



BITS Pilani
Pilani Campus



EEE F411 Internet of Things

IOT Project
Implementation of IOT for Healthcare

BITS Pilani
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Group Members-



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Project hosted link-

<https://health-care-iot-534c9.web.app/>

Github link-

<https://github.com/keshavsethi/Health-Care-IoT>

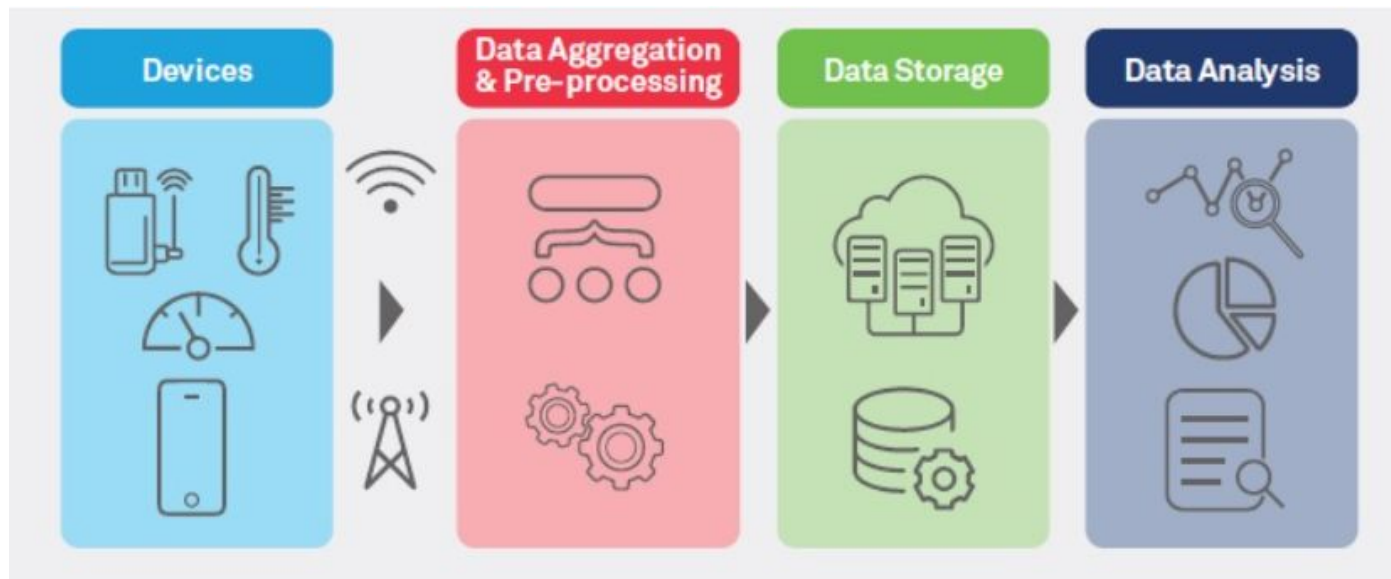
Youtube Video

<https://youtu.be/GL4sibIDw7A>

What can IOT do for Healthcare?



Internet of Things (IoT)-enabled devices have made remote monitoring in the healthcare sector possible, unleashing the potential to keep patients safe and healthy, and empowering physicians to deliver superlative care

