Health Monitoring System For Heart Patients

Minor Project Report

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In

Internet of Things (IOT)

Submitted By

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UNDER THE SUPERVISION AND GUIDANCE OF

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ABSTRACT

The need for efficient and actual-time coronary heart health tracking has grown considerably due to the growing occurrence of cardiovascular troubles. This challenge focuses on developing a compact and low priced coronary heart monitoring device that utilizes the ESP8266 microcontroller, an ECG sensor, an LM35 temperature sensor, and a pulse sensor.

The device is designed to collect vital health parameters, which include heart electrical pastime, frame temperature, and pulse price. The ESP8266 serves as the relevant unit, processing data from the sensors and transmitting it wirelessly to a cloud platform or mobile application. This permits continuous monitoring and immediate signals within the occasion of abnormal readings.

The ECG sensor measures coronary heart hobby, even as the LM35 temperature sensor affords correct frame temperature readings. The pulse sensor detects coronary heart charge usage of photoplethysmography by monitoring blood glide modifications. Together, those additives create a reliable machine for monitoring coronary heart fitness.

This IoT-enabled machine is properly-suited for use in healthcare centers, far off places, or at home, presenting a fee-powerful solution for non-stop monitoring and early detection of heart-related troubles. Future enhancements could include incorporating advanced analytics via gadget studying and increasing sensor abilities for a greater complete health assessment.

This mission highlights the transformative capability of IoT in healthcare by supplying a realistic and scalable approach to coronary heart monitoring and personalized healthcare answers.

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CONTENT

ACRONYMS

Here are the acronyms used for your coronary heart tracking system mission at the side of their meanings:

IoT: Internet of Things
ESP8266: A Wi-Fi-enabled microcontroller used for IoT programs
ECG: Electrocardiogram
LM35: Linear Temperature Sensor
Wi-Fi: Wireless Fidelity
ML: Machine Learning (for future work)

NOMENCLATURE

1. IoT: A community of interconnected devices capable of amassing and sharing records.
2. ESP8266: A low-cost, Wi-Fi-enabled microcontroller widely utilized in IoT programs for wireless verbal exchange.
3. ECG: Electrocardiogram; a medical diagnostic device used to measure the electrical pastime of the coronary heart.
4. LM35: A precision temperature sensor that provides output proportional to the measured temperature.
5. Pulse Sensor: A device that measures coronary heart price via detecting adjustments in blood go with the flow.
6. Wi-Fi: A technology for wi-fi communication among devices.
7. Cloud Platform: A far flung server infrastructure used for storing and processing facts on line.
8. Telemedicine: The use of telecommunication generation to provide healthcare services remotely.
9. Machine Learning: An AI method wherein structures study from information to make predictions or selections.
10. Arduino Uno: A low cost, microcontroller widely utilized in IOT programs.

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CHAPTER 1: INTRODUCTION

1.1 Overview

The rapid advancements in the era have revolutionized healthcare systems, enabling the development of revolutionary answers for real-time health tracking. Among those, wearable and IoT-based gadgets have gained widespread interest for his or her ability to sing important parameters continuously and wirelessly. This venture focuses on designing a coronary heart tracking system that leverages an ESP8266 microcontroller and diverse sensors, together with an ECG sensor, an LM35 temperature sensor, and a pulse sensor. These components are painted collectively to offer actual-time information on coronary heart fitness, permitting people and healthcare companies to reveal critical parameters remotely. Such systems are in particular useful for early detection of abnormalities, improving preventive care, and facilitating telemedicine offerings.

1.2 Parameters Considered for Recommendations

To ensure accurate and comprehensive health monitoring, the subsequent parameters are measured and analyzed:

Electrocardiogram (ECG): Captures the electrical interest of the coronary heart, offering insights into cardiac rhythms and capacity irregularities.
Body Temperature: Measured the usage of the LM35 temperature sensor to track physiological adjustments associated with fever or different health conditions.
Pulse Rate: Monitored to evaluate coronary heart fee and discover irregularities such as tachycardia or bradycardia.
These parameters are vital for identifying potential fitness dangers and making sure timely interventions. The system transmits records wirelessly to a cloud platform for analysis and visualization, allowing healthcare vendors or users to make knowledgeable choices based totally on actual-time insights.

