HEALTH MONITORING DEVICE

A PROJCT REPORT

Submitted by

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SRI LEKHA P K

SWATHI S

VIDYASRI R

in partial fulfilment for the award of the degree

of

BACHELOR OF ENGINEERING

IN

COMPUTER SCIENCE AND ENGINEERING

(ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

RAMAKRISHNAN COLLEGE OF ENGINEERING

(AUTONOMOUS)

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ANNA UNIVERSITY

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HEALTH MONITORING DEVICE

PROJECT WORK

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Under the guidance of

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K. RAMAKRISHNAN COLLEGE OF ENGINEERING

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(AUTONOMOUS)

Under

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BONAFIDE CERTIFICATE

Certified that this project report on **"HEALTH MONITORING DEVICE"** is the bonafide work of **MONESHA P(8115U23AM028),SRILEKHA PK(8115U23AM051), SWATHI S(8115U23AM053), VIDYASRI R(8115U23AM056)** who carried out the project work under my supervision.

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DATE :

SIGNATURE OF EXTERNAL EXAMINER

NAME :
DATE:

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(AUTONOMOUS)
Under
ANNA UNIVERSITY, CHENNAI

DECLARATION BY THE CANDIDATES

We declare that to the best of our knowledge the work reported here in has been composed solely by ourselves and that it has not been in whole or in part in any previous application for a degree.

Submitted for the project Viva- Voce held at K. Ramakrishnan College of Engineering on _____

SIGNATURE OF THE CANDIDATES

ACKNOWLEDGEMENT

It is with great pride that I express our gratitude and indebtedness to our institution, "**K. RAMAKRISHNAN COLLEGE OF ENGINEERING(Autonomous)**", for providing us with the opportunity to do this project.

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I wish to convey our profound and heartfelt gratitude to our esteemed project guide **Mr. M. PONNI VALAVAN.,M.E.,** Department of Artificial Intelligence and Machine Learning, for her incalculable suggestions, creativity, assistance and patience, which motivated us to carry out this project.

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INSTITUTE VISION AND MISSION

VISION OF THE INSTITUTE:

To achieve aprominent position among the top technical institutions.

MISSIONOFTHE INSTIITUTE:

M1: To best standard technical education par excellence through state of the art infrastructure,competent faculty and high ethical standards.

M2: To nurture research and entrepreneurial skills among students in cutting technologies.

M3: To provide education for developing high-quality professionals to transform the society.

DEPARTMENT VISION AND MISSION

DEPARTMENT OF CSE(ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

Vision of the Department

To become a renowned hub for Artificial Intelligence and Machine Learning technologies to produce highly talented globally recognizable technocrats to meet industrial needs and societal expectations.

Mission of the Department

M1: To impart advanced education in Artificial Intelligence and Machine Learning, built upon a foundation in Computer Science and Engineering.

M2: To foster Experiential learning equips students with engineering skills to tackle real-world problems**.**

M3: To promote collaborative innovation in Artificial Intelligence, machine learning, and related research and development with industries.

M4: To provide an enjoyable environment for pursuing excellence while upholding strong personal and professional values and ethics**.**

Programme Educational Objectives (PEOs):

Graduates will be able to:

PEO1: Excel in technical abilities to build intelligent systems in the fields of Artificial Intelligence and Machine Learning in order to find new opportunities**.**

PEO2: Embrace new technology to solve real-world problems, whether alone or as a team, while prioritizing ethics and societal benefits.

PEO3: Accept lifelong learning to expand future opportunities in research and product development.

Programme Specific Outcomes (PSOs):

PSO1: Ability to create and use Artificial Intelligence and Machine Learning algorithms, including supervised and unsupervised learning, reinforcement learning, and deep learning models.

PSO2: Ability to collect, pre-process, and analyze large datasets, including data cleaning, feature engineering, and data visualization..

.

PROGRAM OUTCOMES (POs):

Engineering students will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review, research, literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work:** Function effectively as an individual, and as a member or leaderin diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

ABSTRACT

A health monitoring device is a technological tool designed to continuously or periodically measure and track key health parameters such as heart rate, blood pressure, oxygen levels, temperature, and physical activity. These devices often utilize advanced sensors, wireless communication, and data analysis algorithms to provide real-time health insights. They play a crucial role in preventive healthcare, remote patient monitoring, and chronic disease management. By integrating with smartphones and cloud-based systems, they allow seamless data sharing with healthcare providers, enabling timely interventions. This technology enhances patient engagement, improves health outcomes, and supports personalized healthcare approaches.