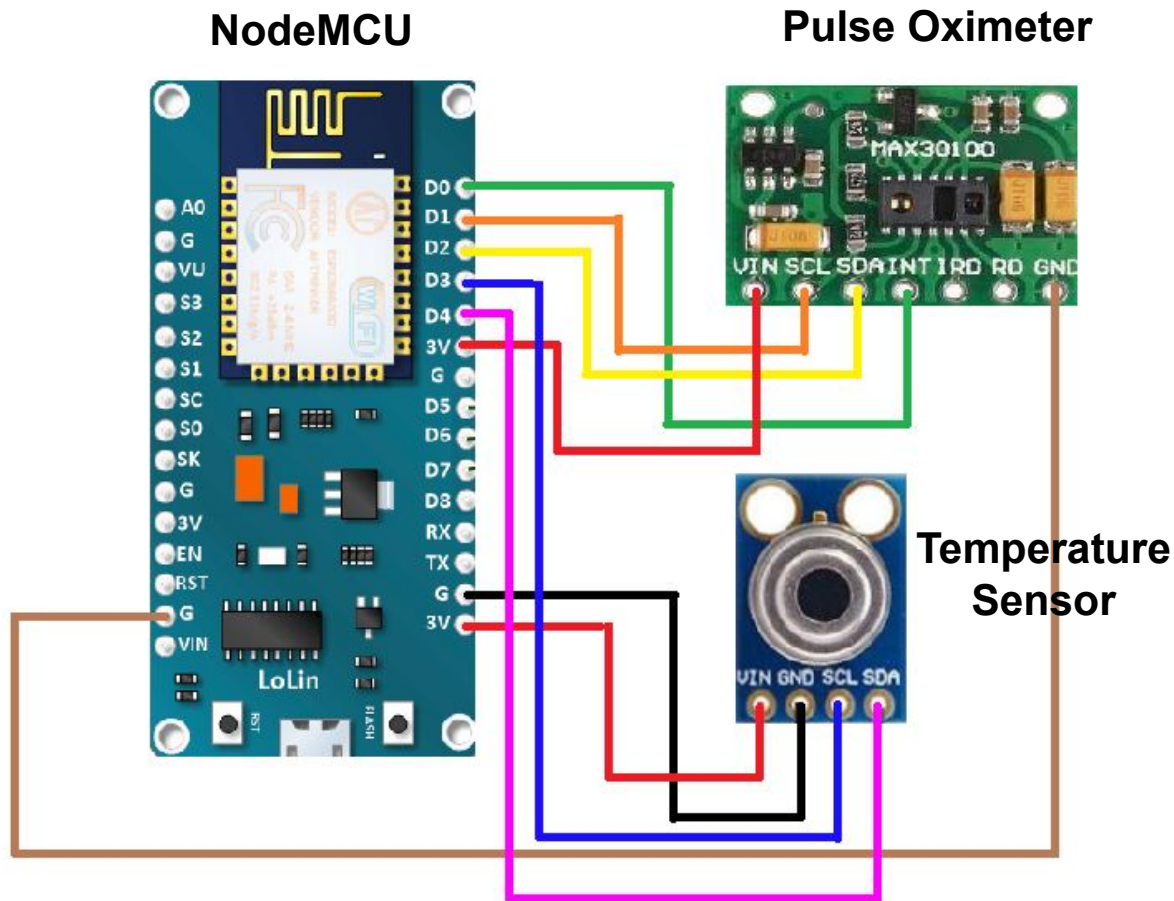


Components Used-

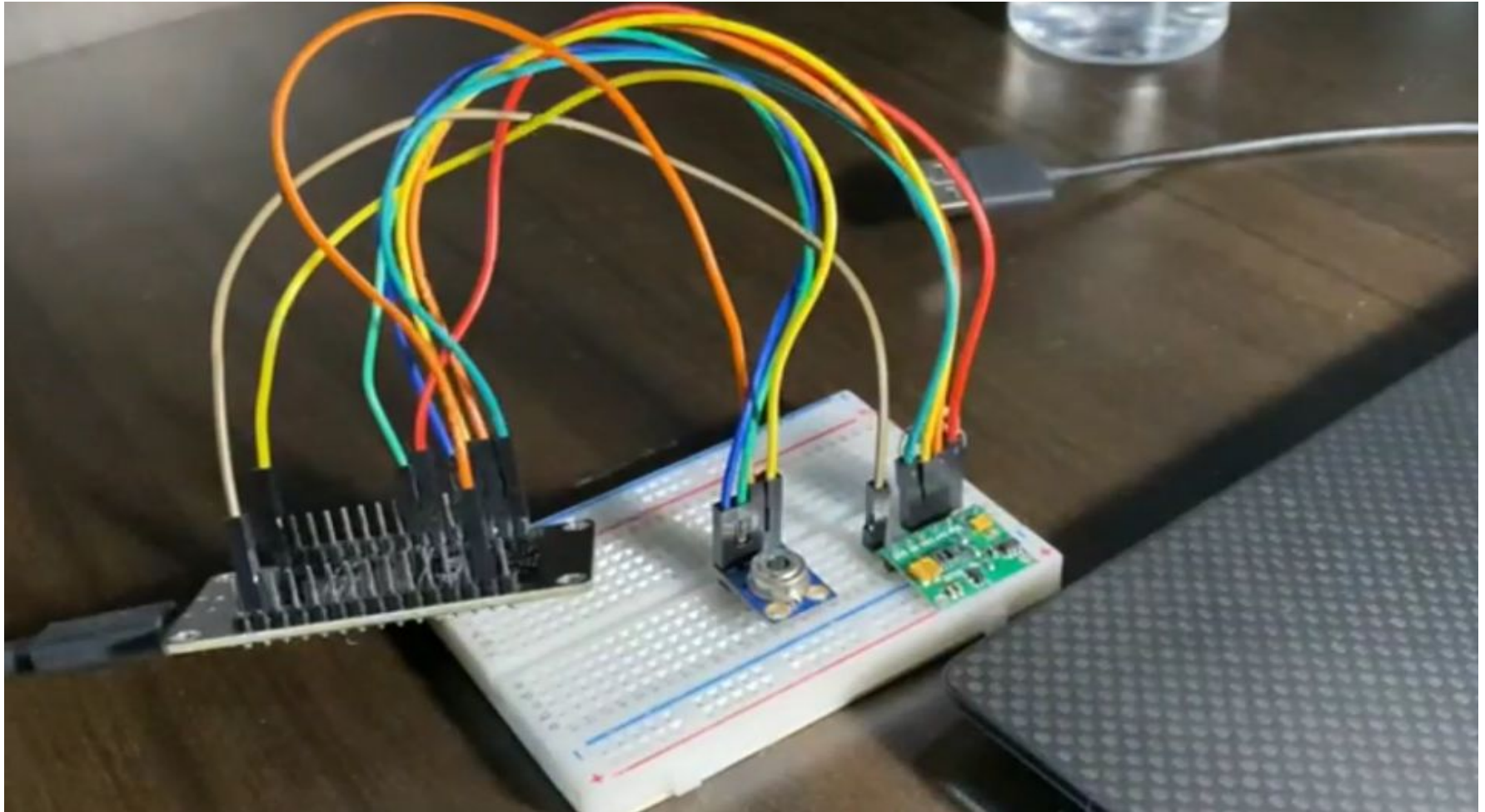


Components	Price
NodeMCU (ESP8266)	Rs. 399
Oximeter sensor (MAX30100)	Rs. 259
Temperature Sensor	Rs. 999
Jumper Wires and Breadboard	Rs. 200
TOTAL	Rs. 1857

Setting up the Hardware



Sensors connections



Setting up Arduino IDE



Pulse oximeter MAX30100

```
#include <Wire.h>
#include "MAX30100_PulseOximeter.h"
#include <ESP8266WiFi.h>
#include "Adafruit_GFX.h"
#define REPORTING_PERIOD_MS 1000
PulseOximeter pox;
float BPM, SpO2;
uint32_t tsLastReport = 0;
void onBeatDetected()
{
    Serial.print("Beat Detected!");
}
```



```
void setup()
{
    Serial.begin(115200);
    pinMode(16, OUTPUT);
    Blynk.begin(auth, ssid, pass);

    Serial.print("Initializing Pulse Oximeter..");

    if (!pox.begin())
    {
        Serial.println("FAILED");
        for(;;);
    }
    else
    {
        Serial.println("SUCCESS");
        pox.setOnBeatDetectedCallback(onBeatDetected);
    }
    delay(1000);
}

void loop()
{
    pox.update();
    Blynk.run();

    BPM = pox.getHeartRate();
    SpO2 = pox.getSpO2();
    ↑ if (millis() - tsLastReport > REPORTING_PERIOD_MS)
    {
        Serial.print("Heart rate:");
        Serial.print(BPM);
        Serial.print(" bpm / SpO2:");
        Serial.print(SpO2);
        Serial.println(" %");

        Blynk.virtualWrite(V7, BPM);
        Blynk.virtualWrite(V8, SpO2);

        tsLastReport = millis();
    }
}
```


Temperature Sensor MLX 90614

```
#include <Wire.h>
#include <Adafruit_MLX90614.h>
Adafruit_MLX90614 mlx = Adafruit_MLX90614();
void setup() {
  Serial.begin(115200);
  Serial.println("Adafruit MLX90614 test");
  mlx.begin();
}
void loop() {
  Serial.print("*C\tObject = ");