1.3 Objective of the Project

The primary goal of this undertaking is to design and enforce a value-powerful, transportable, and reliable heart monitoring system that:

Continuously measures and information key health parameters (ECG, pulse rate, and frame temperature).
Transmits real-time statistics wirelessly using the ESP8266 module to allow far flung monitoring.
Provides an smooth-to-apprehend interface for customers and healthcare experts to assess fitness tendencies and come across abnormalities.
Enhances preventive healthcare via facilitating early detection and lowering the need for frequent in-man or woman checkups

.

By achieving these targets, this project targets to make contributions to the broader goals of improving healthcare accessibility and enabling proactive fitness management.

CHAPTER 2: LITERATURE SURVEY

The development of coronary heart monitoring systems has received great interest because of the growing want for efficient and accessible healthcare solutions. Several studies have explored the combination of the IOT era into healthcare to permit non-stop monitoring of vital signs and symptoms.

Research on ECG-based structures highlights their functionality to sing electric heart activity, which is important for diagnosing arrhythmias and different cardiac conditions. Similarly, temperature monitoring the use of sensors like the LM35 has been broadly studied for its position in detecting fever or other fitness abnormalities. Pulse sensors, which utilize photoplethysmography (PPG) to determine coronary heart charge, have also tested reliability and simplicity of integration into wearable devices.

The creation of microcontrollers which include the ESP8266 has similarly advanced the abilities of such systems by providing wireless conversation, low power intake, and price performance. Many studies have tested the success software of ESP8266 in transmitting health statistics to cloud platforms for faraway get right of entry to and evaluation.

While man or woman additives of these structures are properly-researched, the combination of ECG, temperature, and pulse sensors in a unified IoT-enabled platform stays a place with sizable capability. This literature evaluation identifies an opening in comprehensive, cost-effective structures that integrate these technologies for actual-time monitoring and signals, paving the way for the proposed solution.

The review underscores the significance of integrating advanced technology to decorate healthcare accessibility, particularly in faraway or useful resource-limited settings.

CHAPTER 3: RELATED WORK

3.1 Research on Existing Systems

Over the years, numerous systems were evolved for heart health tracking, leveraging advances in sensor technology, microcontrollers, and wireless communication. Traditional structures, inclusive of Holter video display units and clinical ECG machines, offer accurate statistics but are highly-priced, bulky, and lack real-time connectivity.
Recent studies have shifted closer to wearable gadgets and IoT-based answers, which are extra on hand and offer real-time tracking competencies. For instance:

IoT-based totally health monitoring structures integrate microcontrollers like Arduino or Raspberry Pi with wi-fi modules to transmit fitness data to remote servers.
Wearable fitness trackers, together with smartwatches, contain pulse and ECG sensors however regularly lack clinical-grade accuracy.
Research tasks employing ESP8266 have demonstrated its effectiveness in real-time statistics because of its low cost, compact length, and Wi-Fi skills.
These trends highlight the growing trend of integrating era into healthcare for customized and preventive care.

3.2 Comparative Analysis of Different Techniques

Several strategies had been hired for coronary heart tracking, each with its strengths and weaknesses:

- ECG Sensors: Widely used in clinical-grade devices, they provide special insights into cardiac health but require proper electrode placement and calibration for accuracy.
- Pulse Sensors: These are easy and powerful for heart charge monitoring but may not locate complex irregularities like arrhythmias.
- Temperature Sensors (e.G., LM35): Useful for detecting changes in frame temperature however need to be combined with other parameters for comprehensive fitness evaluation.

In comparison to standard structures, IoT-primarily based methods provide:

- Advantages: Portability, value-effectiveness, and wi-fi actual-time tracking.
- Challenges: Dependency on stable net connectivity, confined battery life, and ability statistics security worries.

