A

Project Phase-I Report on

Health Monitoring Ring

Submitted in partial fulfillment of the requirements
For the Award of the Degree of Bachelor of Technology (B.Tech) in
Electronics and Communication Engineering

Submitted by

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Under the Guidance of

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ACADEMIC YEAR: 2023-2024

Department of Electronics and Communication Engineering
BHARATI VIDYAPEETH
(DEEMED TO BE UNIVERSITY)
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CERTIFICATE

This is to certify that the project phase-I report on **"Project Title"** submitted by

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in partial fulfillment of the requirements for the award of the degree of Bachelor of Technology (B.Tech) in Electronics and Communication Engineering.

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Date:

Place: Pune

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Chapter 1

Introduction and Literature Review

1.1 Introduction

The Health Monitoring Ring project represents a paradigm shift in healthcare technology, merging state-of-the-art advancements with personal well-being. In an era emphasizing individual health, this project introduces a wearable device not only tracking physical activity but also monitoring vital health parameters.

1.2 Literature Review

The literature surrounding wearable health devices has experienced significant growth. Devices tracking heart rate, activity levels, and sleep patterns have proliferated, yet the integration of these features into a compact, stylish ring is an innovative approach. Modern wearable Electronic Control Units (ECUs) have paved the way for efficient health monitoring devices. The use of diagnostic tool simulators communicating via the CAN bus with the ECU enhances the functionality of our Health Monitoring Ring.

1.2.1 A Futuristic Wearable Health Monitoring Ring by Duraiarasu

Duraiarasu introduces a novel concept of a compact health monitoring system integrated into a ring. The project envisions a wearable device that can store real-time data, providing a platform for remote monitoring and evaluation by healthcare professionals.

The inclusion of an SOS feature addresses the critical issue of timely communication with medical assistance.

1.2.2 IoT-Based Health Monitoring System Using NodeMCU by Jai Vasanthan

Jai Vasanthan's work emphasizes the role of IoT and cloud computing in tele-monitoring health systems. The system tracks patient physiological parameters using Raspberry Pi and transmits data wirelessly through Body Wireless Sensor Networks (BWSN). This approach is particularly suitable for remote areas with limited medical facilities, offering a cost-effective solution for continuous health monitoring.

The project draws inspiration from these references, aiming to synthesize the ideas presented and create a wearable device that combines a compact design with advanced monitoring capabilities.

1.3 Revolution

The health tech revolution is apparent in the evolution of wearable devices. Figure 1.1 illustrates the significant milestones in the wearable health tech industry.

