CHAPTER 1

INTRODUCTION

Introducing "HeartWatch," an innovative wearable device tailored for elderly individuals, designed to monitor their heartbeat and pulse in real-time. HeartWatch combines the convenience of a wristwatch with advanced health-tracking technology, offering peace of mind to both wearers and their caregivers.

With HeartWatch, elderly users can effortlessly keep track of their cardiovascular health throughout the day. The device continuously monitors the wearer's heartbeat and pulse, providing instant feedback on their vital signs. Its intuitive interface displays heart rate data in an easy-to-understand format, allowing users to stay informed about their health status at a glance.

But HeartWatch goes beyond mere monitoring—it's equipped with state-of-the-art connectivity features that enable seamless data transmission to the cloud. This means that all heart rate and pulse data collected by the device are securely stored and accessible from anywhere via a dedicated smartphone app or web portal.

For caregivers and family members, HeartWatch provides invaluable insights into the wearer's health trends over time. By remotely accessing the cloud-stored data, they can track changes in heart rate patterns, identify potential health issues early on, and make informed decisions about the wearer's care and well-being.

HeartWatch isn't just a wearable device; it's a lifeline for elderly individuals, offering reassurance, support, and proactive health management. With its user-friendly design, continuous monitoring capabilities, and cloud connectivity, HeartWatch empowers seniors to live healthier, more independent lives while staying connected to their loved ones and healthcare providers.

1.1: Problem Statement:

As the global population ages, there is a growing need for technology-driven solutions to monitor the health of elderly individuals, particularly concerning cardiovascular health. A significant concern for older adults is the timely detection of irregular heartbeats and monitoring of their pulse rates. Traditional methods of monitoring, such as periodic visits to healthcare facilities, may not be sufficient or practical for continuous and real-time monitoring, especially for individuals living independently.

To address this challenge, there is a need for a wearable device, akin to a watch, capable of accurately detecting heartbeats and measuring pulse rates in older adults. This device must be non-intrusive, comfortable to wear for extended periods, and capable of seamlessly integrating into the daily lives of older individuals. Furthermore, it should be equipped with sensors and algorithms capable of reliably detecting irregular heart rhythms, which could indicate potentially serious cardiac issues requiring immediate attention.

The problem statement revolves around the need for a wearable device capable of detecting heartbeats and measuring pulse rates in older adults, coupled with a cloud-based platform for secure data transmission and analysis. This solution aims to empower older individuals to proactively monitor their cardiovascular health while providing caregivers and healthcare professionals with valuable insights for timely intervention and support.

**1.2: Problem Scope:**

The problem scope for developing a wearable device for heartbeat detection and pulse monitoring for elderly individuals, with data collection and transmission to the cloud, involves several key aspects:

1. User Needs Assessment: Understanding the specific requirements and limitations of elderly users is crucial. Factors such as comfort, ease of use, and accessibility need to be considered in the design and functionality of the device.

2. Hardware Development: Designing a wearable device capable of accurately detecting and monitoring the user's heartbeat and pulse is a primary concern. This involves selecting appropriate sensors, such as photoplethysmography (PPG) sensors, to measure pulse rate and heart rate variability.

3. Data Collection and Processing: The device needs to collect data from the sensors continuously and process it to extract relevant information about the user's heart rate and pulse. Signal processing algorithms may be required to filter noise and artifacts from the sensor data.

4. Connectivity and Data Transmission: Integrating wireless connectivity, such as Bluetooth or Wi-Fi, enables the device to communicate with a smartphone or gateway for data transmission to the cloud. Ensuring secure and reliable data transmission is essential to protect sensitive health information.

5. Cloud Infrastructure: Establishing a cloud-based infrastructure to receive, store, and analyze the collected data is necessary. This involves setting up databases, implementing data security measures, and developing algorithms for real-time analysis and insights generation.

6. User Interface and Experience: Designing an intuitive user interface on the wearable device and accompanying mobile app or web portal is critical for elderly users to access their health data easily. Features such as alerts for abnormal heart rate patterns or reminders for medication intake may enhance user experience.

7. Regulatory Compliance: Ensuring compliance with relevant regulations and standards, such as HIPAA (Health Insurance Portability and Accountability Act) for data privacy and FDA (Food and Drug Administration) requirements for medical devices, is essential for the development and deployment of the wearable device.

8. Long-Term Monitoring and Support: Considering the long-term use of the device, provisions for battery life optimization, device maintenance, and user support services should be incorporated into the design and deployment plans.

By addressing these aspects within the problem scope, developers can create a comprehensive solution for heartbeat detection and pulse monitoring tailored to the needs of elderly individuals, promoting their health and well-being through continuous remote monitoring and early intervention.

