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BITS Pilani
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EEE F411

Internet of Things

IOT Project
Implementation of IOT for Healthcare

Group Members-

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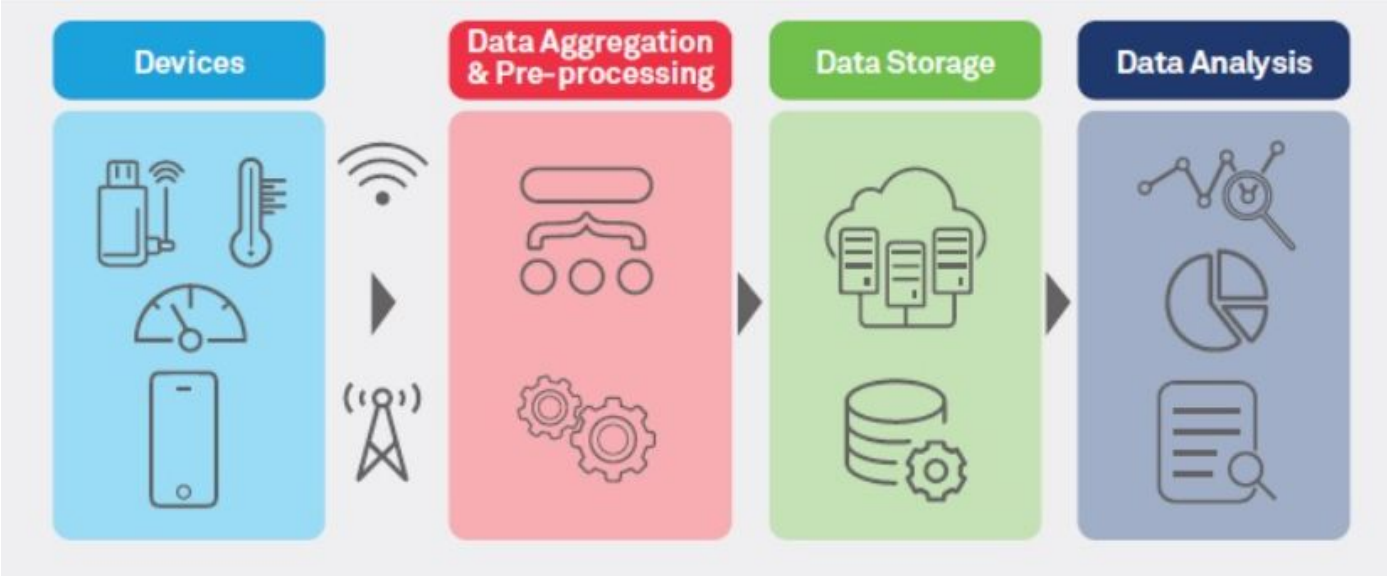
Project hosted link-
https://health-care-iot-534c9.web.app/

Github link-
https://github.com/keshavsethi/Health-Care-IoT

Youtube Video
https://youtu.be/GL4sibIDw7A

What can IOT do for Healthcare?

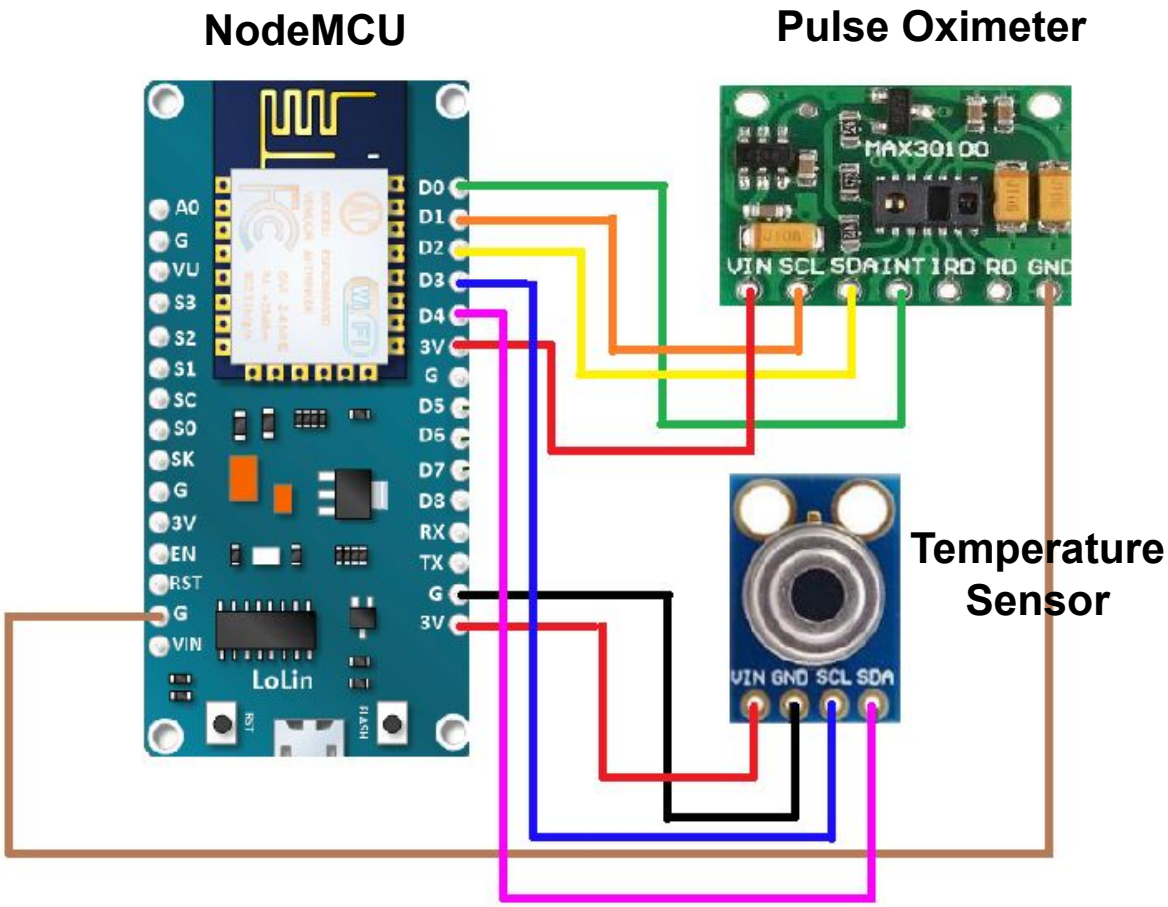
Internet of Things (IoT)-enabled devices have made remote monitoring in the healthcare sector possible, unleashing the potential to keep patients safe and healthy, and empowering physicians to deliver superlative care