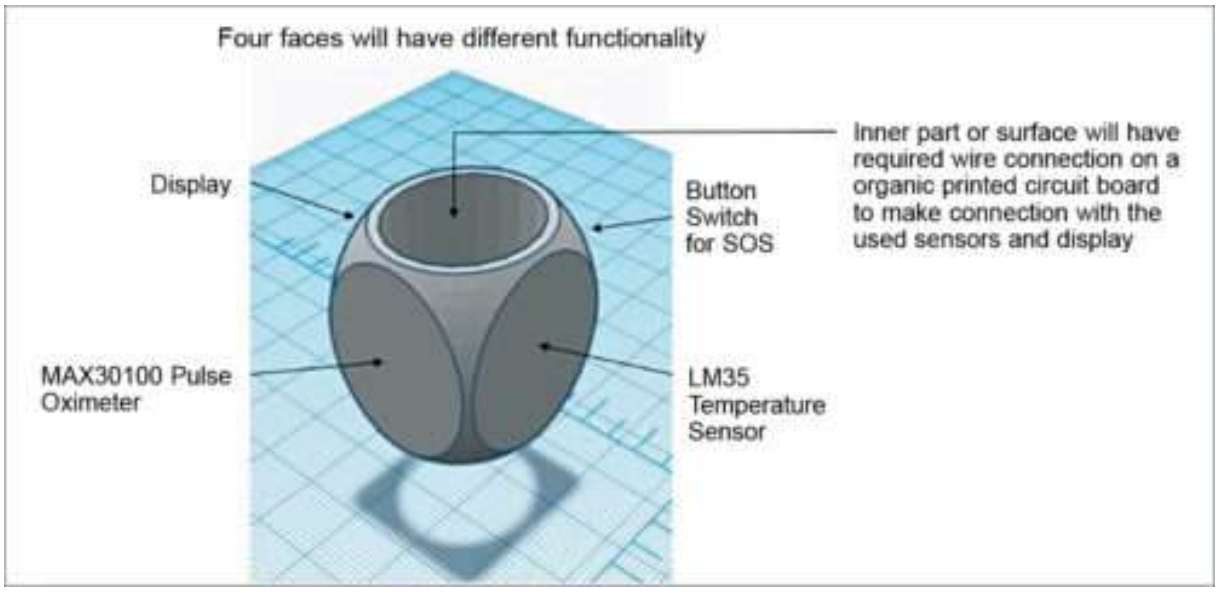

Figure 1.1: Evolution in the wearable health tech industry

Chapter 2

Project Objectives and Significance

2.1 Objectives

The primary objectives of our health monitoring ring project are outlined below:

- Design and implement a compact and wearable health monitoring device.
- Integrate essential sensors, including a Pulse Sensor and Techtonics MAX30102 Heart Rate and Pulse Oximeter Sensor Module, to capture vital health parameters.
- Utilize the HM-10 Bluetooth module for seamless communication with external devices.
- Develop a user-friendly interface for data visualization and analysis.
- Ensure the portability and comfort of the health monitoring ring for everyday use.

2.2 Significance

Continuous health monitoring has become increasingly crucial in today's fast-paced lifestyle. Our health monitoring ring addresses the need for a convenient and portable solution, allowing individuals to track their health in real-time. The significance of our project lies in:

- Providing a wearable solution for continuous health monitoring, enhancing accessibility to vital health data.
- Enabling healthcare professionals to remotely monitor patients, improving the efficiency of healthcare delivery.
- Empowering individuals to take proactive measures towards their well-being by staying informed about their health status.
- Demonstrating the potential of integrating modern technologies for preventive healthcare.

2.3 System Requirements

To achieve the objectives outlined, the project has the following system requirements:

- HM-10 Bluetooth Module for wireless communication.
- Pulse Sensor for heart rate monitoring.
- Techtonics MAX30102 Heart Rate and Pulse Oximeter Sensor Module for pulse oximetry.
- ESP8266 Microcontroller for processing and data transmission.
- Compact and lightweight design for user comfort.

2.4 Feasibility Study

A feasibility study will be conducted to assess the technical, operational, and economic feasibility of the project. This study will include a cost-benefit analysis, technical requirements evaluation, and an assessment of the project's impact on healthcare practices.

2.5 Project Timeline

The project will be executed in phases, each focusing on specific aspects of development. A timeline will be established to ensure efficient progress and timely completion of the health monitoring ring.

2.6 Budget Estimate

A preliminary budget estimate will be prepared, taking into account the cost of components, development tools, and any additional resources required for the project.

2.7 Summary

Chapter 2 has outlined the objectives and significance of our health monitoring ring project, highlighting its potential impact on personal and remote healthcare. The feasibility study, project timeline, and budget estimate will guide the project's execution in the coming phases.

Chapter 3

Project Tools Requirements

3.1 Arduino IDE

The Arduino Integrated Development Environment (IDE) will serve as the primary platform for programming the ESP8266 Microcontroller. Its user-friendly interface and extensive library support make it an ideal choice for embedded system development.

3.2 HM-10 Bluetooth Module

The HM-10 Bluetooth Module is a key component for wireless communication. It will be configured using AT commands through the Arduino IDE, facilitating seamless data transmission between the health monitoring ring and external devices.

3.3 Pulse Sensor

For heart rate monitoring, we'll utilize the Pulse Sensor. However, due to project changes, we'll now incorporate the Techtonics MAX30102 Heart Rate and Pulse Oximeter Sensor Module. This sensor is compatible with the Arduino platform and simplifies the process of acquiring accurate pulse data for real-time health monitoring.

3.4 Techtonics MAX30102 Heart Rate and Pulse Oximeter Sensor Module

The Techtonics MAX30102 Sensor Module will replace the ECG sensor for pulse oximetry. This module is designed for accurate heart rate and blood oxygen saturation measurements, enhancing the capabilities of our health monitoring ring.

3.5 ESP8266 Microcontroller

The ESP8266 Microcontroller will serve as the brain of the health monitoring ring. Its capabilities in data processing, connectivity, and compatibility with Arduino make it an ideal choice for our wearable health device.

3.6 Compact LiPo Battery

To ensure portability and continuous operation, a compact LiPo (Lithium Polymer) battery will power the health monitoring ring. The choice of battery will consider factors such as capacity, weight, and charging requirements.