  Serial.print(mlx.readObjectTempC());
  Serial.println("*C");
  delay(1000);
}
```

Firestore in Nodemcu



```
#include <FirestoreArduino.h>
#include <NTPCClient.h>
#include <WiFiUdp.h>
#define FIREBASE_HOST "health-care-iot-534c9.firebaseio.com"
#define FIREBASE_AUTH "8GaxVgThl2pqejQZd9BspXR195FrGR4Be9Fea81j"

String B = String(BPM);
String Sp= String(SpO2);
String T = String(Temp);
Firestore.pushString("/data/pulse", B);
Firestore.pushString("/data/oxygen", Sp); |
Firestore.pushString("/data/temp", T);
Firestore.pushString("/data/time", formattedTime);
Firestore.pushString("/data/date", currentDate);

delay(2000);
}
```

Software



Please refer to following links for better understanding

Landing Page

<https://health-care-iot-534c9.web.app/>

Dashboard

<https://health-care-iot-534c9.web.app/dashboard.html>

Datatable

<https://health-care-iot-534c9.web.app/tables.html>

Alert table

<https://health-care-iot-534c9.web.app/alert.html>

Chat bot

<https://health-care-iot-534c9.web.app/demo/chatbot.html>

Firestore for backend



The screenshot shows the Firebase console interface. On the left is a dark sidebar with the 'Firestore' logo and navigation links: Project Overview, Develop (Authentication, Cloud Firestore, Realtime Database, Storage, Hosting, Functions, Machine Learning), Quality (Crashlytics), and Extensions. The main panel is titled 'Health Care IoT' and has tabs for Data, Rules, Backups, and Usage. The 'Data' tab is active, showing a tree view of the database structure. The root node is 'health-care-iot-534c9', which contains a 'data' node. The 'data' node has four sub-nodes: 'date', 'oxygen', 'pulse', and 'temp'. The 'temp' node is expanded, showing a list of temperature readings with their corresponding device IDs.