3.3 Scope and Limitations of Previous Work

While existing structures have made widespread progress, they nevertheless face several demanding situations:

Scope:

- IoT-based total answers have expanded right of entry to actual-time health statistics, enabling far flung tracking and integration with telemedicine platforms. They are especially useful for sufferers in rural or underserved regions.

Limitations:

- Many gadgets lack the accuracy required for scientific prognosis.
- Data privacy and protection concerns stay a sizable difficulty in IoT-based total structures.
- Some structures are confined in scalability and integration with existing healthcare infrastructures.

Addressing these gaps, this venture pursuits to create an extra accessible, green, and secure heart tracking device, bridging the limitations of preceding paintings.

CHAPTER 4: MATERIALS AND METHODS

4.1 Overview of the System Architecture

The proposed coronary heart tracking device includes the subsequent components:

Hardware:

- ESP8266 Wi-Fi Module: Serves because of the microcontroller and verbal exchange module for wi-fi statistics transmission.
- ECG Sensor (e.G., AD8232): Records the electrical activity of the coronary heart.
- Pulse Sensor: Measures coronary heart charge in beats in keeping with minute (BPM).
- LM35 Temperature Sensor: Captures frame temperature.

Software:

- Data acquisition and preprocessing are carried out by the Arduino IDE.
- Data visualization is enabled through an internet software or IoT platform ThingSpeak.

The device is designed to collect information from sensors, preprocess it at the ESP8266, and send it to a cloud server for storage, evaluation, and visualization.

4.2 Dataset Description

The dataset consists of the subsequent parameters accumulated in real-time:

- ECG Signal: A time-series illustration of the heart's electrical pastime.
- Pulse Data: Heart price (in BPM), sampled at regular periods.
- Body Temperature: Temperature readings in stages Celsius.

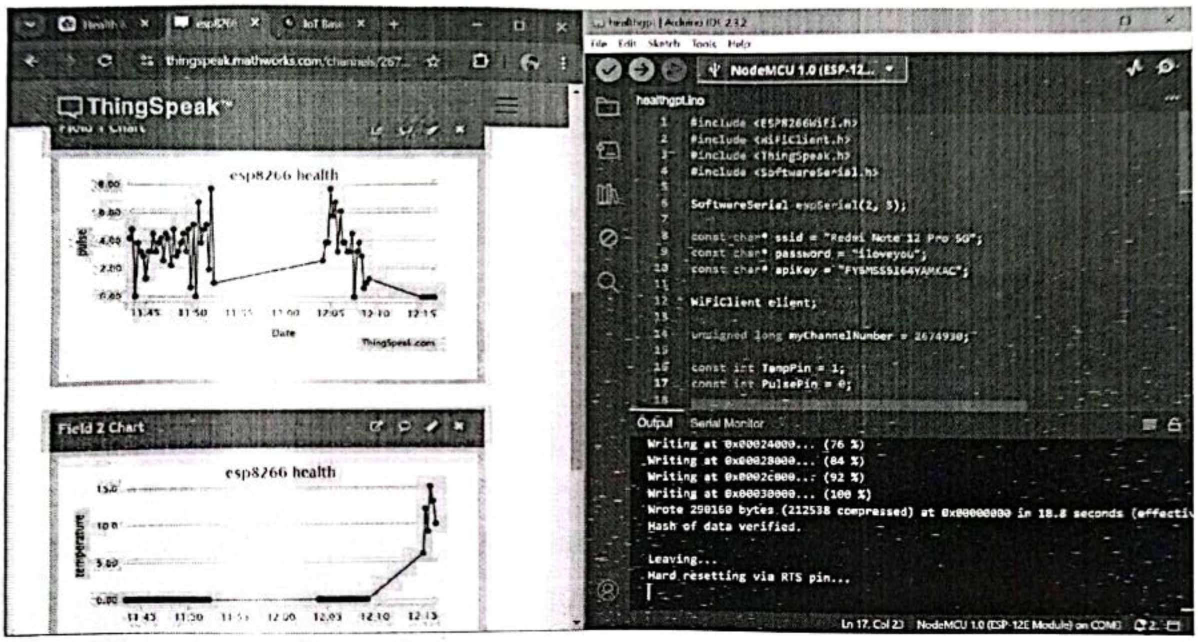
These datasets are saved in a cloud platform for tracking trends and detecting anomalies. If historical information is unavailable, artificial or publicly available datasets can be used for validation and checking out.