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LIST OF FIGURES

LIST OF ABBREVIATIONS

HR	Heart Rate
BP	Blood Pressure
SPO2	Peripheral Capillary Oxygen Saturation
ECG	Electrocardiogram
RR	Respiratory Rate
BMI	Body Mass Index
BPM	Beats Per Minute
IoMT	Internet of Medical Things
FDA	Food and Drug Administration
EMR	Electronic Medical Record
HMD	Health Monitoring Device
AI	Artificial Intelligence
RFID	Radio-Frequency Identification
BLE	Bluetooth Low Energy
PHE	Personal Health Environment

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Health monitoring devices are innovative tools that enable individuals and healthcare providers to track, analyze, and manage health parameters in real-time or periodically. These devices, ranging from wearable technologies to stationary monitoring systems, have revolutionized the healthcare industry by empowering proactive health management.

1.2 PURPOSE AND IMPORTANCE

The primary purpose of health monitoring devices is to provide accurate and real-time tracking of key health metrics, enabling individuals and healthcare providers to monitor and maintain health effectively.

Facilitate Preventive Care: By identifying potential health issues early, these devices help in reducing the risk of severe medical conditions.

Support Chronic Disease Management: Patients with conditions such as diabetes, hypertension, or cardiovascular diseases can use these devices to manage their health better.

Enable Remote Monitoring: Healthcare providers can monitor patients' health from a distance, ensuring timely intervention without the need for frequent hospital visits.

Enhance Patient Engagement: These devices empower users to take charge of their health by providing easy access to health data and insights.

Early Detection: Identifying abnormalities in vital signs before they escalate into critical conditions.

Cost-Effective Healthcare: Reducing the frequency of hospital visits and medical emergencies, ultimately lowering healthcare expenses.

1.3 OBJECTIVES:

1. Ensure Accuracy.

2. Promote Flexibility

3. Enable Scalability

4. Optimize Performance

5. Handle Errors Effectively

6. Support Integration

1.4 PROJECT SUMMARIZATION

The Health Monitoring Device project focuses on designing and developing a system that tracks and analyses vital health metrics in real-time. This device leverages advanced sensors, wireless communication, and data analytics to measure parameters such as heart rate, blood pressure, oxygen saturation, and physical activity.

1. Real-time Monitoring: Continuous tracking of health metrics with high accuracy.

2. Data Integration: Seamless connection to healthcare systems, electronic medical records (EMRs), and IoT platforms.

3. User Engagement: Empowering individuals to take charge of their health through accessible data and insights.

4. Remote Healthcare: Enabling healthcare providers to monitor patients from a distance, reducing hospital visits and enhancing preventive care.

The project aims to address critical healthcare challenges by improving early detection of medical conditions, managing chronic diseases, and personalizing healthcare delivery. With a focus on accuracy, flexibility, scalability, optimization, error handling, and integration, the Health Monitoring Device is positioned to transform traditional healthcare practices into efficient, patient-centric systems.

CHAPTER 2

PROJECT METHODOLOGY

2.1 INTRODUCTION TO SYSTEM ARCHITECTURE

The system architecture of a health monitoring device outlines the structural design and interaction between its components to ensure accurate data collection, processing, and communication. It combines hardware and software systems to deliver a seamless and efficient user experience.

Components of the Architecture:

1. Sensor Layer:

Comprises sensors for tracking health parameters such as heart rate, blood pressure, temperature, and oxygen saturation. Converts physiological signals into electrical signals for further processing.

2. Data Processing Unit:

Processes raw data from sensors using algorithms to filter noise and enhance accuracy. Includes microcontrollers or microprocessors to manage real-time computations.

3. Communication Module:

Facilitates data transmission between the device and external systems via technologies like Bluetooth, Wi-Fi, or cellular networks. Ensures secure data transfer to healthcare providers or cloud-based storage.

4. Storage Layer:

Stores processed data locally or in cloud systems for future analysis and reference. Supports data synchronization across multiple devices.