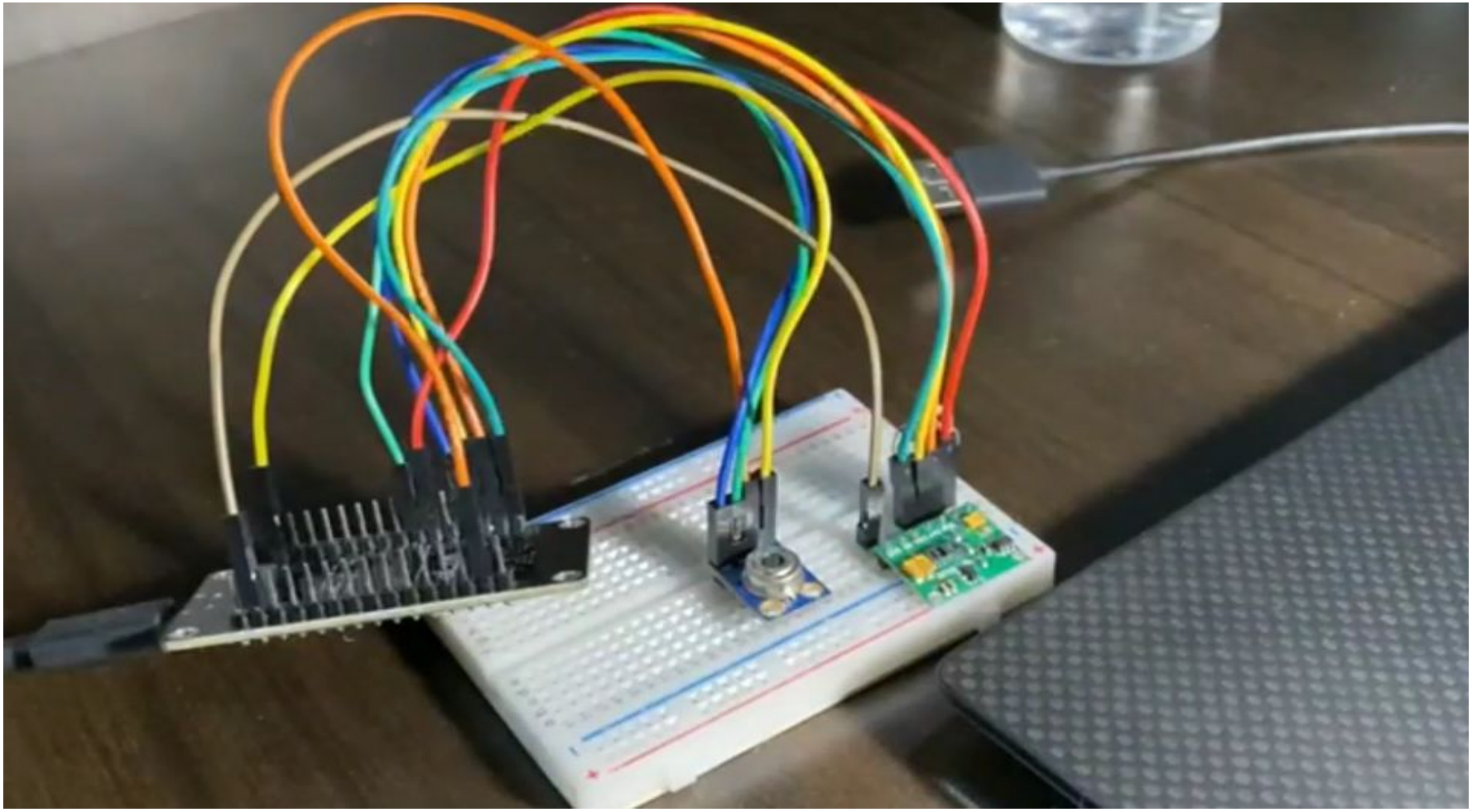
Components Used-

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

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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.println("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);
}
```

Firebase in Nodemcu

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```
#include <FirebaseArduino.h>
#include <NTPClient.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);