**1.3:Advantages of Heart watch**

Creating a wearable device like a watch for heartbeat detection and pulse monitoring, capable of collecting and transmitting data to the cloud, offers several advantages, especially for elderly individuals:

1. Health Monitoring: Continuous monitoring of heart rate and pulse provides valuable insights into the wearer's cardiovascular health. It can help detect irregularities or abnormalities early, allowing for timely medical intervention.

2. Remote Monitoring: Loved ones, caregivers, or healthcare professionals can remotely monitor the wearer's vital signs in real-time through cloud-based platforms. This enables proactive healthcare management and rapid response to any concerning changes.

3. Emergency Response: In the event of a sudden cardiac event or health emergency, the device can automatically alert designated contacts or emergency services, providing peace of mind to both the wearer and their caregivers.

4. Fall Detection: Some wearable devices incorporate sensors that can detect falls. Coupled with heartbeat and pulse monitoring, this feature enhances safety for elderly individuals, especially those prone to accidents or medical emergencies.

5. Data Analysis and Trends: By aggregating data in the cloud, healthcare providers can analyze long-term trends in the wearer's heart health, identify patterns, and make informed decisions about their care and treatment plans.

6. User-Friendly Interface: A wearable device in the form of a watch is convenient and non-intrusive, making it more likely that elderly individuals will consistently wear and use it. User-friendly interfaces and intuitive design further enhance usability.

7. Customization and Alerts: The device can be tailored to the wearer's specific health needs and preferences. Customizable alerts can remind the wearer to take medication, engage in physical activity, or follow other healthcare recommendations.

8. Privacy and Security: Cloud-based solutions can implement robust security measures to protect the privacy and confidentiality of the wearer's health data, ensuring compliance with relevant regulations such as HIPAA (Health Insurance Portability and Accountability Act).

9. Empowerment and Independence: By providing real-time feedback on their vital signs, wearable devices empower elderly individuals to take an active role in managing their health. This fosters a sense of independence and confidence in their ability to maintain their well-being.

10. Early Intervention and Prevention: Continuous monitoring allows for the early detection of potential health issues, enabling proactive intervention and preventive measures to maintain optimal health and quality of life.

Overall, a wearable device for heartbeat detection and pulse monitoring, with data collection and cloud connectivity features, has the potential to significantly improve the health outcomes and quality of life for elderly individuals, while also providing valuable support to their caregivers and healthcare providers.

**1.4 Proposed Solution:**

One proposed solution for monitoring the heartbeat of elderly individuals is a wearable device resembling a watch, equipped with a built-in pulse sensor. This device continuously tracks the wearer's heart rate, providing real-time data on their pulse. The pulse sensor detects the pulsation of blood vessels on the wrist and accurately measures heartbeats per minute (BPM). The device is designed to be comfortable and non-intrusive, ensuring elderly users can wear it throughout the day without discomfort.

The collected heartbeat data is then securely transmitted to the cloud via wireless connectivity, such as Bluetooth or Wi-Fi. In the cloud, sophisticated algorithms analyze the data to identify any irregularities or abnormalities in the individual's heart rate pattern. These algorithms can detect potential issues like arrhythmias or unusually high or low heart rates.

Additionally, the cloud-based platform provides a user-friendly interface accessible to both the wearer and their caregivers or healthcare professionals. This interface displays the collected heartbeat data in a clear and understandable format, allowing users to monitor their heart health over time.

Furthermore, the system can be configured to send alerts or notifications in case of any concerning changes in the individual's heart rate, enabling prompt medical intervention if necessary. Overall, this solution offers a convenient and proactive approach to monitoring the heart health of elderly individuals, providing peace of mind for both users and their caregivers.

1.5 Aim and Objectives

Aim:

The main aim of the described device is to provide continuous monitoring of heart rate and pulse for elderly individuals through a wearable device, such as a watch. By collecting real-time data and transmitting it to the cloud, the device enables remote monitoring of vital signs. This technology aims to enhance the safety and well-being of elderly people by allowing caregivers or healthcare professionals to track their heart health remotely, detect any irregularities or emergencies promptly, and provide timely interventions if necessary. Ultimately, the goal is to improve the overall quality of life for elderly individuals by providing them with a convenient and effective means of monitoring their cardiovascular health.

**Objectives:**

The description outlines a wearable device designed to monitor the heartbeat and pulse of elderly individuals, transmitting the data to the cloud. The objectives of this device include:

1. Health Monitoring: The primary objective is to monitor the health status of elderly individuals, specifically their heartbeat and pulse. This continuous monitoring can help detect irregularities or abnormalities in heart rhythm, which may indicate underlying health issues.