5. User Interface (UI):

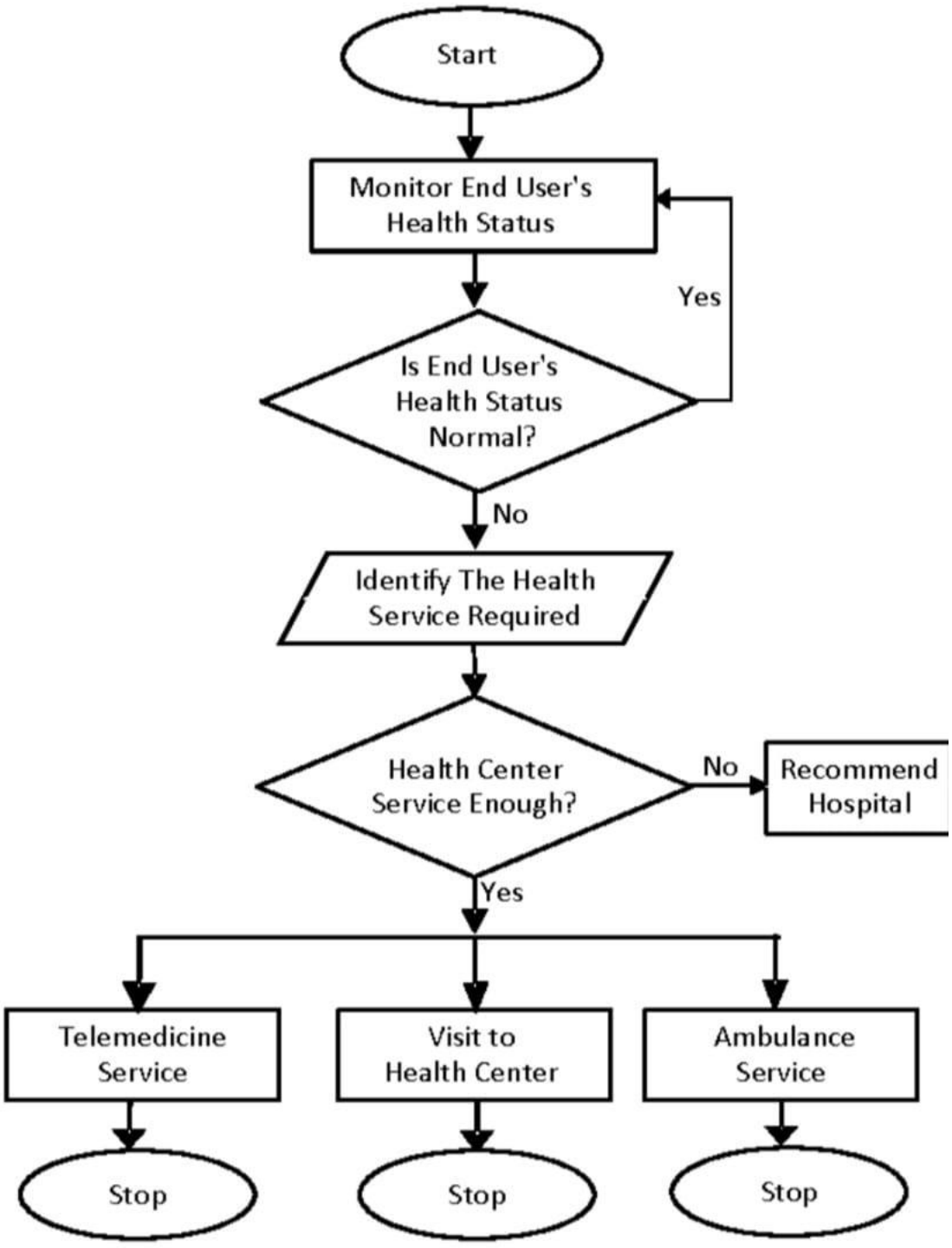
Provides a graphical or app-based interface for users to view health metrics in real-time. Includes

alerts and notifications for abnormal readings or critical health conditions.

6. Integration and Analytics Layer:

Connects to external healthcare systems like Electronic Medical Records (EMRs) or telehealth platforms. Utilizes AI and machine learning for predictive analytics and personalized health insights.

2.2 DETAILED SYSTEM FLOW DIAGRAM



CHAPTER 3

CORE FEATURES AND MODULES

3.1 CORE FEATURES

1. Real-Time Monitoring

Continuous tracking of health metrics like heart rate, blood pressure, and oxygen levels. Instant notifications for abnormal readings

.