Health Care IoT ▾

Data Rules Backups Usage

<https://health-care-iot-534c9.firebaseio.com/>

health-care-iot-534c9

- data
 - date
 - oxygen
 - pulse
 - temp
 - MLOXinDVedd5udn8gc6: "35.50"
 - MLOXiramee439rewGSo: "38.50"
 - MLOXlw2mp1qbwaqbQ1l: "36.80"
 - MLOXm-SnAWxNbrxE9qU: "37.00"
 - MLOXm3nIr2-7nOa17TA: "38.90"
 - MLOXm8Bycf8pTIM17gY: "38.60"

```
const config = {  
  apiKey: "AIzaSyCq0dIjUsNL95Uc00JBmhUwGHXtWCtNTLU",  
  authDomain: "health-care-iot-534c9.firebaseio.com",  
  databaseURL: "https://health-care-iot-534c9.firebaseio.com",  
  projectId: "health-care-iot-534c9",  
  storageBucket: "health-care-iot-534c9.appspot.com",  
  messagingSenderId: "214130811754",  
  appId: "1:214130811754:web:a15dbec4a135da9b3d7b13",  
  measurementId: "G-3ZLX17QWM7"  
};  
firebase.initializeApp(config);
```

Landing Page

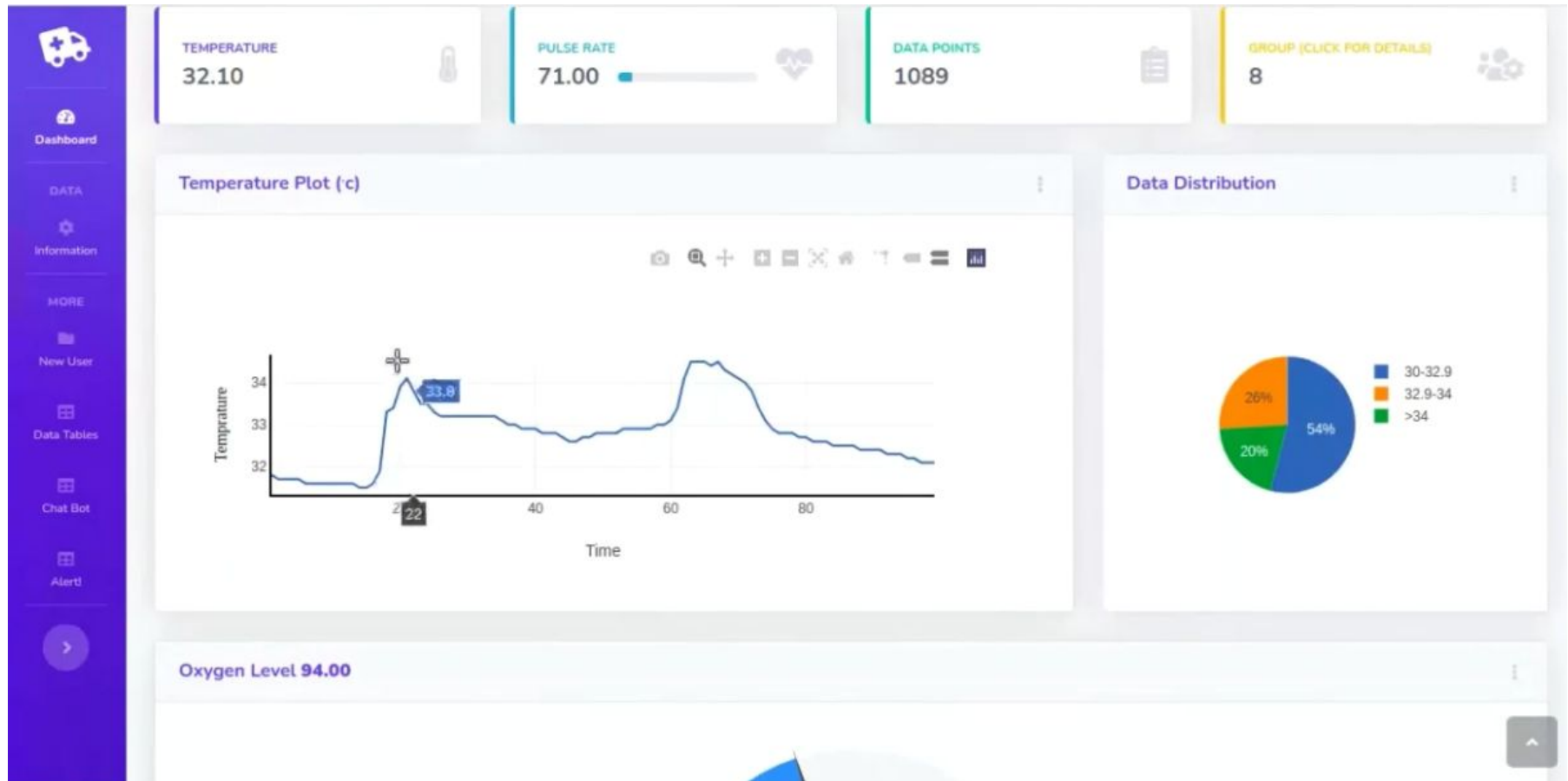
[Features](#)[How It Works](#)[Get Started](#)[Dashboard](#)