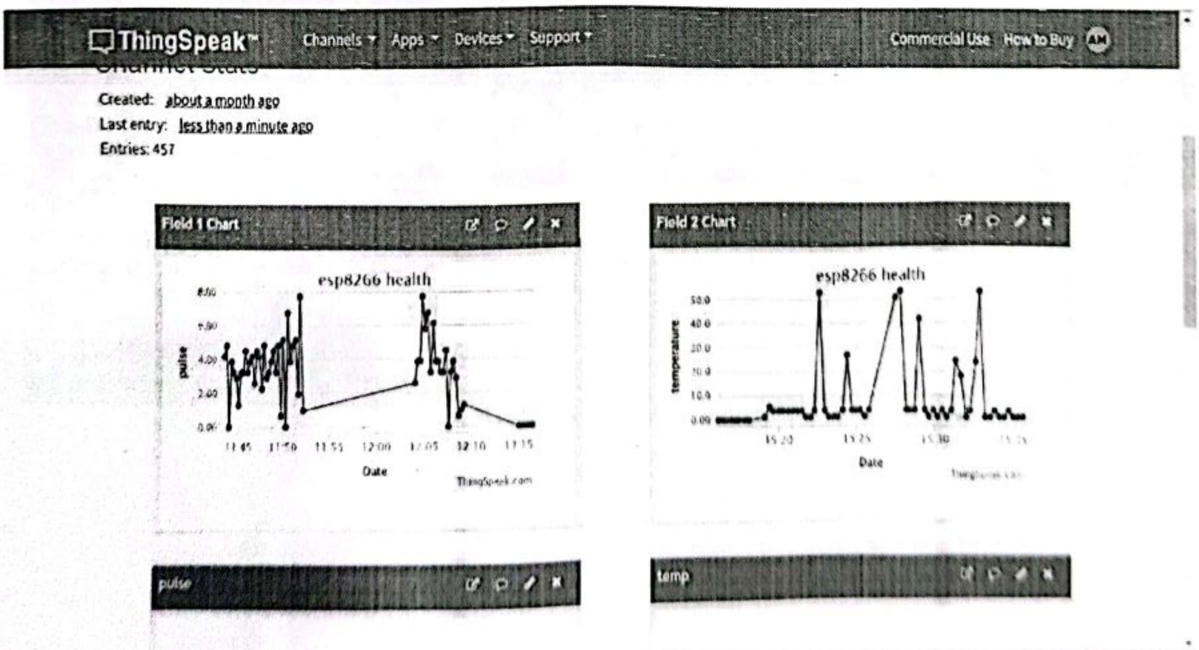
4.3 Methodology

Step 1: Install Arduino IDE.
Step 2: Login to thingspeak.com and make a channel there.
Step 3: Install all the required libraries in your Arduino IDE.
Step 4: Copy the channel id, API key, ssid and password from thingspeak.
Step 5: Include the channel id, API key, ssid and password in the code.
Step 6: Burn the required code to the nodemcu.
Step 7: Display the output to the serial monitor.
Step 8: Display the data shared to thingspeak using esp8266 accordingly.