Firebase.pushString("/data/pulse", B);
Firebase.pushString("/data/oxygen", Sp);
Firebase.pushString("/data/temp", T);
Firebase.pushString("/data/time", formattedTime);
Firebase.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

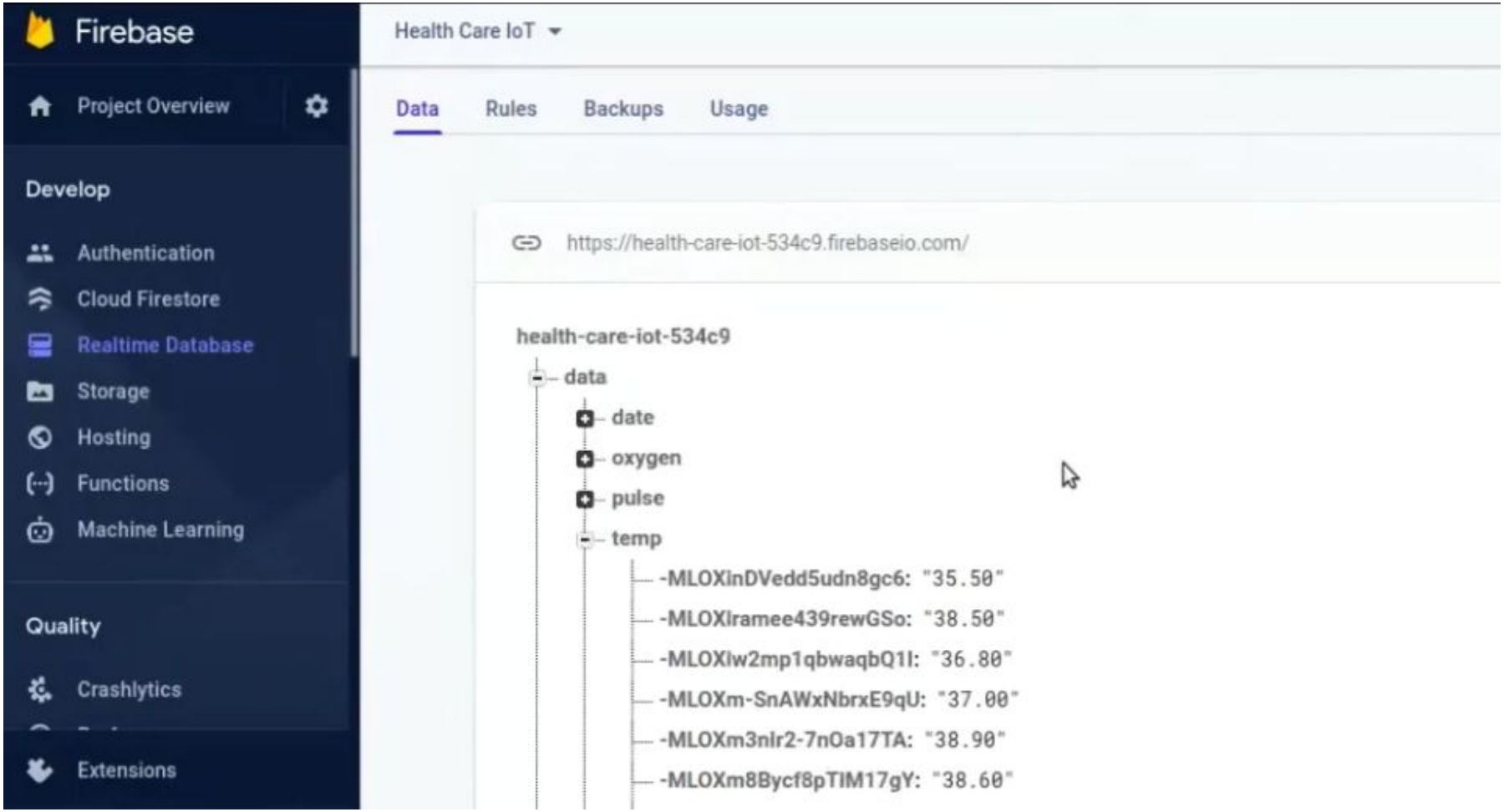
Alert table

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

Chat bot

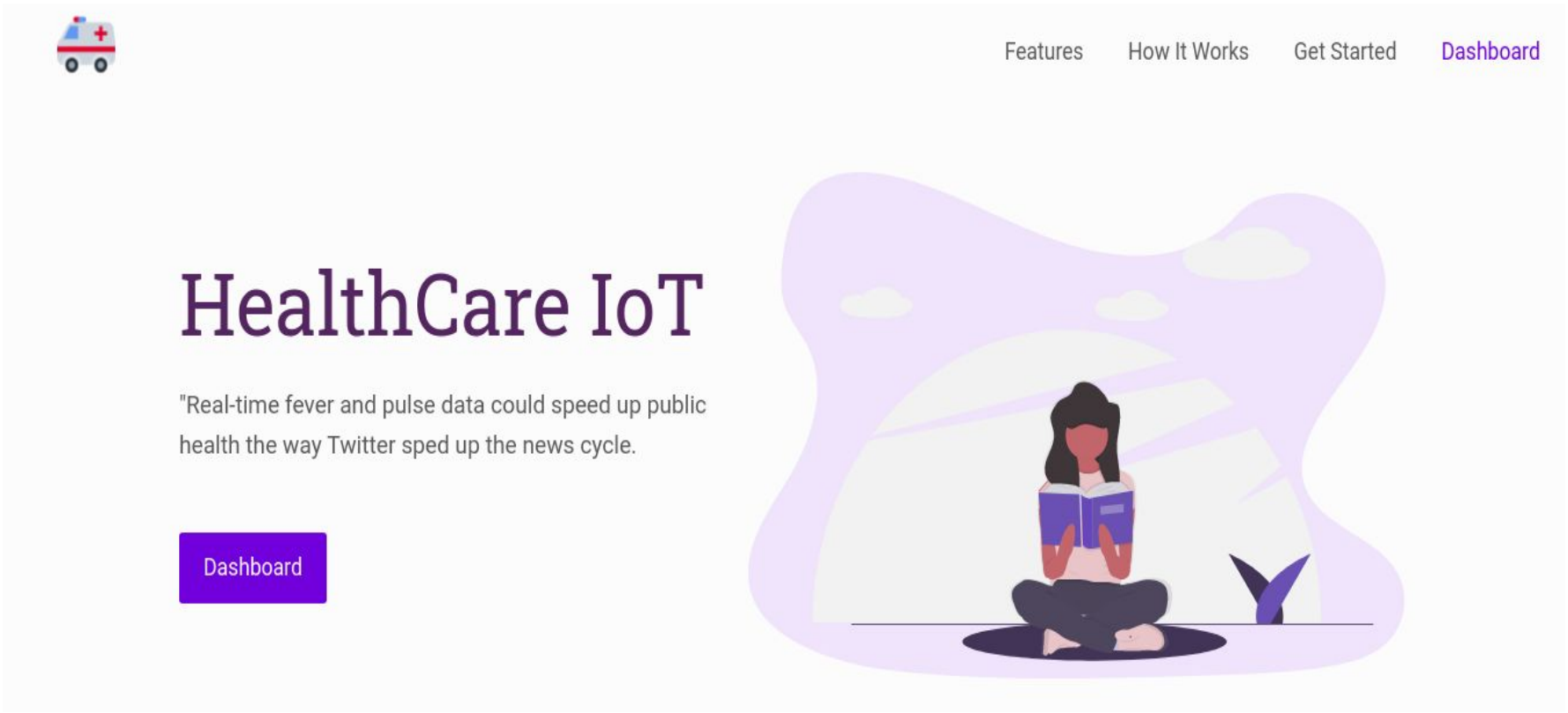
https://health-care-iot-534c9.web.app/demo/chatbot.html

Firebase for backend

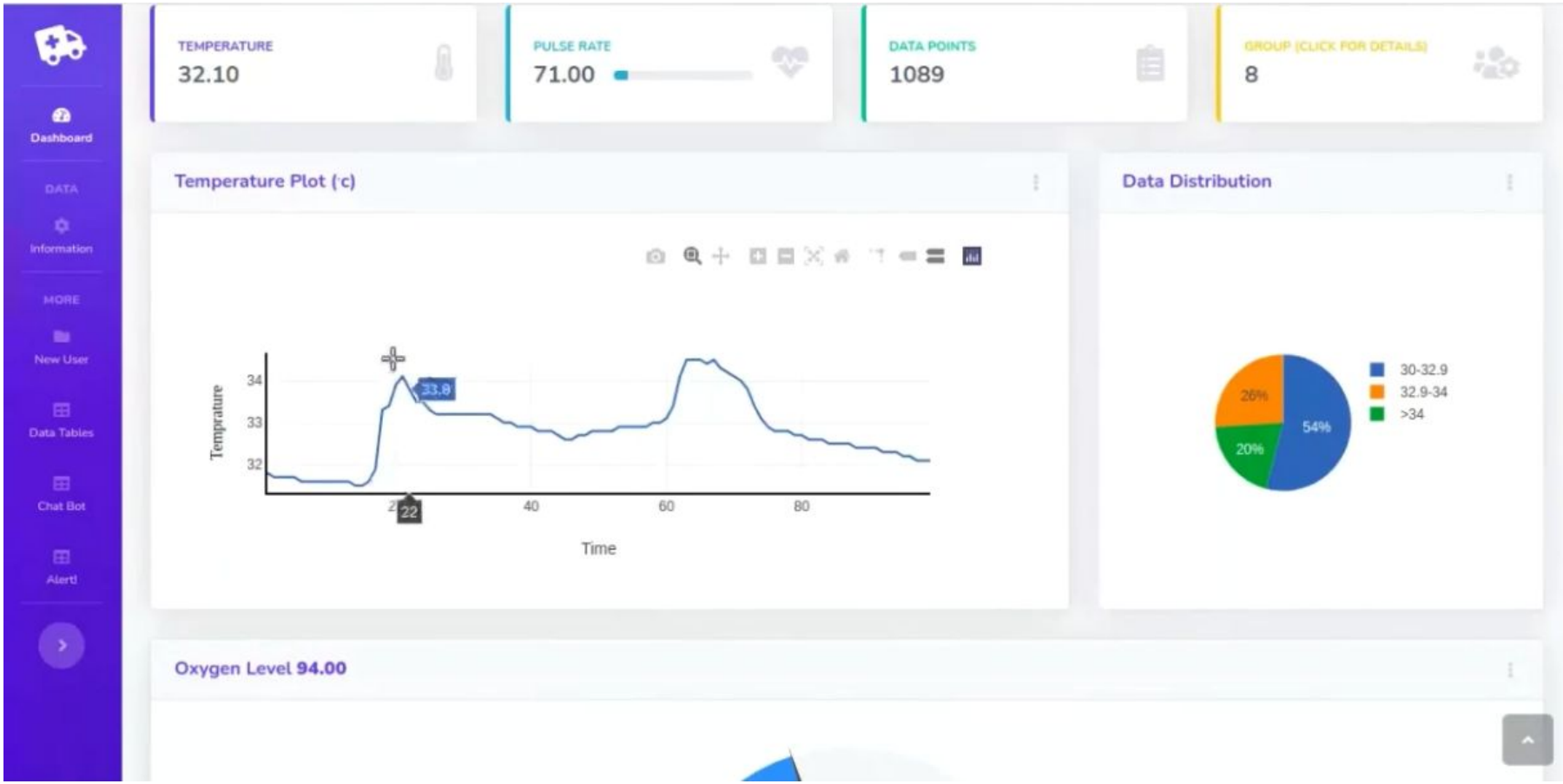