HealthCare IoT

"Real-time fever and pulse data could speed up public health the way Twitter sped up the news cycle."

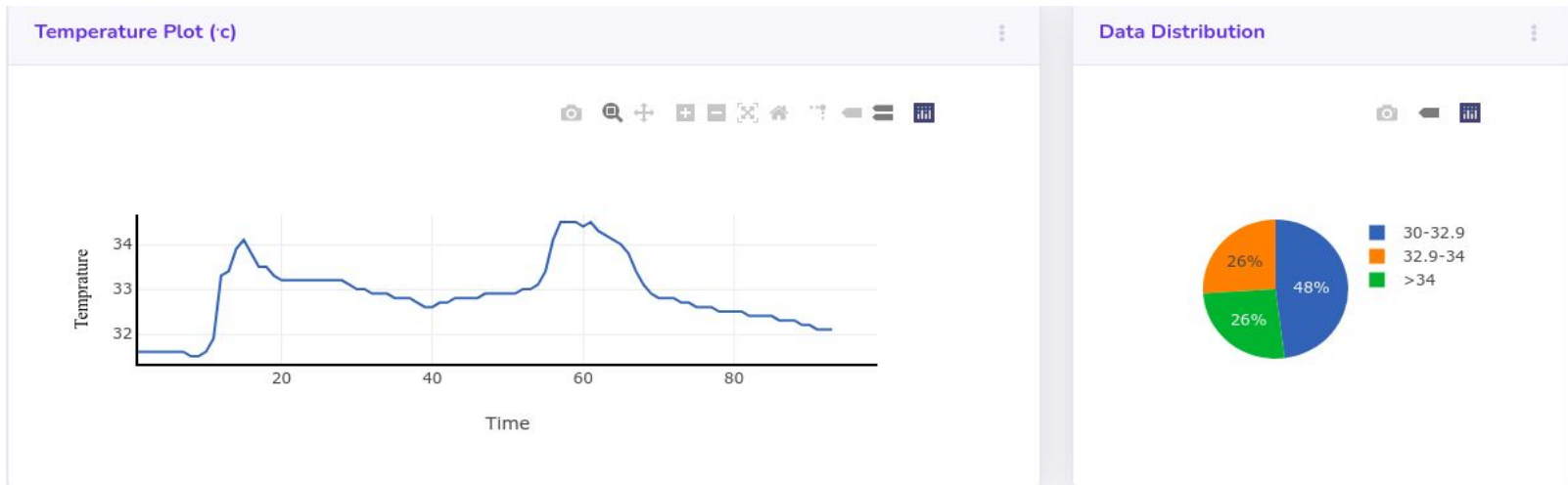
[Dashboard](#)

Dashboard



<https://health-care-iot-534c9.web.app>

Temperature Plot



```
firebase.database().ref('data/temp').limitToLast(100).on('value', ts_measures => {  
  let values = [];  
  let alertvalues=[];  
  let ids = [];  
  let alertids=[];  
  ts_measures.forEach(ts_measure => {  
    values.push(ts_measure.val());  
    document.getElementById("temperature_head").innerHTML= ts_measure.val();  
  });  
  for(i=1;i<=values.length;i++){  
    ids[i]=i;  
  }  
});
```

Temperature Plot



```
148
149     const layout = {
150         height: 300,
151         width: 700,
152         xaxis: {
153             title: 'Time',
154             linecolor: 'black',
155             linewidth: 2
156         },
157         yaxis: {
158             title: 'Temprature',
159             titlefont: {
160                 family: 'Times New Roman',
161                 size: 14,
162                 color: '#000'
163             },
164             linecolor: 'black',
165             linewidth: 2,
166         },
167         margin: {
168             r: 50,
169             pad: 0
170         }
171     }
172     // At last we plot data :- )
173     Plotly.newPlot(myPlotDiv, data, layout, { responsive: true });
174     );
```