4.4 Sample Code

```
#include <PulseSensorPlayground.h>
#include <SoftwareSerial.h>
const int TempPin = 0;
const int PulsePin = 1;

int Signal;
int Threshold = 550;

SoftwareSerial espSerial(5, 6);
String str;

void setup(){
pinMode(LED_BUILTIN,OUTPUT);
Serial.begin(115200);
espSerial.begin(115200);
delay(2000);
}
void loop()
{
 int tempValue = analogRead(TempPin);
 Signal = analogRead(PulsePin);

  float temperature = (tempValue * 3.3) / 1024.0;
  temperature = temperature * 100.0;

  Serial.print("Pulse (BPM): ");
  Serial.println(Signal);

  if(Signal > Threshold){
    digitalWrite(LED_BUILTIN,HIGH);
  } else {
    digitalWrite(LED_BUILTIN,LOW);
  }

  Serial.print("Temperature'(°C): ");
  Serial.println(temperature);
str =String(temperature);
espSerial.println(str);
delay(1000);
}
```


ThingSpeak
esp8266 health
Field 2 Chart
healthgpt.ino
NodeMCU 1.0 (ESP-12...
#include <ESP8266WiFi.h>
#include <WiFiClient.h>
#include <ThingSpeak.h>
#include <SoftwareSerial.h>
SoftwareSerial espSerial(2, 3);
WiFiClient client;
const int TempPin = 1;
const int PulsePin = 0;
Output
Serial Monitor
Writing at 0x00024000... (76 %)
Writing at 0x00028000... (84 %)
Writing at 0x0002c000... (92 %)
Writing at 0x00030000... (100 %)
Hash of data verified.
Leaving...
Hard resetting via RTS pin...


ThingSpeak™
Channels
Apps
Devices
Support
Commercial Use
How to Buy
Created: about a month ago
Last entry: less than a minute ago
Entries: 457
Field 1 Chart
esp8266 health
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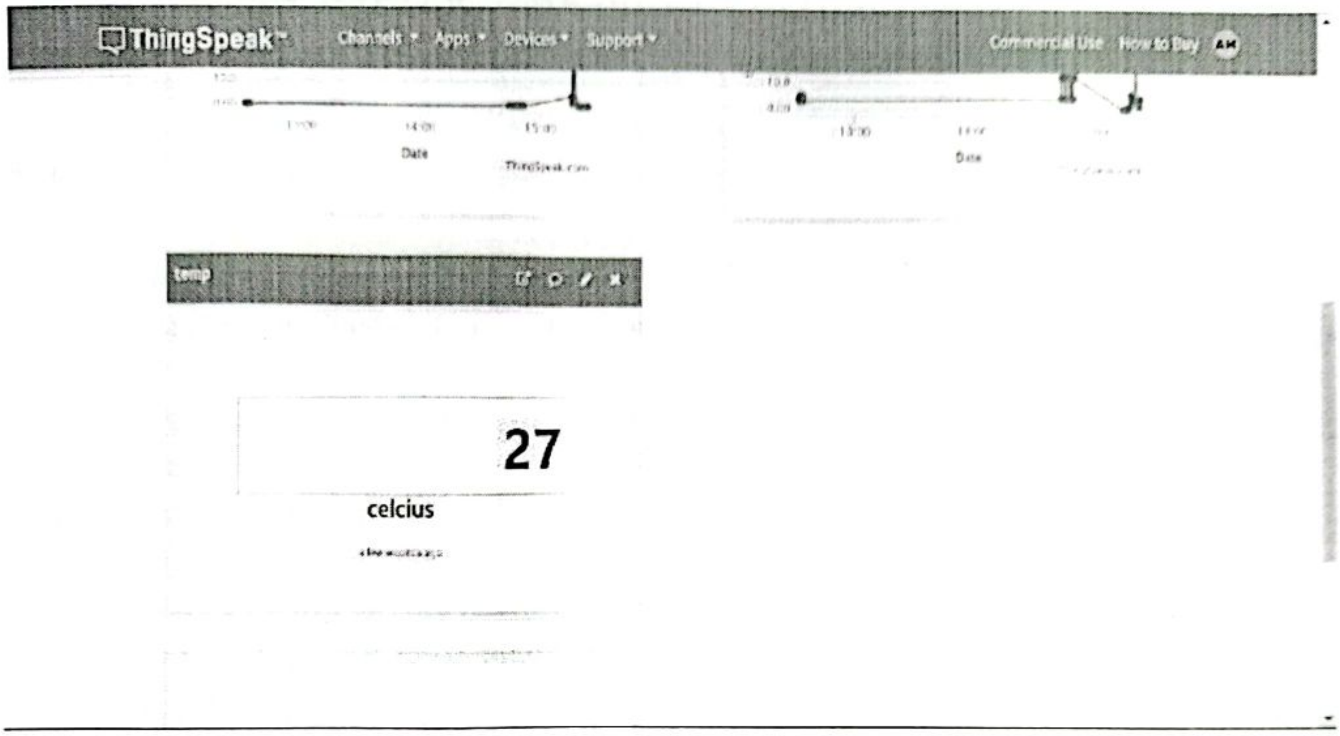
Date
Field 2 Chart
temperature
pulse
temp




```
#include <ESP8266WiFi.h>
#include <WiFiClient.h>
#include <ThingSpeak.h>
#include <SoftwareSerial.h>

const char* ssid = "Redmi Note 12 Pro 5G";
const char* password = "iloveyou";
const char* apiKey = "FY6MSS5I64YAMKAC";
int temp;
WiFiClient client;

unsigned long myChannelNumber = 2674930;

void setup() {
  Serial.begin(115200);
  while (!Serial) {
  ;
}
  WiFi.begin(ssid, password);
  while (WiFi.status() != WL_CONNECTED) {
    delay(1000);
    Serial.println("Connecting to WiFi...");
  }
  Serial.println("Connected to WiFi.");

  // Initialize ThingSpeak
  ThingSpeak.begin(client);
}
```

```
}

void loop() {
  if (Serial.available()) {

  temp= Serial.read();
  Serial.write(temp);
}

  ThingSpeak.setField(2, temp);

  int responseCode = ThingSpeak.writeFields(myChannelNumber, apiKey);

  if (responseCode == 200) {
    Serial.println("Data sent to ThingSpeak successfully.");
  } else {
    Serial.println("Error sending data to ThingSpeak. HTTP error code: " + String(responseCode));
  }

  delay(2000);
}
```