```
const config = {
  apiKey: "AIzaSyCqOdIjUsNL95Uc00JBmhUWgHXtWCtNTLU",
  authDomain: "health-care-iot-534c9.firebaseapp.com",
  databaseURL: "https://health-care-iot-534c9.firebaseio.com",
  projectId: "health-care-iot-534c9",
  storageBucket: "health-care-iot-534c9.appspot.com",
  messagingSenderId: "214130811754",
  appId: "1:214130811754:web:a15dbec4a135da9b3d7b13",
  measurementId: "G-3ZLX17QWM7"
};
firebase.initializeApp(config);
```

Landing Page

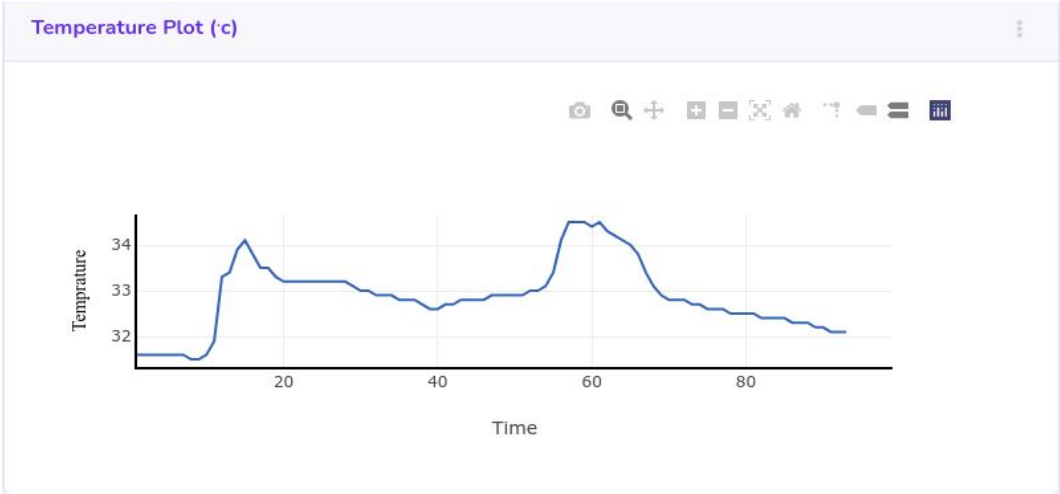


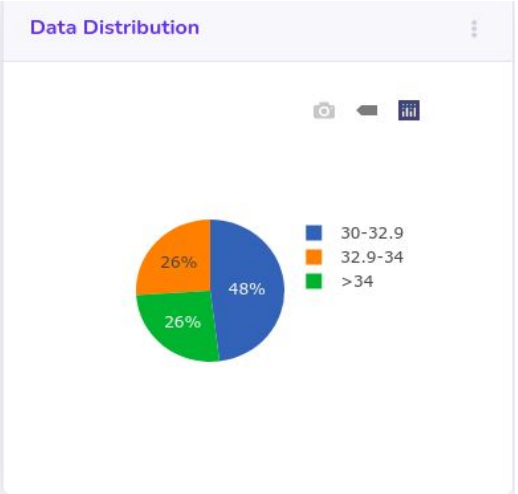
Dashboard



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("temprature_head").innerHTML= ts_measure.val();
  });
  for(i=1;i<=values.length;i++){
      ids[i]=i;
  }
```