3.7 Arduino Development Kit

An Arduino development kit, including essential components and accessories, will be utilized for testing and prototyping during the development phase. This kit will expedite the assembly and debugging processes.

3.8 MATLAB for Data Analysis

MATLAB will be employed for in-depth data analysis, enabling us to extract valuable insights from the health parameters collected by the ring. MATLAB's extensive

toolboxes for signal processing and data visualization will enhance our analytical capabilities.

3.9 Summary

Chapter 3 has outlined the tools required for the development of our health monitoring ring project. These tools, ranging from programming environments to specialized sensors, will collectively contribute to the successful implementation of the wearable health device.

Chapter 4

Design

4.1 Overall System Architecture

The health monitoring ring will adopt a modular design, comprising interconnected components to ensure seamless functionality. A high-level system architecture diagram is depicted in Figure 4.1.

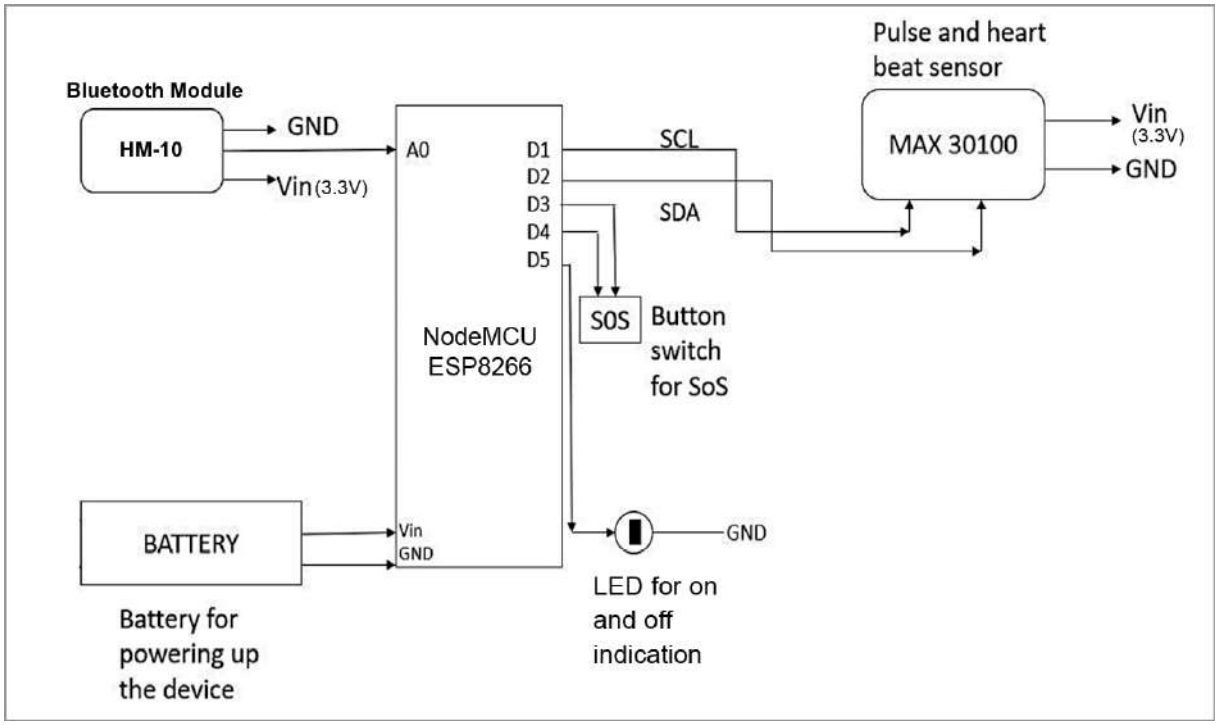

Figure 4.1: High-Level System Architecture of the Health Monitoring Ring

The architecture illustrates the flow of data between the HM-10 Bluetooth Module, Pulse Sensor, MAX30102 Sensor Module, ESP8266 Microcontroller, and the Compact

LiPo Battery. This design enables efficient communication and real-time health parameter monitoring.

4.2 Physical Design of the Ring

Considering the wearable nature of the device, the physical design of the health monitoring ring is crucial. The compact form factor will prioritize user comfort while housing all necessary components securely. The materials chosen will be hypoallergenic and suitable for continuous skin contact.