2. Safety and Well-being: By continuously monitoring vital signs like heartbeat and pulse, the device aims to ensure the safety and well-being of elderly individuals, particularly those who may be at higher risk of cardiac events or other health complications.

3. Early Detection of Health Issues: By collecting and analyzing data over time, the device can provide insights into the individual's health trends and patterns. Early detection of deviations from normal heart rate or pulse patterns can prompt timely medical intervention or lifestyle adjustments.

4. Remote Monitoring: Transmitting the collected data to the cloud enables remote monitoring by healthcare professionals or caregivers. This allows for real-time monitoring of the individual's health status, even when they are not in close proximity to their caregivers or healthcare providers.

5. Data Analysis and Insights: Storing the collected data in the cloud facilitates data analysis and the generation of insights. By analyzing trends and patterns in the data, healthcare professionals can gain a deeper understanding of the individual's health status and make informed decisions regarding their care and treatment.

6. Alerts and Notifications: The device can be programmed to trigger alerts or notifications in case of abnormal heart rate or pulse readings. This ensures timely intervention in case of emergencies or critical health events.

7. User-Friendly Design: The device is designed to be wearable, convenient, and user-friendly, making it easy for elderly individuals to incorporate into their daily lives. This encourages consistent use and adherence to monitoring protocols.

Overall, the objectives of the described device revolve around proactive health monitoring, early detection of health issues, remote monitoring capabilities, and empowering both individuals and caregivers with valuable health insights.

CHAPTER 2

Literature Survey

Heart rate monitoring for elderly individuals, particularly in the form of wearable devices like watches, has become increasingly prevalent due to its potential to provide real-time health insights and facilitate proactive healthcare management. Such devices typically employ photoplethysmography (PPG) technology, which utilizes light to detect changes in blood volume and thus infer heart rate. PPG sensors, integrated into wearable devices, illuminate the skin and measure the light absorption to detect pulsatile blood flow. This method offers a non-invasive and convenient means of continuous heart rate monitoring, making it suitable for elderly individuals who may require constant health monitoring without the need for intrusive medical procedures.

In addition to heart rate monitoring, these wearable devices often include features for collecting and transmitting data to the cloud, enabling remote monitoring and analysis by healthcare providers or caregivers. This connectivity allows for the seamless transmission of vital health information, including heart rate trends, fluctuations, and anomalies, to cloud-based platforms. By aggregating and analyzing this data, healthcare professionals can gain valuable insights into the individual's cardiovascular health over time, potentially identifying patterns or warning signs of health issues such as arrhythmias, tachycardia, or bradycardia.

Literature in this field underscores the importance of accurate and reliable heart rate monitoring, particularly for elderly individuals who may be at higher risk of cardiovascular complications. Studies have shown that wearable devices equipped with PPG sensors can provide heart rate measurements comparable to traditional electrocardiography (ECG) methods, with the added benefit of continuous monitoring outside of clinical settings. Furthermore, research has demonstrated the feasibility of integrating cloud-based data storage and analysis into wearable health monitoring systems, highlighting the potential for scalable and accessible healthcare solutions for elderly populations.

One key advantage of wearable heart rate monitoring devices for the elderly is the ability to provide early detection and intervention for cardiac-related issues. By continuously monitoring heart rate patterns and detecting deviations from baseline values, these devices can alert caregivers or healthcare providers to potential health concerns in real-time, allowing for timely intervention or adjustment of treatment plans. This proactive approach to healthcare management can lead to improved health outcomes and quality of life for elderly individuals, reducing the risk of adverse events or hospitalizations.

Moreover, the integration of cloud-based data storage and analysis enables longitudinal tracking of heart rate trends and patterns over time. By securely storing data in the cloud, wearable devices can provide a comprehensive view of an individual's cardiovascular health history, facilitating personalized healthcare interventions and treatment strategies. Additionally, the remote accessibility of cloud-based health data allows for collaborative care between multiple healthcare providers and caregivers, ensuring coordinated and informed decision-making for elderly individuals with complex health needs.

In conclusion, the literature supports the efficacy and potential benefits of wearable heart rate monitoring devices equipped with PPG sensors for elderly populations. These devices offer a non-invasive and convenient means of continuous heart rate monitoring, coupled with the capability to collect and transmit data to cloud-based platforms for remote analysis and storage. By leveraging these technologies, healthcare providers and caregivers can gain valuable insights into the cardiovascular health of elderly individuals, enabling proactive intervention and personalized care to improve health outcomes and quality of life.