Temperature Plot

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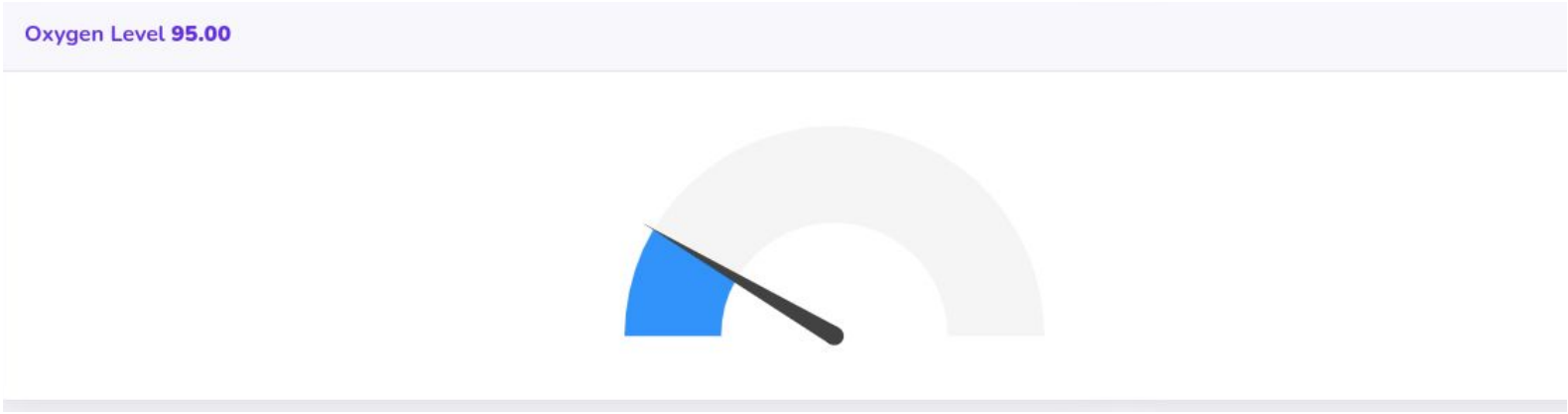
```
148
149     const layout = {
150         height: 300,
151         width: 700,
152         xaxis: {
153             title:'Time',
154             linecolor: 'black',
155             linewidth: 2
156         },
157         yaxis: {
158             title: 'Temprature',
159             titlefont: {
160                 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

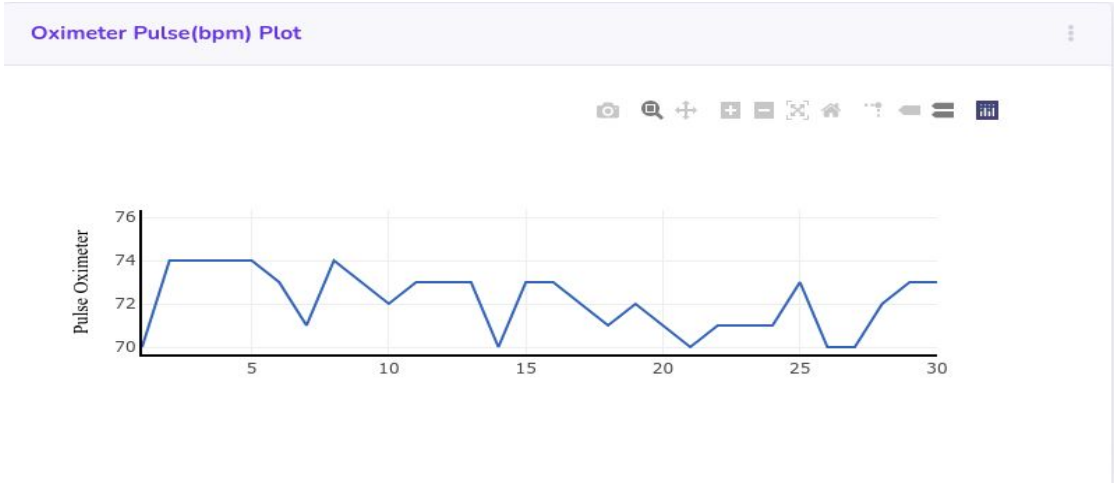


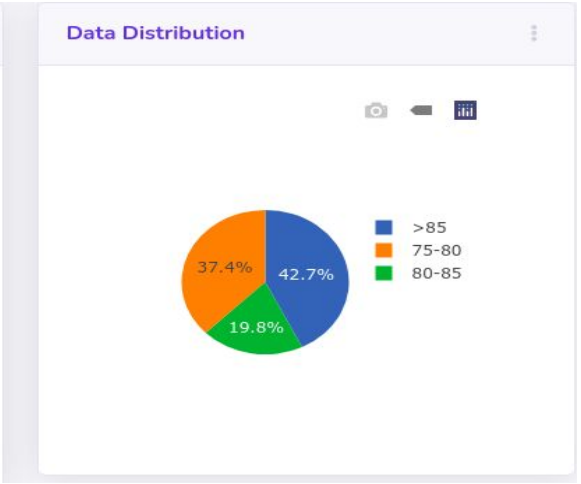