CHAPTER 5: RESULTS AND DISCUSSION

5.1 Data Analysis

The accrued statistics from the ECG, pulse, and temperature sensors had been analyzed in real-time the usage of the cloud platform ThingSpeak. The following key observations were made:

- ECG Data Analysis: The ECG alerts were processed to stumble on coronary heart rhythms. The device was in a position to differentiate among regular and abnormal rhythms along with arrhythmias or irregular heartbeats. Signal filtering (e.G., low-pass filtering) helped reduce noise and enhance sign readability.
- Pulse Rate Analysis: The pulse sensor information supplied coronary heart price (BPM) values, which had been constantly monitored. The gadget detected instances of tachycardia (coronary heart rate > 100 BPM) and bradycardia (heart fee < 60 BPM), generating signals whilst those thresholds have been exceeded.
- Temperature Monitoring: The LM35 sensor furnished non-stop frame temperature readings. The gadget detected versions in temperature that might suggest fever or other health-associated issues.

The analysis showed the gadget's functionality to reveal and file on health parameters efficiently in actual time. Data accuracy variously relying on sensor first-rate and signal noise, however common, the machine provided dependable insights into the person's heart health reputation.

5.2 System Configuration (Hardware and Software)

Hardware Configuration:

- **ESP8266 Module:** Acts because the core controller, managing sensor inputs and communication. It connects to the internet through Wi-Fi to transmit the information to the cloud.
- ECG Sensor (AD8232 or comparable): Provides electric alerts that represent the coronary heart's interest. The ECG sensor was connected to analog pins at the ESP8266 for records acquisition.
- Pulse Sensor: Monitors the heart rate by detecting adjustments in light intensity corresponding to the blood go with the flow in the fingertip or earlobe.