CHAPTER 3

Methodology

Developing a wearable device for heartbeat detection and pulse monitoring, specifically tailored for elderly individuals, involves a systematic methodology to ensure accuracy, reliability, and user-friendliness. The process typically begins with comprehensive research into the physiological characteristics of the target demographic, including factors such as heart rate variability and pulse strength, to inform the design requirements.

Once the requirements are established, the hardware components of the wearable device are carefully selected and integrated. This includes choosing suitable sensors capable of accurately detecting heartbeats and measuring pulse, as well as ensuring the device is comfortable to wear for extended periods, lightweight, and unobtrusive. Advanced signal processing algorithms may also be implemented to filter noise and extract relevant data from sensor readings.

The development of the accompanying software involves creating user interfaces that are intuitive and accessible to elderly users, considering factors such as font size, contrast, and simplicity of navigation. Additionally, the software must be capable of collecting real-time data from the sensors, processing it, and transmitting it securely to the cloud for storage and analysis. This may involve integrating wireless communication modules such as Bluetooth or Wi-Fi.

Testing and validation are critical stages in the development process to ensure the accuracy and reliability of the wearable device. This includes both laboratory testing under controlled conditions and field testing with elderly individuals in real-world scenarios. Feedback from users is gathered and used to iteratively improve the design and functionality of the device.

Data security and privacy considerations are paramount when transmitting sensitive health data to the cloud. Robust encryption protocols and secure authentication mechanisms are implemented to protect the integrity and confidentiality of the data. Compliance with relevant regulations such as HIPAA (Health Insurance Portability and Accountability Act) is also ensured to maintain legal and ethical standards.

Finally, ongoing maintenance and support are provided to users to address any technical issues, update software, and ensure the continued effectiveness of the wearable device. This may involve remote troubleshooting and software updates pushed from the cloud platform. Regular monitoring of user feedback and performance metrics allows for continuous improvement and optimization of the device over time.

NODEMCU

(ESP8266)