Oximeter Blood Oxygen Saturation (SpO2) level



Oxygen Level **95.00**



```
let oxygen;
firebase.database().ref('data/oxygen').on('value', ts_measures => {
  ts_measures.forEach(ts_measure => {
    oxygen = ts_measure.val();
  });
  document.getElementById("o2_head").innerHTML = oxygen;
});
```

SpO2

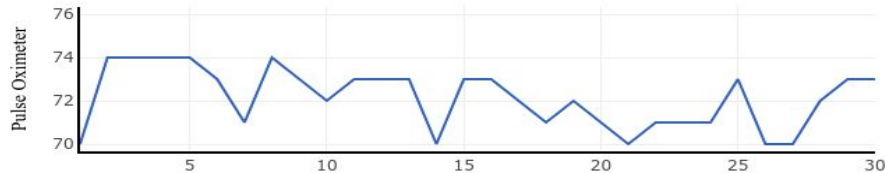


```
var opts = {
  lines: 12,
  angle: 0,
  lineWidth: 0.46,
  pointer: {
    length: 0.68,
    strokeWidth: 0.035,
    color: '#424242'
  },
  limitMax: false,
  colorStart: '#363636',
  colorStop: '#03A9F4',
  strokeColor: '#f5f5f5',
  generateGradient: true,
  highDpiSupport: true
};
var target = document.getElementById('canvas-preview');
var gauge = new Gauge(target).setOptions(opts);
gauge.maxValue = document.getElementById('maxVal').textContent;
gauge.animationSpeed = 32;
gauge.set((oxygen%90)*10);
gauge.setTextField((oxygen%90)*10);
});
```

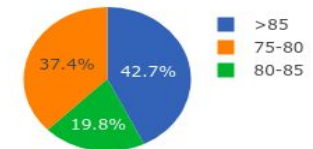
Pulse graph



Oximeter Pulse(bpm) Plot



Data Distribution



```
firebase.database().ref('data/pulse').limitToLast(30).on('value', ts_measures => {  
  let values2 = [];  
  values2[0]=76;  
  let ids = [];  
  ts_measures.forEach(ts_measure => {  
    values2.push(ts_measure.val());  
    document.getElementById("pulse_head").innerHTML = ts_measure.val();  
  });  
  for(i=1;i<=values2.length;i++){  
    ids[i]=i;  
  }  
})
```


Pulse graph



```
$('.progress-bar').css('width', (values2[29]%70)*10+'%').attr('aria-valuenow', (values2[29]%70)*10)
for(i=0;i<values2.length;i++){
    if(values2[i] > 75 && values2[i] < 80 ){
        count1++;
    }
    else if(values2[i] > 80 && values2[i] < 85 ){
        count2++;
    }
    else {
        count3++;
    }
}
// Get a reference to the DOM node that welcomes the plot drawn by Plotly.js:
myPlotDiv = document.getElementById('pulseplot');
mytempp = document.getElementById('mypulse');
var data1 = [{
    values: [count1, count2, count3],
    labels: ['75-80', '80-85', '>85'],
    type: 'pie'
}];

var layout1 = {
    height: 300,
    width: 300
};

Plotly.newPlot(mytempp, data1, layout1, { responsive: true });
```

Datatable for Temperature and Pulse (Latest 200)



Show 10 entries

Search:

id	Temp	Pulse
01:13:44	32.90	73.00
01:18:25	32.40	71.00
01:18:30	nan	72.00
01:18:35	29.70	74.00
01:18:40	29.70	73.00
01:18:45	29.70	70.00
01:18:50	29.80	70.00
01:19:27	29.70	71.00
01:19:32	30.60	72.00

Datatable(Add row method)



```
var table = $('#table1').DataTable ( {
} );
firebase.database().ref('data/temp').limitToLast(200).on('value', ts_measures => {
  ts_measures.forEach(ts_measure => {
    values.push(ts_measure.val());
  });
  for(i=1;i<=values.length;i++){
    ids[i-1]=i;
  }
});

firebase.database().ref('data/time').limitToLast(200).on('value', ts_measures => {
  ts_measures.forEach(ts_measure => {
    time.push(ts_measure.val());
  });
});

firebase.database().ref('data/pulse').limitToLast(200).on('value', ts_measures => {
  let i=0;
  ts_measures.forEach(ts_measure => {
    values.push(ts_measure.val());
    var dataSet = [time[i], values[i],ts_measure.val()];
    table.rows.add([dataSet]).draw();
    i++;
  });
});
```

Chatbot (Duckduckgo API)



Hey I am healthy Bot, How you doin?

Check what can I say?

Play some sample conversations!