4.3 Bluetooth Communication Protocol

The HM-10 Bluetooth Module will establish a reliable communication link between the health monitoring ring and external devices. The design will include protocols for data transmission, ensuring data integrity and security during wireless interactions.

4.4 Sensor Integration

The Pulse Sensor and MAX30102 Sensor Module will be strategically integrated into the ring to optimize data accuracy. Proper sensor placement will be considered to enhance signal acquisition and minimize interference.

4.5 Power Management

Efficient power management is vital for prolonged usage. The design will incorporate power-saving features, and the Compact LiPo Battery will be selected based on its capacity to support continuous monitoring without frequent recharging.

4.6 User Interface

A minimalistic user interface, possibly through LED indicators or a small display, will provide users with real-time feedback on their health parameters. The design will prioritize simplicity and intuitiveness.

4.7 Enclosure and Material Selection

The choice of materials for the ring's enclosure will consider durability, comfort, and aesthetic appeal. The design will prioritize a sleek and unobtrusive appearance while ensuring robust protection for the internal components.

4.8 Summary

Chapter 4 has outlined the design considerations for the health monitoring ring project. The overall system architecture, physical design, communication protocols, sensor integration, power management, user interface, and material selection collectively contribute to the holistic design of the wearable health device.

Chapter 5

Bills of Materials

5.1 Components Purchased from Amazon

Additional Note: The components purchased from Amazon include crucial elements for the successful realization of our health monitoring ring. These materials were carefully selected to meet the project's requirements, ensuring the reliability and functionality of our wearable health device.

Amazon.in - Order 406-0063489-7030742 03/11/23, 12:25 AM

amazon.in

Details for Order #406-0063489-7030742

Print this page for your records.

Order Placed: 3 November 2023
Amazon.in order number: 406-0063489-7030742
Order Total: 454.00

Not Yet Dispatched

Items Ordered	**Price**
1 of: *xcluma BT-09 Android iOS HM-10 BLE Bluetooth 4.0 CC2540 CC2541 Serial Wireless Module* Sold by: xcluma® (seller profile) New Serial Number:	454.00

Delivery Address:
Manav Behl
H.no.-a1, Phase-5, Patang Plaza, Katraj
Bharati Vidhyapeeth Back Gate
PUNE, MAHARASHTRA 411043
India

Delivery Option:
Standard Delivery

Payment information

Payment Method:
Visa ending in 2460

Billing Address:
Manav Behl
E-406, Shekhar Enclave, Kanadia Road
Sanchar Nagar
INDORE, MADHYA PRADESH 452016
India

Item(s) Subtotal:	454.00
Shipping:	0.00
Total:	454.00
Grand Total:	**454.00**

To view the status of your order, return to Order Summary.

Please note: this is not a GST invoice.