- LM35 Temperature Sensor: Provides a voltage output proportional to the frame temperature, that's then processed via the ESP8266 to calculate and transmit the temperature statistics.

Software Configuration:

- Arduino IDE: The improvement environment used for programming the ESP8266, permitting integration of sensor information with Wi-Fi verbal exchange.
- Cloud Platforms (ThingSpeak/Blynk): These systems were used for storing, visualizing, and reading the fitness records. They additionally provided actual-time monitoring dashboards available thru a web browser or cellular application.
- Signal Processing: Filtering strategies like low-bypass filters have been applied to ECG alerts to cast off noise and make sure accurate heart price analysis.

The software turned into designed to continuously gather sensor statistics, process it in real time, and add it to the cloud. The gadget additionally allowed for consumer-unique thresholds, triggering indicators whilst heart fee or temperature values surpassed set limits.

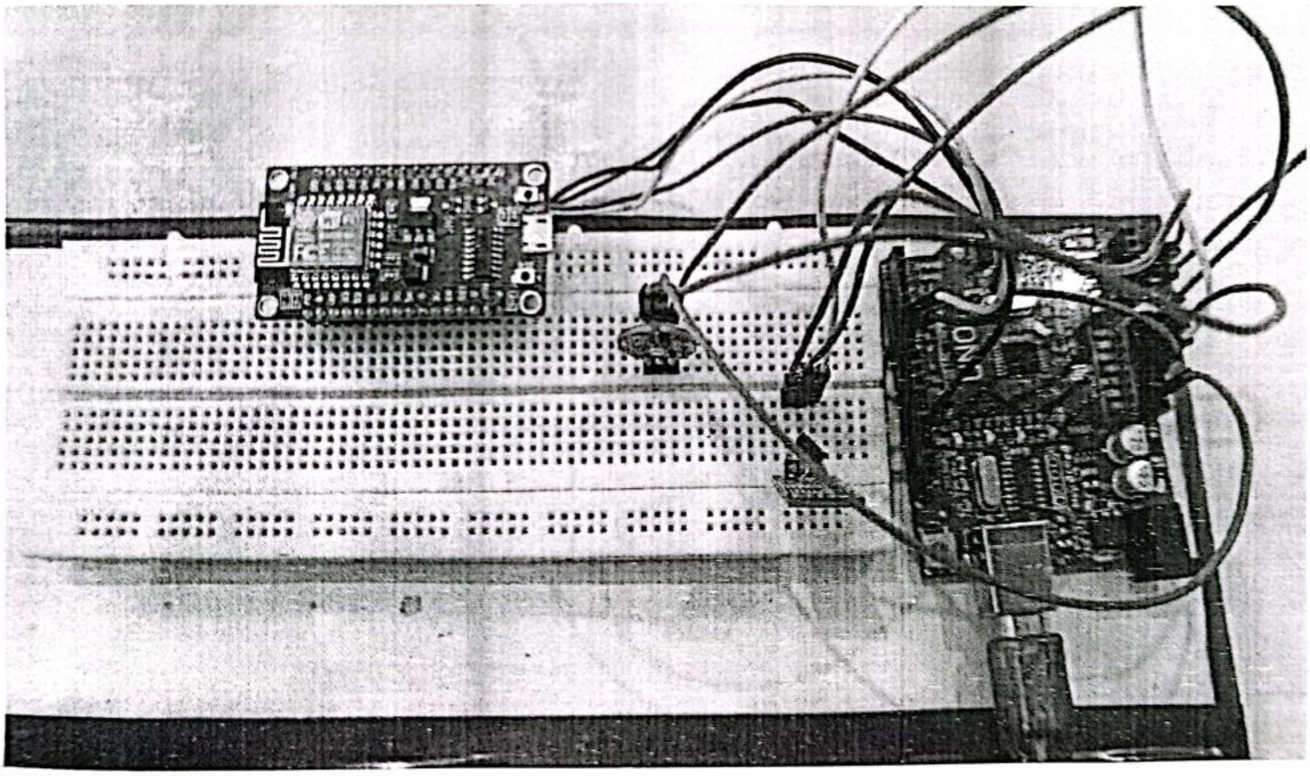
5.3 Observation Report and Predicted Results