Healthy Bot A cough is a sudden expulsion of air through the large breathing passages that can help clear them of fluids, irritants, foreign particles and microbes. As a protective reflex, coughing can be repetitive with the cough reflex following three phases: an inhalation, a forced exhalation against a closed glottis, and a violent release of air from the lungs following opening of the glottis, usually accompanied by a distinctive sound. Frequent coughing usually indicates the presence of a disease. Many viruses and bacteria benefit, from an evolutionary perspective, by causing the host to cough, which helps to spread the disease to new hosts. Most of the time, irregular coughing is caused by a respiratory tract infection but can also be triggered by choking, smoking, air pollution, asthma, gastroesophageal reflux disease, post-nasal drip, chronic bronchitis, lung tumors, heart failure and medications such as angiotensin-converting-enzyme inhibitors.


You cough

Healthy Bot Hey, my friend


You hi


Alert table





Ask our Health Bot....



Keshav Sethi

Alert Hub (Latest 100 data points)

Here you will find all of your past health records safely kept. The aggregate, anonymized data used in this model is a product of high accuracy sensors used for parameters measurement.

"Real-time fever and pulse data could speed up public health the way Twitter sped up the news cycle."
- Nirav Shah(MD, MPH Former New York State Health Commissioner)"

DataTables for Temperature and Pressure

Show entries

id	Temp	Pulse
1	32.90	74.00
2	32.40	74.00
9	30.60	74.00
10	30.60	74.00
11	30.50	74.00

Generating Alert table from Data Table



```
firebase.database().ref('data/temp').limitToLast(200).on('value', ts_measures => {
  ts_measures.forEach(ts_measure => {
    values.push(ts_measure.val());
  });
  for(i=1;i<=values.length;i++){
    ids[i-1]=i;
  }
});
var TEMP_THRESHOLD=32;
var PULSE_THRESHOLD=73;

firebase.database().ref('data/pulse').limitToLast(200).on('value', ts_measures => {
  let i=0;
  ts_measures.forEach(ts_measure => {
    let value=ts_measure.val();
    if(value>PULSE_THRESHOLD) {
      values.push(value);
      if(values[i]>TEMP_THRESHOLD) {
        var dataSet = [ids[i], values[i],ts_measure.val()];
        alerttable.rows.add([dataSet]).draw();
      }
      i++;
    }
  });
});
```


Email Alert



Alert!! Inbox x



healthcare.group8@gmail.com <healthcare.group8@gmail.com>

to me ▾

Thu, Nov 5, 11:07 PM



Hope you are well, your temptature crossed thershold value, Please check!!



healthcare.group8@gmail.com

Hope you are well, your temptature crossed thershold value, Please check!!

Thu, Nov 5, 11:07 PM



healthcare.group8@gmail.com

Hope you are well, your temptature crossed thershold value, Please check!!

Thu, Nov 5, 11:07 PM



healthcare.group8@gmail.com

Hope you are well, your temptature crossed thershold value, Please check!!

Thu, Nov 5, 11:07 PM



healthcare.qroup8@gmail.com

Thu, Nov 5, 11:07 PM



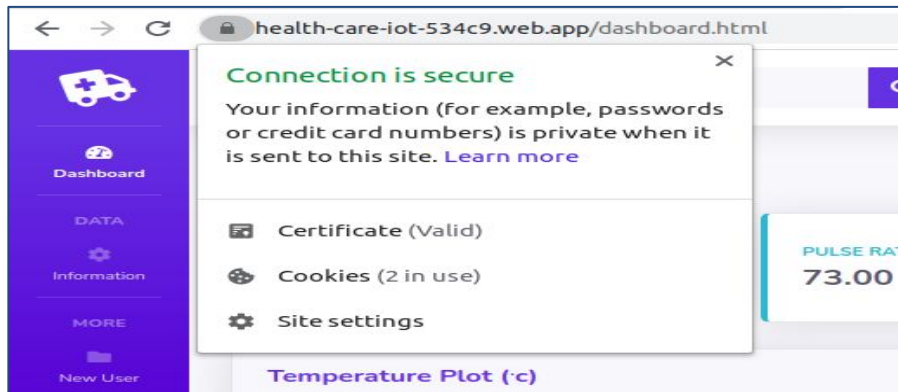
```
if(values[values.length-1] > 34){  
    console.log("email check");  
    Email.send({  
        Host: "smtp.gmail.com",  
        Username: "healthcare.group8@gmail.com",  
        Password: "keshavsethi",  
        To: 'keshav.sethi0004@gmail.com',  
        From: "healthcare.group8@gmail.com",  
        Subject: "Alert!!",  
        Body: "Hope you are well, your temptature crossed thershold value, Please check!!",  
    });  
}
```