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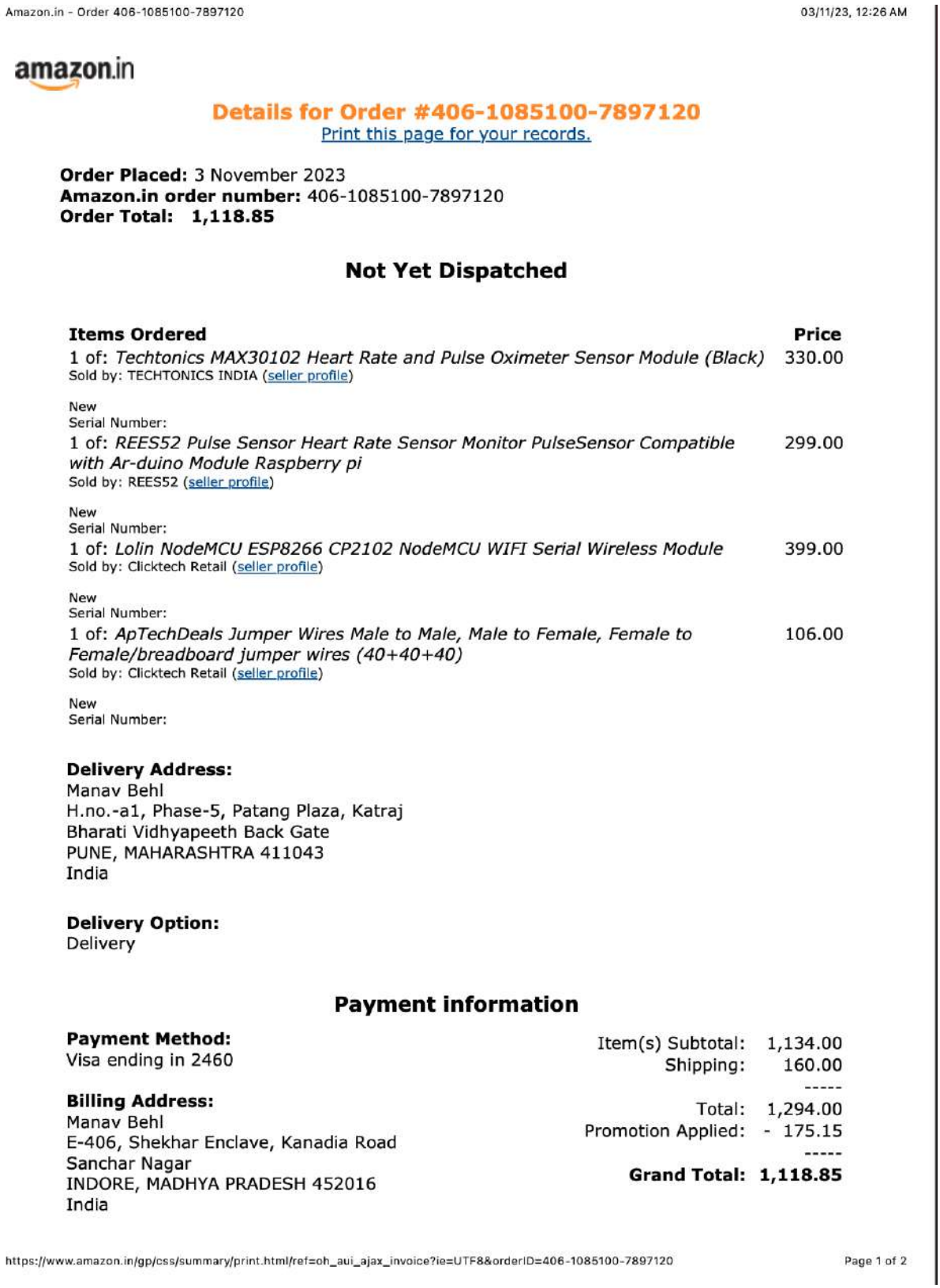
https://www.amazon.in/gp/css/summary/print.html/ref=oh_aui_ajax_invoice?ie=UTF8&orderID=406-0063489-7030742# Page 1 of 1

Figure 5.1: Amazon Invoice 1



Amazon.in - Order 406-1085100-7897120 03/11/23, 12:26 AM

amazon.in

Details for Order #406-1085100-7897120

Print this page for your records.

Order Placed: 3 November 2023
Amazon.in order number: 406-1085100-7897120
Order Total: 1,118.85

Not Yet Dispatched

Items Ordered	**Price**
1 of: *Techtonics MAX30102 Heart Rate and Pulse Oximeter Sensor Module (Black)* Sold by: TECHTONICS INDIA (seller profile) New Serial Number:	330.00
1 of: *REES52 Pulse Sensor Heart Rate Sensor Monitor PulseSensor Compatible with Ar-duino Module Raspberry pi* Sold by: REES52 (seller profile) New Serial Number:	299.00
1 of: *Lolin NodeMCU ESP8266 CP2102 NodeMCU WIFI Serial Wireless Module* Sold by: Clicktech Retail (seller profile) New Serial Number:	399.00
1 of: *ApTechDeals Jumper Wires Male to Male, Male to Female, Female to Female/breadboard jumper wires (40+40+40)* Sold by: Clicktech Retail (seller profile) New Serial Number:	106.00

Delivery Address:
Manav Behl
H.no.-a1, Phase-5, Patang Plaza, Katraj
Bharati Vidhyapeeth Back Gate
PUNE, MAHARASHTRA 411043
India