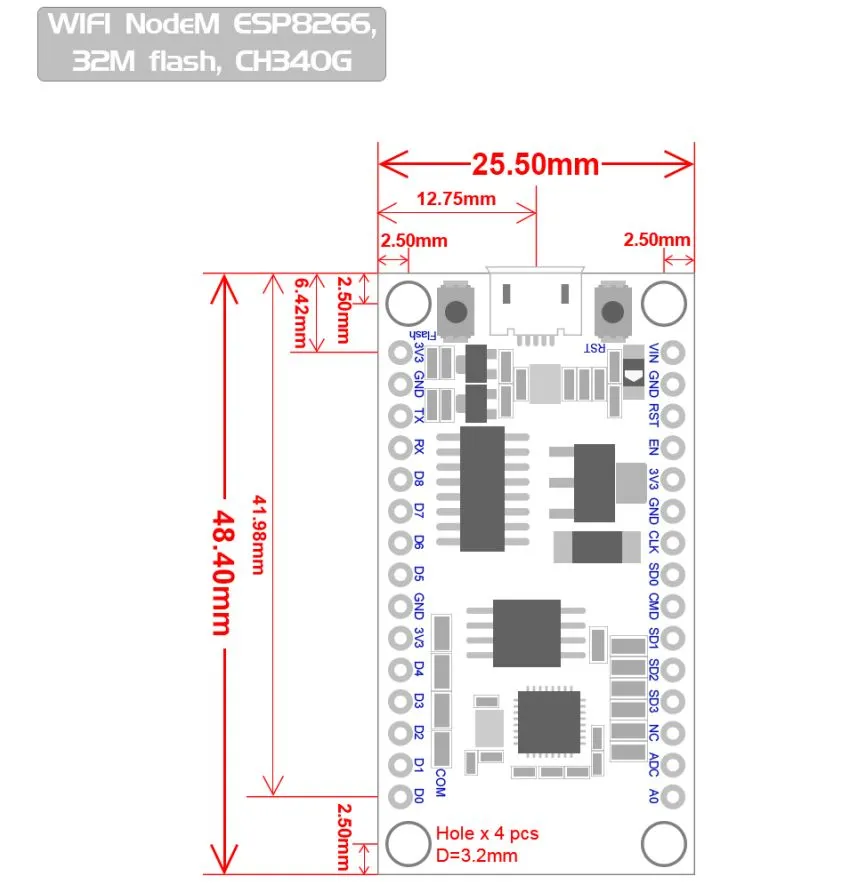
OLED

PULSE SENSOR

**Figure 3.1:Block diagram of heart watch**

3.1 NodeMCU (ESP8266 )

The NodeMCU ESP8266 is a powerful and versatile platform designed for Internet of Things (IoT) development. The ESP8266 is a cost-effective Wi-Fi microchip known for its capability to enable wireless communication in IoT applications. NodeMCU, on the other hand, is an open-source firmware and development kit that simplifies the process of prototyping and programming the ESP8266. With built-in Wi-Fi connectivity, the NodeMCU ESP8266 allows devices to connect to the internet wirelessly, making it suitable for a wide range of IoT projects. One notable feature is its support for the Lua scripting language, providing a high-level programming environment for developers. Additionally, it is compatible with the Arduino IDE, allowing those familiar with Arduino to use the NodeMCU platform. Equipped with General Purpose Input/Output (GPIO) pins, the ESP8266 facilitates interfacing with various electronic components, making it ideal for applications such as home automation and sensor networks. The NodeMCU ESP8266 has garnered significant community support, resulting in an extensive collection of libraries and documentation, making it a popular choice for rapid IoT prototyping and development.



**Figure 3.2 NodeMCU 2D View**

**NodeMCU Specification:**

The NodeMCU development board is based on the ESP8266 microcontroller, and different versions of NodeMCU boards may have slight variations in specifications. As of my knowledge cutoff in January 2022, here are the general specifications for the NodeMCU ESP8266 development board:

**1. Microcontroller:** ESP8266 Wi-Fi microcontroller with 32-bit architecture.

**2. Processor:** Tensilica L106 32-bit microcontroller.

**3. Clock Frequency:** Typically operates at 80 MHz.

**4. Flash Memory:**

* Built-in Flash memory for program storage.
* Common configurations include 4MB or 16MB of Flash memory.

**5. RAM:** Typically equipped with 80 KB of RAM.

**6. Wireless Connectivity:**

* Integrated Wi-Fi (802.11 b/g/n) for wireless communication.
* Supports Station, SoftAP, and SoftAP + Station modes.

**7. GPIO Pins:** Multiple General Purpose Input/Output (GPIO) pins for interfacing with sensors, actuators, and other electronic components.

**8. Analog Pins:** Analog-to-digital converter (ADC) pins for reading analog sensor values.

**9. USB-to-Serial Converter:** Built-in USB-to-Serial converter for programming and debugging.

**10. Operating Voltage:** Typically operates at 3.3V (Note: It is crucial to connect external components accordingly to avoid damage).

**11. Programming Interface:** Programmable using the Arduino IDE, Lua scripting language, or other compatible frameworks.

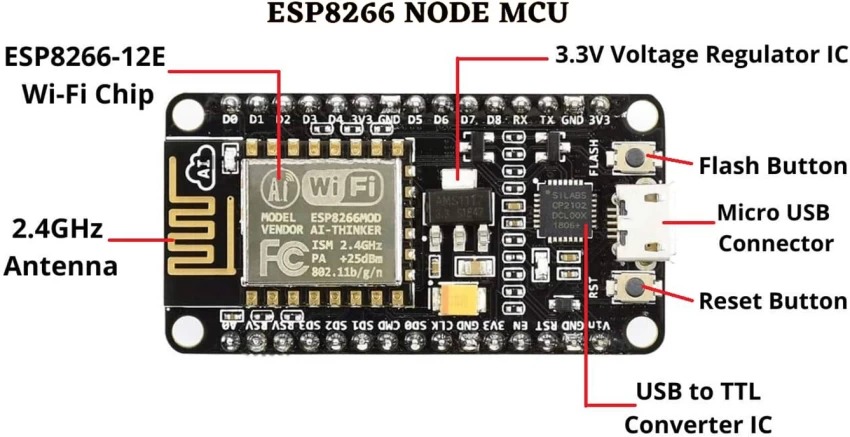
**12. Voltage Regulator:** Onboard voltage regulator for stable operation.

**13. Reset Button:** Reset button for restarting the board.

**14. Dimensions:** Standard NodeMCU boards often have dimensions around 49mm x 24mm.

**15. Power Consumption:** Low power consumption, making it suitable for battery-operated applications.

**16. Community Support:** Active community support with extensive documentation and libraries.



**Figure 3.3: NodeMCU Parts**

The NodeMCU ESP8266 development board typically has GPIO (General Purpose Input/Output) pins that can be used for various purposes, including interfacing with sensors, actuators, and other electronic components. Below is a common pinout configuration for the NodeMCU development board



