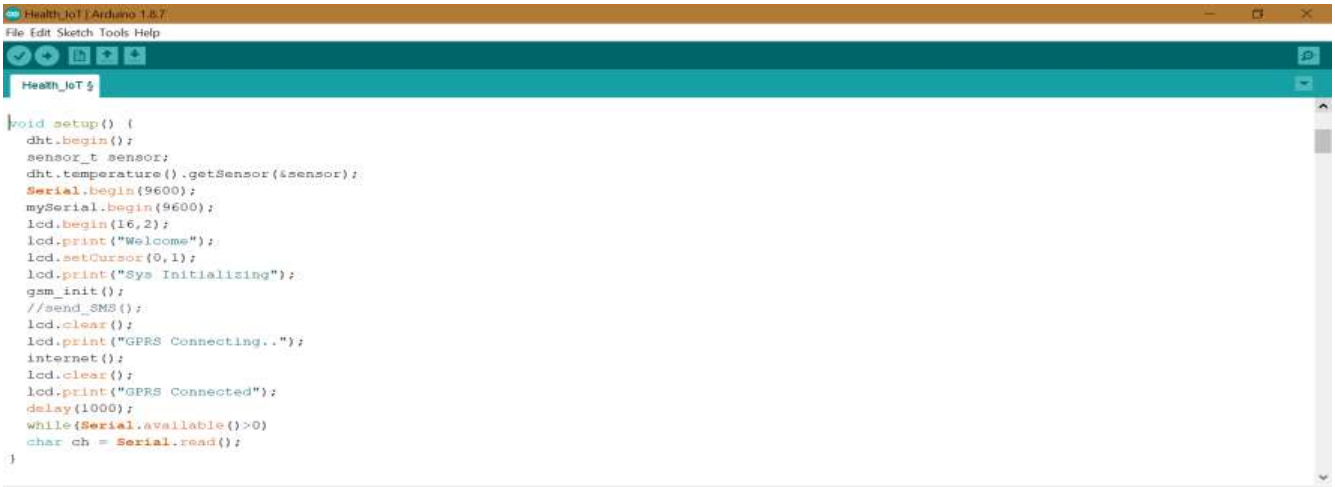



Fig3.2: Setup Function


Fig3.3: Loop function

## 4. SERVER SIDE PROGRAMMING

### 4.1 MySQL Code:

```
SET SQL_MODE = "NO_AUTO_VALUE_ON_ ZERO";
SET AUTOCOMMIT = 0;
START TRANSACTION;
SET time_zone = "+00:00";
/*!40101 SET @OLD_CHARACTER_SET_CLIENT =@@CHARACTER_SET_CLIENT */;
/*!40101 SET @OLD_CHARACTER_SET_RESULTS =@@CHARACTER_SET_RESULTS */;
/*!40101 SET @OLD_COLLATION_CONNECTION =@@COLLATION_CONNECTION */;
/*!40101 SET NAMES utf8mb4 */;
--
-- Database: `user`
--

-- --------------------------------------------------------
--
-- Table structure for table `deepika`
--
CREATE TABLE `deepika` (
  `id` int(11) NOT NULL,
  `hr` varchar(10) DEFAULT NULL,
  `temp` varchar(10) DEFAULT NULL,
  `hum` varchar(10) DEFAULT NULL,
  `sys` varchar(10) DEFAULT NULL,
  `dys` varchar(10) DEFAULT NULL,
  `date` datetime NOT NULL DEFAULT CURRENT_ TIMESTAMP) ENGINE=MyISAM DEFAULT CHARSET=latin1;
```

### 4.2 PHP Scripting:

#### 4.2.1 PHP script to insert value in Database

```
<?php
$host = "localhost";
$userName = "s*****";
$password = "********";
$dbName = "user";
 // Create database connection
$conn = new mysqli($host, $userName, $password, $dbName);
 // Check connection
if ($conn->connect_error) {
die("Connection failed: " . $conn->connect_error);
}
$pulse= $conn->real_escape_string($_GET['pulse']);
$temp = $conn->real_escape_string($_GET['temp']);
$hum = $conn->real_escape_string($_GET['hum']);
$location = $conn->real_escape_string($_GET['location']);
$sql="INSERT INTO sensor (pulse, temp, hum, location) VALUES ('".$pulse."','".$temp."','".$hum."', '".$location."')";
 if(!$result = $conn->query($sql)){
die('There was an error running the query [' . $conn->error . ']');
}
else
{
echo "Registered...! login to continue";
echo $pulse;
}
?>
```