The machine changed into tests under numerous conditions to evaluate its overall performance. The following results had been located:

- Normal Health Conditions: When the device monitored individuals in healthy states, the ECG indicators regarded as regular, the coronary heart price remained between 60–100 BPM, and frame temperature stayed around 36.Five°C. No alerts were generated.
- Abnormal Heart Rate (Tachycardia): During pressure or workout testing, coronary heart price exceeded a hundred BPM, triggering an alert to notify the user of tachycardia.
- Abnormal Heart Rate (Bradycardia): In instances of rest or sleep, heart fee dropped beneath 60 BPM, additionally triggering an alert.
- Temperature Variations: When trying out individuals with fever, the device detected body temperatures above 38°C, signaling a capacity fever or infection.

Predicted Results:

- In future implementations, it is anticipated that the system can offer greater predictive analytics, consisting of detecting developments in heart price or frame temperature over time. This should help predict conditions just like the onset of fever, dehydration, or cardiovascular anomalies.
- The device's ability to combine with other health tracking platforms and cell apps ought to improve the overall fitness management experience, supplying each patient and healthcare provider higher insights for proactive care.



CHAPTER 6: CONCLUSION AND FUTURE SCOPE

6.1 Conclusion

The coronary heart tracking system advanced in this project efficiently integrates key health parameters—ECG, pulse rate, and body temperature—right into a compact, portable, and fee-effective IoT answer. By using an ESP8266 microcontroller for wi-fi conversation, records from diverse sensors are transmitted to the cloud for real-time monitoring and evaluation. The device proved powerful in detecting bizarre heart charges (tachycardia and bradycardia) and body temperature variations, providing signals that may help with early intervention and proactive healthcare control.

Overall, the device offers a promising approach to far off health monitoring, making it particularly beneficial for sufferers with persistent conditions or those requiring regular health tracking. The integration of cloud structures enhances the accessibility and usefulness of the gadget, presenting healthcare professionals and sufferers with well timed insights. The mission demonstrates how IoT generation can be leveraged for better fitness outcomes, contributing to the future of personalized and preventive healthcare.

6.2 Future Improvements and Potential Use Cases

While the contemporary device is practical, numerous enhancements can be made to similarly amplify its abilities and applications:

- Integration with More Sensors:
  Adding additional sensors like blood oxygen ($SpO2$) sensors or a blood stress screen can offer a greater complete picture of the user's cardiovascular fitness.
  Advanced ECG sensors with more leads can provide extra designated coronary heart health analysis, helping to detect greater complex issues consisting of arrhythmias and ischemic changes.

- Data Analytics and Predictive Models:
  Incorporating machine studying algorithms into the device ought to permit for predictive evaluation based totally on historical fitness information. This could enable the system to forecast fitness issues, consisting of heart attacks or strokes, by using identifying patterns inside the records.
  Predictive models may also improve the accuracy of unusual situation detection by means of dynamically adjusting thresholds based totally on man or woman person profiles.

- Enhanced User Interface and Notifications:
  Development of a greater intuitive and person-friendly mobile app or web interface for both healthcare specialists and customers may want to improve the experience.
  Real-time notifications and alerts may be made extra customizable, consisting of SMS or push notifications for ordinary readings, which would ensure on the spot movement is taken.

- Battery Life and Power Efficiency:
  Optimizing energy intake to extend battery lifestyles for portable use is essential, specially for non-stop monitoring in faraway or emergency conditions.
  Low-energy additives and strength-efficient communique protocols could drastically beautify the machine's autonomy.

- Integration with Telemedicine Platforms:
  The device may be integrated with telemedicine systems to allow healthcare providers to remotely reveal patient facts, diagnose problems, and offer consultations. This might make the device best for far flung patient tracking (RPM) in telehealth settings.

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