**Figure 3.4: NodeMCU ESP8266 Pinout**

  ADC   | A0                         | GPIO16

  EN    | Enable                     | GPIO14

  D0    | GPIO16                   | GPIO12

  D1    | GPIO5                     | GPIO13

  D2    | GPIO4                     | GPIO15

  D3    | GPIO0                     | GPIO2

  D4    | GPIO2                     | GPIO9

  D5    | GPIO14                   | GPIO10

  D6    | GPIO12                   | GPIO3

  D7    | GPIO13                   | GPIO1

  D8    | GPIO15                   | TX (GPIO1)

  D9    | GPIO3 (RX)            | RX (GPIO3)

  D10  | GPIO1 (TX)            | D11 (MOSI)

  D11  | MOSI                      | D12 (MISO)

  D12  | MISO                      | D13 (SCK

**ADC**: Analog-to-Digital Converter pin for reading analog sensor values.

**EN** (Enable): Enable pin.

**D0-D8**: Digital GPIO pins.

**D9 (RX) and D10 (TX)**: Serial communication pins for programming and debugging.

**D11 (MOSI), D12 (MISO), D13 (SCK**): Pins used for SPI communication.

**D14 (SDA) and D15 (SCL)**: Pins used for I2C communication.

It's important to note that GPIO pins labeled as "D" (Digital) are typically used for general-purpose digital input/output. Additionally, GPIO pins labeled as "A" (Analog) can be used as analog inputs with the ADC. GPIO pins 6, 7, 8, 9, 10, and 11 have additional functions, so it's advised to refer to the specific NodeMCU documentation for detailed information on pin functionality and capabilities.

**3.2 Pulse sensor**

An alternate name of this sensor is heartbeat sensor or heart rate sensor. The working of this sensor can be done by connecting it from the fingertip or human ear to Arduino board. So that heart rate can be easily calculated.

The pulse sensor includes a 24 inches color code cable, ear clip, Velcro Dots-2, transparent stickers-3, etc.



**Figure 3.5: Pulse sensor**

A color code cable is connected to header connectors. So this sensor is easily connected to an Arduino into the project without soldering.

An ear clip size is the same as a heart rate sensor and it can be connected using hot glue at the backside of the sensor to wear on the earlobe.

Two Velcro dots are completely sized toward the sensor at the hook side. These are extremely useful while making a Velcro strap to cover approximately a fingertip. This is used to cover the Sensor around the finger.

Transparent strikers are protection layers used to protect the sensor from sweaty earlobes and fingers. This sensor includes three holes in the region of the external edge so that one can easily connect anything to it.

**Pulse Sensor Specifications**

The main specifications of this sensor mainly include the following.

This is a hear beat detecting and biometric pulse rate sensor

Its diameter is 0.625

Its thickness is 0.125

The operating voltage is ranges +5V otherwise +3.3V

This is a plug and play type sensor

The current utilization is 4mA

Includes the circuits like Amplification & Noise cancellation

This pulse sensor is not approved by the FDA or medical. So it is used in student-level projects, not for the commercial purpose in health issues applications.

**Pin Configuration**

The heartbeat sensor includes three pins which discussed below.



**Figure 3.6 Pulse-sensor-pin-configuration**

**Pin-1 (GND):** Black Color Wire – It is connected to the GND terminal of the system.

**Pin-2 (VCC):** Red Color Wire – It is connected to the supply voltage ( +5V otherwise +3.3V) of the system.

**Pin-3 (Signal):** Purple Color Wire – It is connected to the pulsating o/p signal.

**Applications of Pulse Sensor**

* This sensor is used for Sleep Tracking
* This sensor is used for Anxiety monitoring
* This sensor is used in remote patient monitoring or alarm system
* This sensor is used in Health bands
* This sensor is used in complex gaming consoles

**3.3 OLED**

OLED displays are often integrated with various sensors to enhance functionality and interactivity in electronic devices. These sensors can include ambient light sensors for automatic brightness adjustment, proximity sensors for touchless interaction, or even environmental sensors for monitoring factors like temperature and humidity. The combination of OLED displays and sensors allows for a more immersive and responsive user experience. For example, in smartphones, ambient light sensors paired with OLED displays can dynamically adjust the screen brightness based on the surrounding light conditions, optimizing visibility and conserving power. The integration of sensors with OLED technology showcases the versatility of these displays in creating smart and adaptive electronic systems.



**Figure 3.7:OLED**

**Features Of OLED :**

OLED (Organic Light-Emitting Diode) displays offer several features that make them popular choices in various electronic applications:

**1. High Contrast Ratio:** OLED displays provide excellent contrast ratios, resulting in vibrant and sharp images with deep blacks and bright whites. This feature enhances the overall visual experience and readability of displayed content.