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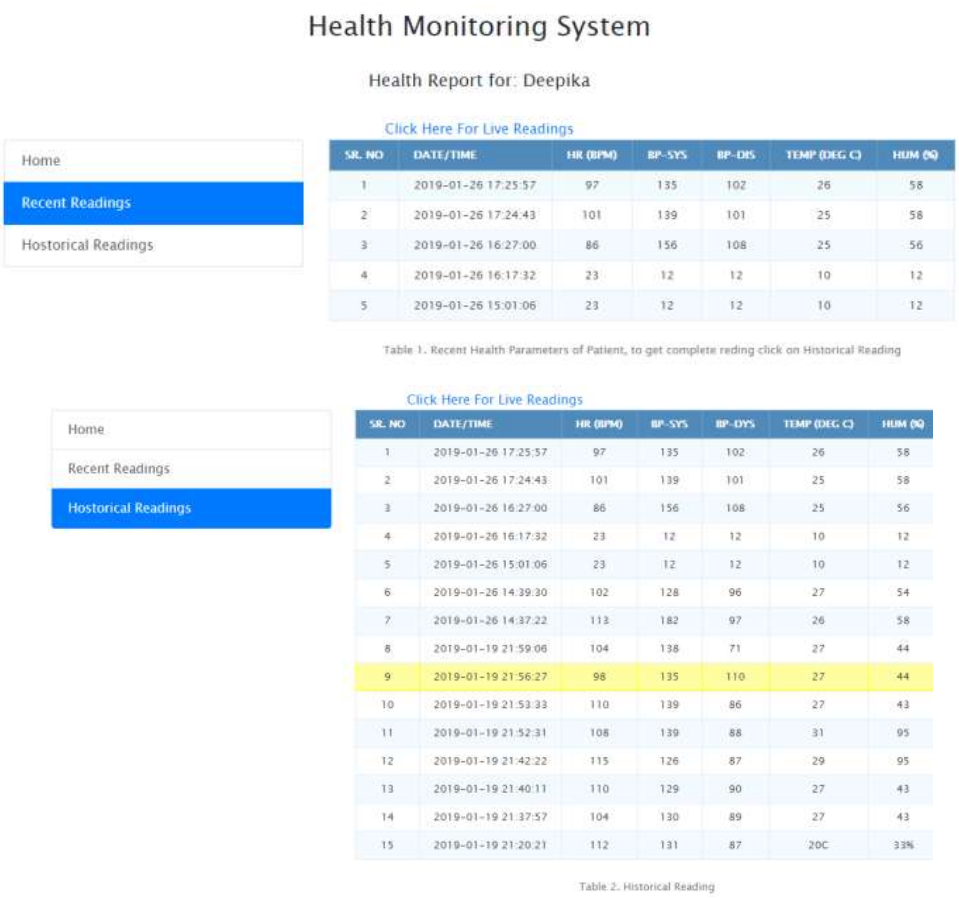
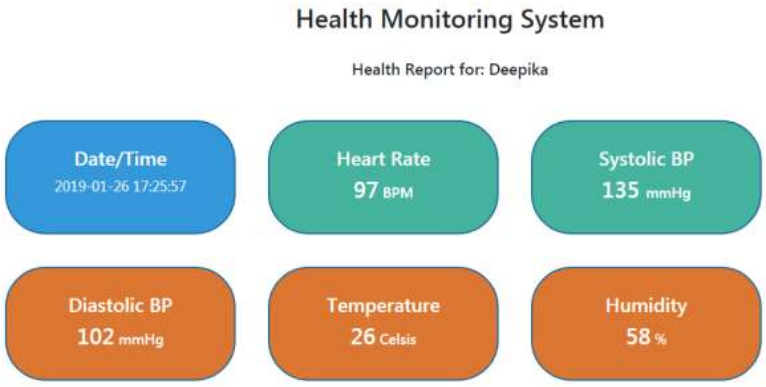
### 4.2.2 PHP script to read and show values from database

```
<?php
$servername = "localhost";
$username = "s*****";
$password = "******";
$dbname = "user";
?>
 <?php $conn = new mysqli($servername, $username, $password, $dbname);
                        // Check connection
if ($conn->connect_error) {
die("Connection failed: " . $conn->connect_error);        }
      else {
                        $sql = "SELECT * FROM sensor ORDER BY id DESC LIMIT 5";
                        $result = $conn->query($sql);
                        if ($result->num_rows > 0) { $count=1; ?>
                        <table class="demo-table">
<caption class="title"> <center>Table 1.
            Recent Health Parameters of Patient, to get complete reding click on Historical Reading</center></caption>
<thead>
<tr>
<th>Sr. No</th>
<th>Date/Time</th>
<th>Heart Rate (BPM)</th>
<th>Temperature (Deg C)</th>
<th>Humidity (%)</th>
</tr>
</thead>
<tbody>
<?php
while($row = $result->fetch_assoc()) { ?>
<tr>
<td  style="text-align:center"><?php echo $count ?></td>
<td style="text-align:center"> <?php echo $row["date"] ?></td>
<td style="text-align:center"><?php echo $row["pulse"] ?></td>
<td style="text-align:center"><?php echo $row["temp"]?></td>
<td      style="text-align:center"><?php      echo      $row["hum"];
$count++?></td>
                                    </tr>
                        <?php } ?>
                        </tbody>
                        </table>
                        <?php
            }           else {
                                                echo "0 results";
                        }
                        }
                        $conn->close();
                        ?>
```

## 5. OUTPUT OF SYSTEM.






## 4. CONCLUSIONS

The rapid advancement of cloud computing, mobile applications and wearable devices facilitates the IoT‟s role in transforming the traditional approach to healthcare into smart and personalized healthcare. The IoT-enabled healthcare systems can be categorized under three primary areas, as follows: monitoring and controlling, information sharing and collaboration, and big data and data analytics.
The IoT enabled health care devices offers wide sensor connectivity like Blood Pressure Sensor, Temperature sensor, Humidity sensor, Glucose and $SPO_2$ Sensor.

## 5. ACKNOWLEDGEMENT

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My thanks and appreciations also go to my colleague in developing the project and people who have willingly helped me out with their abilities.

## 6. REFERENCES

[1]. https://www.nxp.com/files-static/corporate/doc/white_paper/IOTREVHEALCARWP.pdf
[2]. https://pdfs.semanticscholar.org/d33e/20dbab9cda34d5fb94d0999f187343ce5786.pdf
[3]. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6109224/
[4]. Z. Jian, W. Zhanli, and M. Zhuang, “Temperature measurement system and method based on home gateway,” N 201110148247, 2012.