```
let oxygen;
firebase.database().ref('data/oxygen').on('value', ts_measures => {
    ts_measures.forEach(ts_measure => {
    oxygen = ts_measure.val();
    });
    document.getElementById("o2_head").innerHTML = oxygen;
```

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






```
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)

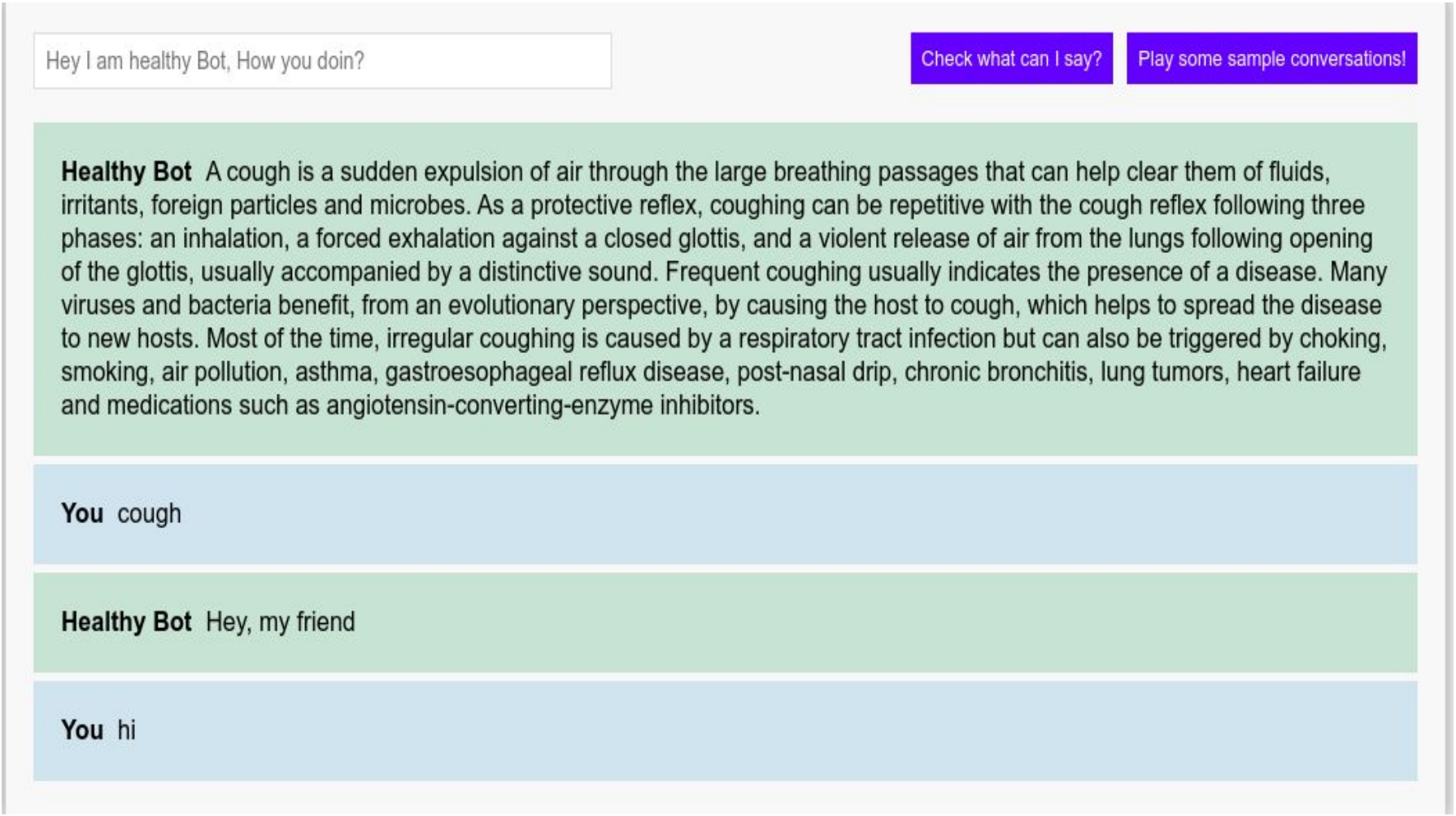
Show 10 entries Search:

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

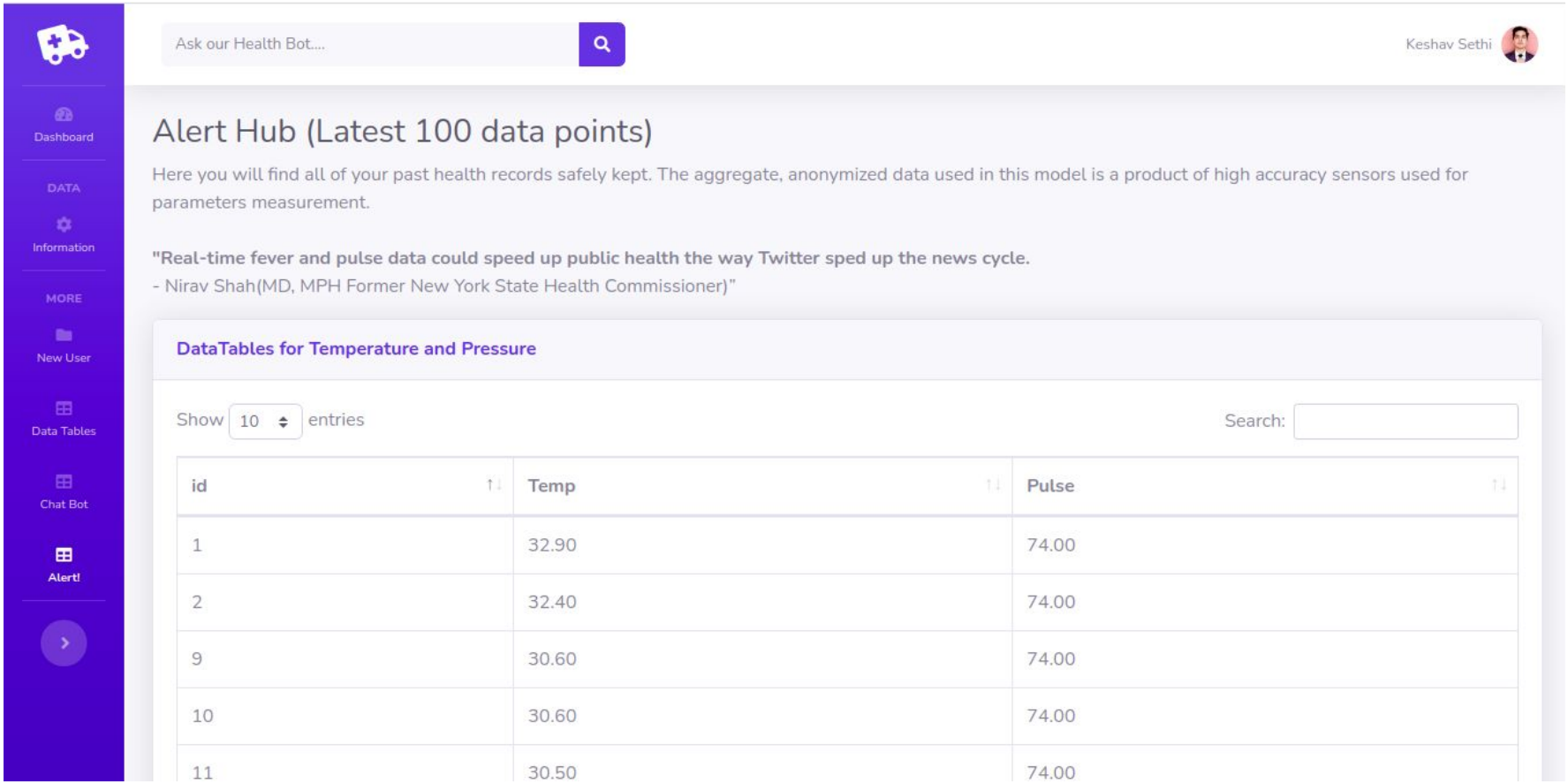
Datatable(Add row method)

```
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)



Alert table


Ask our Health Bot....
Keshav Sethi
Dashboard
DATA
Information
MORE
New User
Data Tables
Chat Bot
Alert!
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 10 entries
Search:
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

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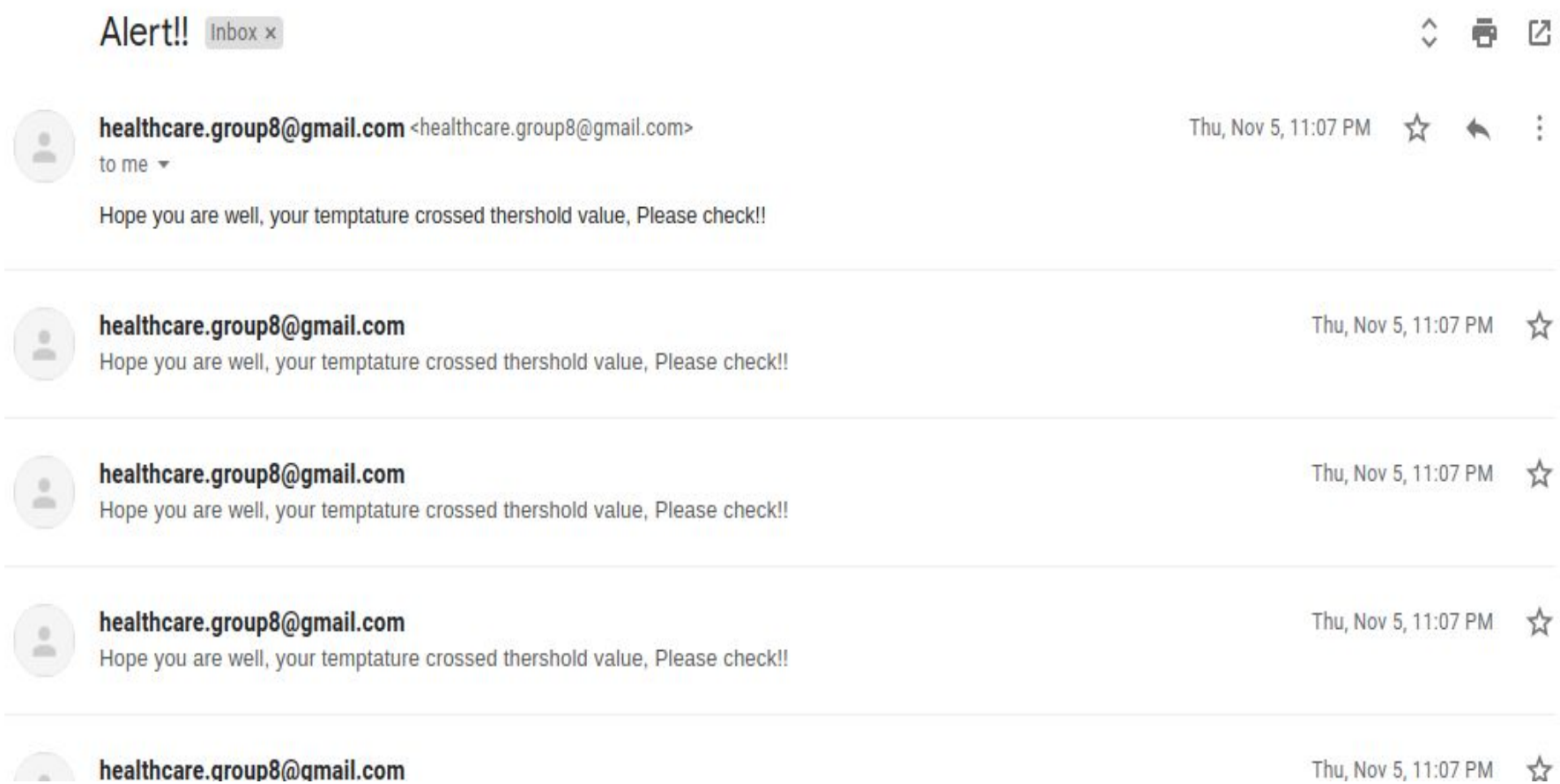
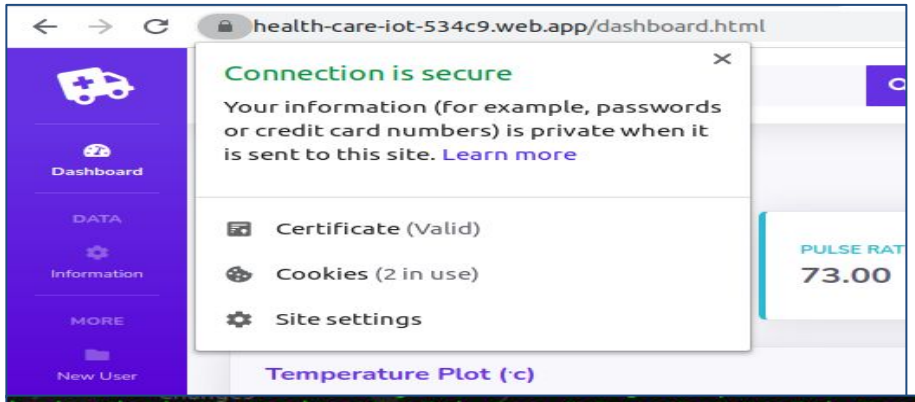
```
firebase.database().ref('data/temp').limitToLast(200).on('value', ts_measures => {
  ts_measures.forEach(ts_measure => {
  values.push(ts_measure.val());
  });
  for(i=1;i<=values.length;i++){
      ids[i-1]=i;
  }
  });
  var TEMP_THRESHOLD=32;
  var PULSE_THRESHOLD=73;