**2. Wide Viewing Angles:** OLED panels offer wide viewing angles, allowing users to view content clearly from various positions without color distortion or loss of image quality. This makes OLED displays suitable for applications where multiple viewers may be present.

**3. Fast Response Time:** OLEDs have fast response times, enabling smooth and fluid motion in video playback and gaming applications. This feature reduces motion blur and ghosting effects, resulting in sharper and more responsive visuals.

**4. Thin and Lightweight:** OLED displays are thin and lightweight, making them ideal for applications where space and weight constraints are significant considerations. Their slim profile and low weight make OLEDs suitable for portable devices such as smartphones, tablets, and wearable gadgets.

**5. Flexibility and Bendability:** OLED technology allows for flexible and bendable displays, enabling innovative form factors and designs. Flexible OLED panels can be curved or folded to fit curved surfaces or unconventional shapes, offering new possibilities for product design and user interaction.

**6. Energy Efficiency:** OLED displays are energy-efficient compared to traditional LCDs (Liquid Crystal Displays) because they do not require a backlight to illuminate the screen. Each OLED pixel emits its own light, allowing for precise control of brightness and power consumption. This feature results in lower energy consumption and longer battery life in portable devices.

**7. Uniform Illumination:** OLED panels provide uniform illumination across the entire display surface, ensuring consistent brightness and color accuracy from edge to edge. This feature eliminates the backlight bleed and uneven lighting associated with some LCD displays, resulting in a more visually pleasing viewing experience.

Overall, the features of OLED displays, including high contrast ratio, wide viewing angles, fast response time, thin and lightweight design, flexibility, energy efficiency, wide color gamut, and uniform illumination, make them versatile and attractive options for a wide range of electronic devices and applications.

**Applications of OLED:**

Smartphones: OLED displays are commonly used in smartphones due to their ability to provide vibrant colors, high contrast ratios, and flexibility. They are often used in high-end devices for their superior display quality.

Televisions: OLED TVs have gained popularity for their ability to deliver deep blacks, high contrast ratios, and excellent picture quality. The individual pixel control allows for more accurate representation of colors and details.

Tablets and Laptops: OLED displays are used in tablets and laptops to provide a more visually appealing and power-efficient viewing experience. The thin and lightweight nature of OLED panels is advantageous in portable devices.

Wearable Devices: OLED displays are well-suited for wearable devices such as smartwatches and fitness trackers. Their flexibility allows for curved displays, and the ability to display information with high contrast is beneficial for small screens.

Automotive Displays: OLED technology is increasingly being integrated into car displays, including infotainment systems, digital dashboards, and rear-seat entertainment systems. The ability to bend or curve OLED displays is advantageous for fitting various car designs.

Gaming Devices: OLED displays are used in gaming devices such as handheld consoles and gaming laptops. The fast response times and high refresh rates contribute to a smoother gaming experience.

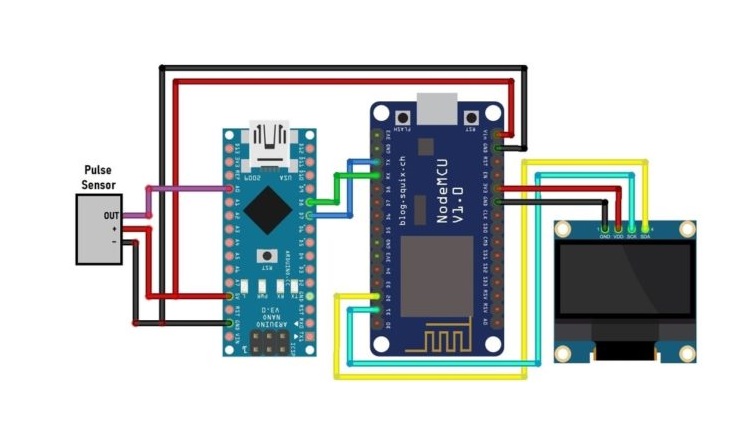
Cameras and Camera Viewfinders: Some high-end cameras and electronic viewfinders use OLED displays to provide photographers with accurate and vibrant previews of their shots.

Virtual Reality (VR) and Augmented Reality (AR) Headsets: OLED displays are used in VR and AR headsets to provide immersive and high-quality visual experiences. The fast response times are crucial for reducing motion blur in virtual environments.