2. Data Accuracy and Reliability

Advanced sensors and algorithms to ensure precise and reliable measurements. Noise filtering and calibration techniques.

3. User-Friendly Interface

Intuitive apps or dashboards for real-time visualization of health data. Notifications and alerts for anomalies or health milestones

.

4. Remote Accessibility

Data synchronization with mobile devices or cloud platforms for remote monitoring. Telehealth integration to share data with healthcare providers.

5. Data Storage and History

Local and cloud-based data storage for historical analysis and insights. Trend visualization for long-term health tracking.

6. Custom Alerts and Recommendations

Personalized alerts for critical conditions.AI-based health suggestions and fitness recommendations.

3.2 CORE MODULES

1. Sensor Module

Includes hardware sensors for measuring physiological parameters like heart rate, SpO2, temperature, and activity levels.

2. Processing Module

A microcontroller or microprocessor for data collection, filtering, and processing. Ensures real-time performance and computational efficiency.

3. Communication Module

Enables data transfer via Bluetooth, Wi-Fi, or cellular networks. Ensures secure and fast communication with connected devices

4. Storage Module

Handles data storage locally on the device or remotely on cloud servers. Includes mechanisms for data backup and synchronization.

5. Power Management Module

Optimizes battery usage for extended device life. Includes charging circuits and low-power operation modes.

6. User Interface Module

Provides access to health data via mobile apps, web dashboards, or device screens. Supports alerts, notifications, and data export options

7. Integration and Analytics Module

Connects to external systems like Electronic Medical Records (EMRs) or AI-driven analytics platforms. Provides insights, trends, and predictive analysis for better healthcare management

CHAPTER 4

USER RECOMMENDATIONS

To maximize the effectiveness and usability of the health monitoring device, users should follow these recommendations:

4.1 Daily Use

1. Consistent Usage:

Wear or use the device regularly as per instructions to ensure accurate tracking of health trends.

2. Proper Fit and Placement:

Ensure the device is securely fitted (e.g., on the wrist or chest) or placed correctly for precise sensor readings

3. Regular Calibration:

Calibrate the device periodically, if required, to maintain measurement accuracy.

4.2 Device Maintenance

1. Keep Clean and Dry:

Clean sensors and device components regularly to avoid inaccuracies due to dirt or moisture**.**

2. Charge Timely:

Monitor battery levels and charge the device appropriately to avoid interruptions.

3.Update Firmware:

Keep the device's software or firmware updated for optimal performance and new features. Data Management.

4. Monitor Trends:

Regularly review health data to identify patterns or changes in your vital signs.

5. Set Alerts:

Enable notifications for critical thresholds to address any potential health risks promptly.

6. Share Data with Healthcare Providers:

Use the integration features to share your health records with doctors for personalized medical advice.

4.3 Lifestyle Recommendations

1. Follow Recommendations:

Act on fitness or health suggestions provided by the device to improve overall well-being

.

2. Combine with Healthy Habits:

Use the device as a tool to complement a healthy lifestyle, including balanced nutrition, exercise, and adequate sleep.

3. Understand Limitations:

Recognize that the device provides supportive data but is not a substitute for professional medical advice.

By adhering to these recommendations, users can effectively utilize the health monitoring device to enhance their health management and make informed decisions about their well-being.

CHAPTER-5

PERFORMANCE CONSIDERATION

5.1 PERFORMANCE CONSIDERATION

The performance of a Health Monitoring Device is critical to its reliability, efficiency, and user satisfaction. Below are the key considerations for ensuring optimal performance:

1. Accuracy of Measurements

The device must deliver precise and reliable health data under varying environmental and user conditions. Advanced sensor calibration and noise reduction techniques are essential to minimize errors.

2. Real-Time Data Processing

The system should process and display health metrics in real time to enable timely decision-making. Efficient algorithms and optimized microcontrollers can reduce latency and ensure smooth operation.

3. Battery Life and Power Efficiency

The device should consume minimal power to maximize battery life, especially for continuous monitoring. Low-power sensors and energy-efficient components are crucial for prolonged usage.

4. Data Storage and Retrieval

The device must efficiently handle data storage, ensuring quick access to both real-time and historical health records. Cloud integration should be optimized for seamless data synchronization without delays.