  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 ×
healthcare.group8@gmail.com <healthcare.group8@gmail.com>
Thu, Nov 5, 11:07 PM
to me
Hope you are well, your temptature crossed thershold value, Please check!!
healthcare.group8@gmail.com
Thu, Nov 5, 11:07 PM
Hope you are well, your temptature crossed thershold value, Please check!!
healthcare.group8@gmail.com
Thu, Nov 5, 11:07 PM
Hope you are well, your temptature crossed thershold value, Please check!!
healthcare.group8@gmail.com
Thu, Nov 5, 11:07 PM
Hope you are well, your temptature crossed thershold value, Please check!!
healthcare.group8@gmail.com
Thu, Nov 5, 11:07 PM

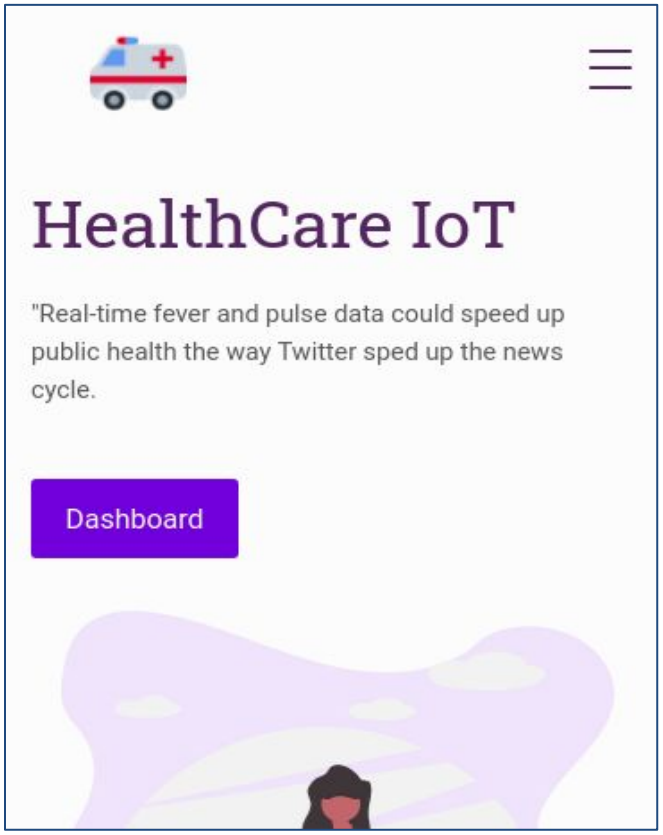
```
if(values[values.length-1] > 34){
    console.log("email check");
    Email.send({
        Host: "smtp.gmail.com",
        Username: "healthcare.group8@gmail.com",
        Password: "keshavsethi",
        To: 'keshav.sethi0004@gmail.com',
        From: "healthcare.group8@gmail.com",
        Subject: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

Hosted and Secure

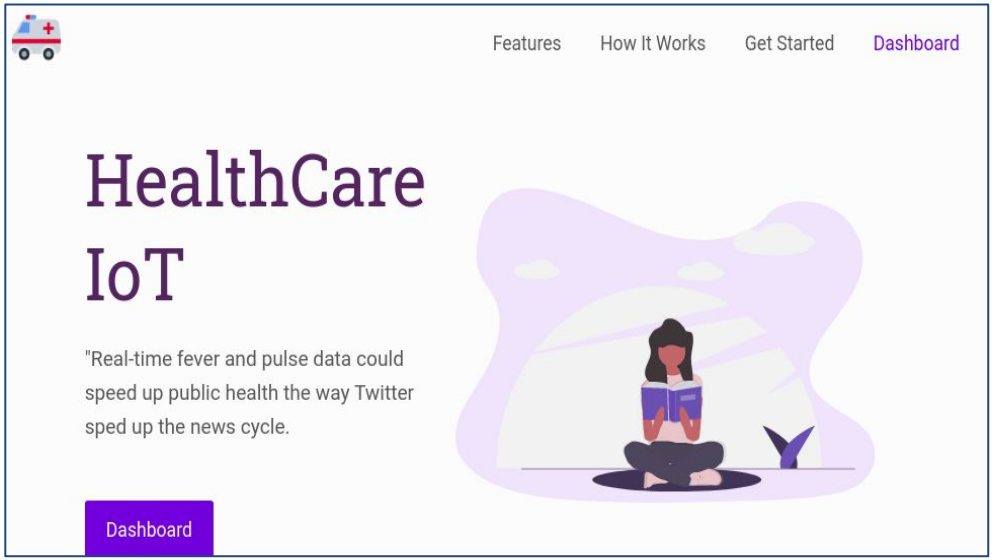



```
keshav@keshav:~/Desktop/Health Care IoT project/Health-Care-IoT$ firebase deploy

=== 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.firebaseapp.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!!