Hosted and Secure

innovate

achieve

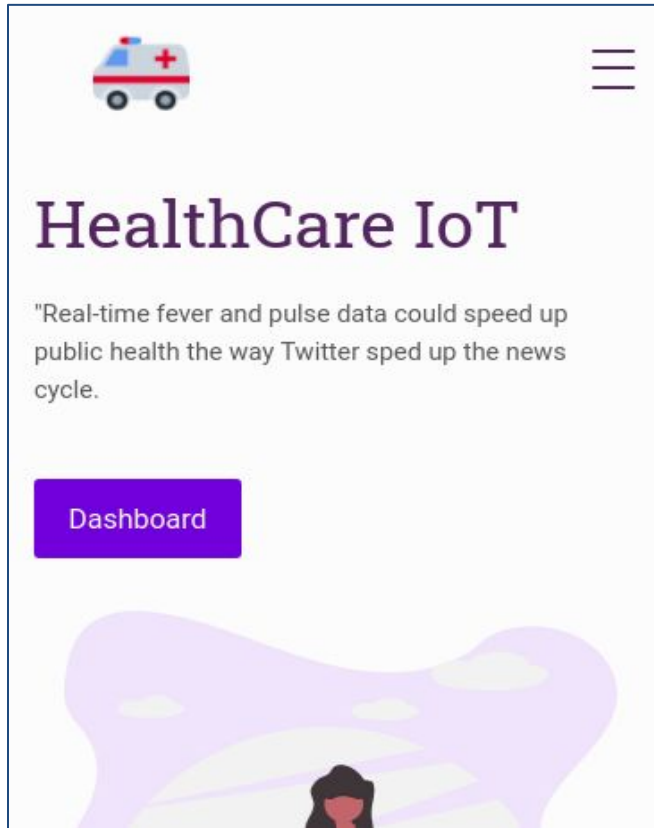
lead



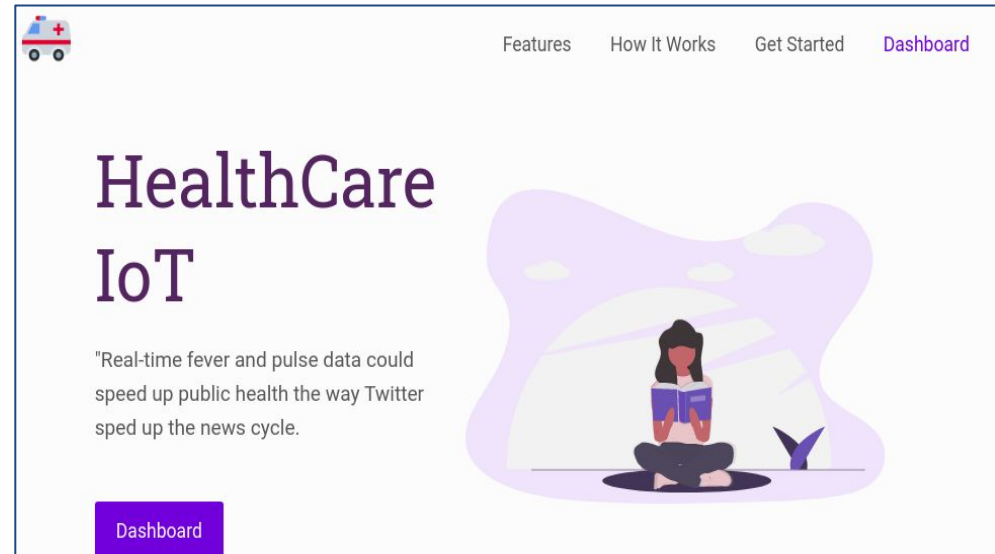
```
keshav@keshav:~/Desktop/Health Care IoT project/Health-Care-IoT$ firebase deploy
== Deploying to 'health-care-iot-534c9' ...
i deploying database, hosting
i database: checking rules syntax...
✓ database: rules syntax for database health-care-iot-534c9 is valid
i hosting[health-care-iot-534c9]: beginning deploy...
i hosting[health-care-iot-534c9]: found 1868 files in public
✓ hosting[health-care-iot-534c9]: file upload complete
i database: releasing rules...
✓ database: rules for database health-care-iot-534c9 released successfully
i hosting[health-care-iot-534c9]: finalizing version...
✓ hosting[health-care-iot-534c9]: version finalized
i hosting[health-care-iot-534c9]: releasing new version...
✓ hosting[health-care-iot-534c9]: release complete
✓ Deploy complete!

Project Console: https://console.firebase.google.com/project/health-care-iot-534c9/overview
Hosting URL: https://health-care-iot-534c9.firebaseio.com
keshav@keshav:~/Desktop/Health Care IoT project/Health-Care-IoT$
```

Responsive Design



Mobile



Desktop

Please Visit

<https://health-care-iot-534c9.web.app/>

Thank you!!