5. Scalability and Load Management

As the number of users and integrated features grows, the device should maintain consistent performance. Scalable architecture and cloud-based solutions can manage increased workloads effectively.

6. Error Handling and Fault Tolerance

The system should detect and handle sensor malfunctions or data inconsistencies to maintain reliability. Robust error-handling mechanisms ensure the device operates smoothly even under adverse conditions.

7. Security and Data Integrity

The device must encrypt sensitive health data to prevent breaches. Secure data transmission protocols ensure the integrity of data during synchronization and sharing.

CHAPTER 6

APPLICATION DEVELOPMENT

The application development for the Health Monitoring Device plays a pivotal role in creating a seamless bridge between the user and the hardware. This app acts as the central hub for managing health data, visualizing metrics, and offering personalized health insights. The process involves designing, developing, and deploying a reliable, secure, and user-friendly application.

6.1 Overview

Backend

Frontend Code (HTML, CSS, JavaScript)

Run the Application

6.2 Project Architecture

Step 1: Backend Setup

The backend serves as the brain of the application, enabling data processing, secure storage, device integration, and real-time insights. It ensures the app operates seamlessly and provides users with a reliable and secure experience, making it an indispensable part of the health monitoring ecosystem

```
const express = require('express');
const cors = require('cors');

const app = express();
app.use(cors());

const healthData = [
  { heartRate: 75, temperature: 36.5, spo2: 98 },
  { heartRate: 80, temperature: 36.7, spo2: 97 },
  { heartRate: 72, temperature: 36.4, spo2: 99 },
];

app.get('/health-data', (req, res) => {
  res.json(healthData);
});
const PORT = 3000;
app.listen(PORT, () => {
  console.log(Server running on port ${PORT});
});
```

Step 2: Frontend Code (HTML, CSS, JavaScript)

```
import React, { useEffect, useState } from 'react';
import { View, Text, StyleSheet, FlatList } from 'react-native';

const App = () => {
  const [data, setData] = useState([]);

  useEffect(() => {
    fetch('http://localhost:3000/health-data')
      .then((response) => response.json())
      .then((data) => setData(data))
      .catch((error) => console.error('Error fetching data:', error));
  }, []);

  const renderItem = ({ item }) => (
    <View style={styles.card}>
      <Text style={styles.text}>Heart Rate: {item.heartRate} bpm</Text>
      <Text style={styles.text}>Temperature: {item.temperature} °C</Text>
      <Text style={styles.text}>SpO2: {item.spo2}%</Text>
    </View>
  );
return (
    <View style={styles.container}>
      <Text style={styles.title}>Health Monitoring Dashboard</Text>
```

```
      <FlatList
        data={data}
        renderItem={renderItem}
        keyExtractor={(item, index) => index.toString()}
      />
    </View>
  );
};

const styles = StyleSheet.create({
  container: {
    flex: 1,
    padding: 20,
    backgroundColor: '#f8f8f8',
  },
  title: {
    fontSize: 24,
    fontWeight: 'bold',
    marginBottom: 20,
    textAlign: 'center',
  },
  card: {
    backgroundColor: '#fff',
    padding: 15,
    borderRadius: 10,
    marginBottom: 10,
    shadowColor: '#000',
    shadowOpacity: 0.2,
    shadowRadius: 5,
    elevation: 2,
  },
  text: {
    fontSize: 18,
    color: '#333',
  },
});

export default App;
```

CHAPTER 7

CONCLUSION & FUTURE SCOPE

7.1 CONCLUSION

The development of the Health Monitoring Device has been a significant step toward modernizing healthcare by integrating technology with real-time health tracking. This project demonstrates the capability of advanced sensors, data processing, and communication technologies to provide accurate, reliable, and user-friendly solutions for monitoring vital health parameters.

The device architecture ensures flexibility, scalability, and optimization, allowing seamless integration with healthcare systems for effective management of individual and population health. By addressing key challenges such as error handling, data accuracy, and remote accessibility, the device offers a practical and efficient solution for both personal health management and clinical applications.

Through this documentation, the project's objectives, features, modules, and user recommendations have been outlined to ensure a comprehensive understanding of the system. The implementation of such a device not only supports proactive health management but also contributes to the broader vision of accessible, patient-centered care.