**CHAPTER 4**

Design and Coding

4.1 Circuit Diagram



**4.2 Project Code**

include <ESP8266WiFi.h>

#include <Firebase\_ESP\_Client.h>

#include "addons/TokenHelper.h"

#include "addons/RTDBHelper.h"

#include "DHT.h"

#include <U8g2lib.h>

U8G2\_SSD1306\_128X64\_NONAME\_F\_HW\_I2C u8g2(U8G2\_R0, /\* reset=\*/ U8X8\_PIN\_NONE);

int PulseSensorPurplePin = A0; // Pulse Sensor PURPLE WIRE connected to ANALOG PIN 0

int LED13 = D0;

int Signal;

int Threshold = 770; // Determine which Signal to "count as a beat", and which to ignore.

#define DHTPIN1 D6 // what pin we're connected to

#define DHTTYPE DHT11 // DHT 11

DHT dht1(DHTPIN1, DHTTYPE);

#define WIFI\_SSID "123456789"

#define WIFI\_PASSWORD "123456789"

#define API\_KEY "AIzaSyCt\_DVJB7W8VSSwmPKIFfS5\_IaogaAeyVM"

#define DATABASE\_URL "https://hear-beat-project-default-rtdb.firebaseio.com/"

FirebaseData fbdo;

FirebaseAuth auth;

FirebaseConfig config;

unsigned long sendDataPrevMillis = 0;

bool signupOK = false;

void setup() {

u8g2.begin();

u8g2.clearBuffer();

u8g2.setFont(u8g2\_font\_ncenB08\_tr);

u8g2.setFontRefHeightExtendedText();

u8g2.setDrawColor(1);

pinMode(LED13, OUTPUT); // pin that will blink to your heartbeat!

Serial.begin(115200);

Serial.println();

Serial.println("DHTxx test!");

dht1.begin();

pinMode(LED13, OUTPUT);

WiFi.begin(WIFI\_SSID, WIFI\_PASSWORD);

Serial.print("Connecting to Wi-Fi");

while (WiFi.status() != WL\_CONNECTED)

{

Serial.print(".");

delay(300);

}

Serial.println();

Serial.print("Connected with IP: ");

Serial.println(WiFi.localIP());

Serial.println();

config.api\_key = API\_KEY;

config.database\_url = DATABASE\_URL;

if (Firebase.signUp(&config, &auth, "", ""))

{

Serial.println("ok");

signupOK = true;

}

else

{

Serial.printf("%s\n", config.signer.signupError.message.c\_str());

}

config.token\_status\_callback = tokenStatusCallback; //see addons/TokenHelper.h

Firebase.begin(&config, &auth);

Firebase.reconnectWiFi(true);

}

void loop()

{

Signal = analogRead(PulseSensorPurplePin);

Serial.println(Signal);

Serial.print("Humidity1 =");

Serial.print(dht1.readHumidity());

Serial.println(" %");

Serial.print("Temperature1, ");

Serial.print(dht1.readTemperature());

Serial.println(" c");

// Display data on OLED

u8g2.clearBuffer();

u8g2.setCursor(0, 15);

u8g2.print("Pulse: ");

u8g2.print(Signal);

u8g2.setCursor(0, 30);

u8g2.print("Humidity: ");

u8g2.print(dht1.readHumidity());

u8g2.print(" %");

u8g2.setCursor(0, 45);

u8g2.print("Temperature: ");

u8g2.print(dht1.readTemperature());

u8g2.print(" C");

u8g2.sendBuffer();

if (Signal > Threshold)

{

digitalWrite(LED13, LOW);

}

else

{

digitalWrite(LED13, HIGH);

}

if (Firebase.ready() && signupOK && (millis() - sendDataPrevMillis > 1000 || sendDataPrevMillis == 0))

{

sendDataPrevMillis = millis();

if (Firebase.RTDB.setInt(&fbdo, "main/Pulse", Signal))

{

Serial.println("PATH: " + fbdo.dataPath());

Serial.println("TYPE: " + fbdo.dataType());

}

else

{

Serial.println("Failed REASON: " + fbdo.errorReason());

}

if (Firebase.RTDB.setInt(&fbdo, "main/Temperature1", dht1.readTemperature()))

{

Serial.println("PATH: " + fbdo.dataPath());

Serial.println("TYPE: " + fbdo.dataType());

}

else

{

Serial.println("Failed REASON: " + fbdo.errorReason());

}

delay(1000)

**4.3 Conclusion**

The Internet of Things (IoT) based Health Monitoring System using Pulse Sensor, OLED, and integrated with NodeMCU, successfully demonstrates real-time heart rate measurement and remote monitoring capabilities. This IoT-enabled system provides an accurate, user-friendly, and compact solution for health monitoring, making it suitable for various healthcare applications.

This project showcases the potential of IoT technology in transforming healthcare, enabling efficient and effective monitoring and management of health."