In conclusion, this project highlights the potential of health monitoring devices to transform healthcare by enabling early detection, personalized treatment, and improved quality of life. With continuous advancements, these systems will play a pivotal role in building smarter, more efficient healthcare solutions in the future.

7.2 FUTURE SCOPE

The Health Monitoring Device has significant potential for future advancements, ensuring its scalability and relevance in the ever-evolving healthcare landscape. One of the primary areas of development lies in incorporating advanced monitoring capabilities, such as tracking additional health parameters like hydration levels, stress metrics, and sleep patterns. The adoption of non-invasive and pain-free technologies will further enhance user comfort and usability.

Artificial Intelligence (AI) and machine learning present exciting opportunities for the device's evolution. By integrating AI, the system can offer predictive analytics to foresee potential health risks and provide early warnings, enabling timely interventions. Moreover, personalized health insights and automated recommendations based on real-time and historical data can improve healthcare outcomes significantly.

Connectivity and integration are crucial for the device's growth. Enhanced interoperability with IoT-enabled devices, smart healthcare systems, and global Electronic Health Records (EHRs) will facilitate seamless data sharing and unified healthcare management. Additionally, advancements in miniaturization could lead to the development of more compact, lightweight, and user-friendly designs, integrating the device into everyday accessories like smartwatches, glasses, or clothing.

Energy efficiency is another critical focus area. Future models can incorporate advanced battery technologies to extend operational life, alongside energy harvesting techniques, such as utilizing body heat or motion, to ensure sustainability. Cost-effective designs will also play a vital role in making the device accessible to underserved regions and low -resource settings, promoting global health equity

APPENDICES

APPENDIX A

SOURCECODE

```
    <!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>Health Monitoring Dashboard</title>
  <style>
    /* Global Styles */
    body {
      font-family: Arial, sans-serif;
      background-color: #f4f4f9;
      color: #333;
      margin: 0;
      padding: 0;
    }

    .container {
      max-width: 1200px;
      margin: 0 auto;
      padding: 20px;
      text-align: center;
    }

    h1 {
```

```
  font-size: 2.5em;
  margin-bottom: 20px;
}

/* Metrics Container */
.metrics-container {
  display: grid;
  grid-template-columns: repeat(auto-fill, minmax(250px, 1fr));
  gap: 20px;
  padding: 20px;
}

/* Metric Card Styles */
.metric-card {
  background-color: #fff;
  padding: 20px;
  border-radius: 10px;
  box-shadow: 0 4px 8px rgba(0, 0, 0, 0.1);
  text-align: center;
}

.metric-card h3 {
  font-size: 1.2em;
  margin-bottom: 10px;
}

.metric-card .metric-value {
  font-size: 1.5em;
  font-weight: bold;
}
```

```
/* Color Classes */
.green {
  border-left: 5px solid green;
}

.red {
  border-left: 5px solid red;
}

.blue {
  border-left: 5px solid blue;
}

.orange {
  border-left: 5px solid orange;
}

.green .metric-value {
  color: green;
}

.red .metric-value {
  color: red;
}

.blue .metric-value {
  color: blue;
}
```

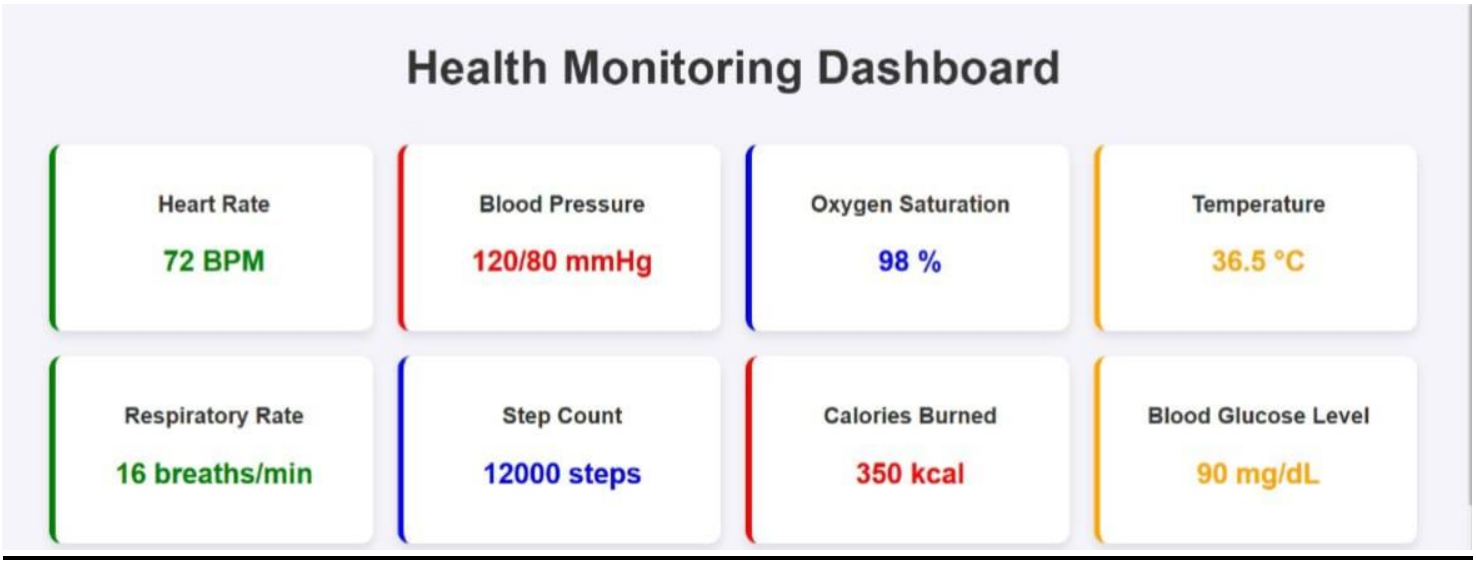
```
    .orange .metric-value {
      color: orange;
    }
  </style>
</head>
<body>

  <div class="container">
    <h1>Health Monitoring Dashboard</h1>

    <div id="metrics-container" class="metrics-container">
      <!-- Dynamic content will be loaded here -->
    </div>
  </div>

  <script src="https://cdn.jsdelivr.net/npm/axios/dist/axios.min.js"></script>
  <script>
    // Simulating the backend data
    const simulatedData = {
      heartRate: 72,
      bloodPressure: '120/80 mmHg',
      oxygenSaturation: 98,
      temperature: 36.5,
      respiratoryRate: 16,
      stepCount: 12000,
      caloriesBurned: 350,
      bloodGlucose: 90,
    };

    // Fetch health data (simulating backend response)
```

```
  function fetchHealthData() {
    return new Promise((resolve) => {
      setTimeout(() => {
        resolve(simulatedData);
      }, 500); // Simulating an API call delay
    });
  }

  // Displaying the health metrics on the webpage
  fetchHealthData().then(function(data) {
    const metricsContainer = document.getElementById('metrics-container');

    // Create the HTML structure for each health metric
    const metrics = [
      { title: 'Heart Rate', value: data.heartRate, unit: 'BPM', color: 'green' },
      { title: 'Blood Pressure', value: data.bloodPressure, unit: '', color: 'red' },
      { title: 'Oxygen Saturation', value: data.oxygenSaturation, unit: '%', color: 'blue' },
      { title: 'Temperature', value: data.temperature, unit: '°C', color: 'orange' },
      { title: 'Respiratory Rate', value: data.respiratoryRate, unit: 'breaths/min', color:
'green' },
      { title: 'Step Count', value: data.stepCount, unit: 'steps', color: 'blue' },
      { title: 'Calories Burned', value: data.caloriesBurned, unit: 'kcal', color: 'red' },
      { title: 'Blood Glucose Level', value: data.bloodGlucose, unit: 'mg/dL', color: 'orange'
}
    ];

    // Loop through the metrics and create HTML elements
    metrics.forEach(metric => {
      const metricCard = document.createElement('div');
      metricCard.classList.add('metric-card');
```

```
        metricCard.classList.add(metric.color);

        const title = document.createElement('h3');
        title.textContent = metric.title;

        const value = document.createElement('p');
        value.textContent = ${metric.value} ${metric.unit};
        value.classList.add('metric-value');

        metricCard.appendChild(title);
        metricCard.appendChild(value);

        metricsContainer.appendChild(metricCard);
      });
    })
    .catch(function (error) {
      console.log('Error fetching data: ', error);
    });
  </script>

</body>
</html>
```

APPENDIX B

SCREEN SHOT RESULT



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