Delivery Option:
Delivery

Payment information

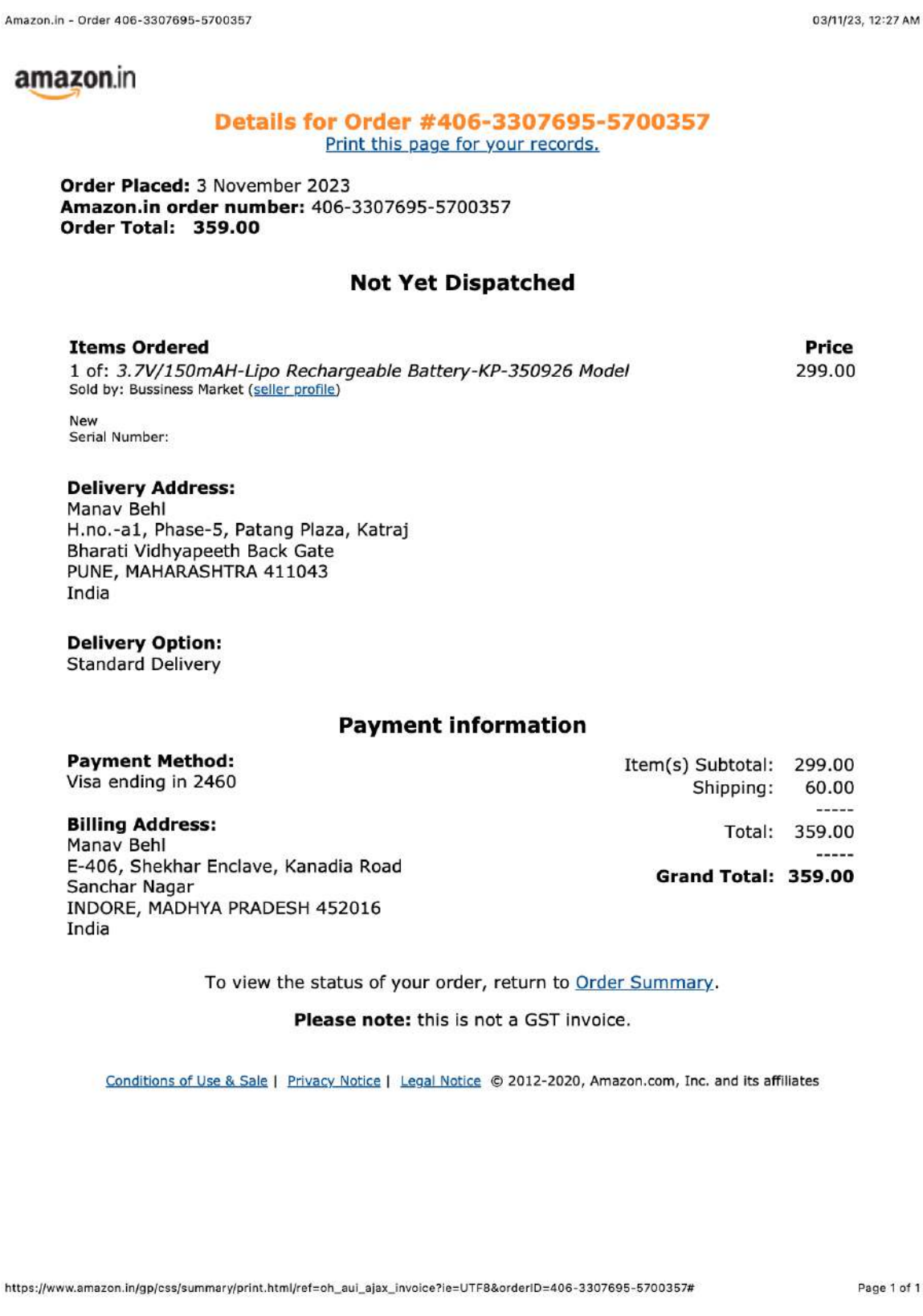
Payment Method:
Visa ending in 2460

Billing Address:
Manav Behl
E-406, Shekhar Enclave, Kanadia Road
Sanchar Nagar
INDORE, MADHYA PRADESH 452016
India

Item(s) Subtotal:	1,134.00
Shipping:	160.00
Total:	1,294.00
Promotion Applied:	- 175.15
Grand Total:	**1,118.85**

https://www.amazon.in/gp/css/summary/print.html/ref=oh_aui_ajax_invoice?ie=UTF8&orderID=406-1085100-7897120 Page 1 of 2

Figure 5.2: Amazon Invoice 2



Amazon.in - Order 406-3307695-5700357 03/11/23, 12:27 AM

amazon.in

Details for Order #406-3307695-5700357

Print this page for your records.

Order Placed: 3 November 2023
Amazon.in order number: 406-3307695-5700357
Order Total: 359.00

Not Yet Dispatched

Items Ordered	**Price**
1 of: *3.7V/150mAH-Lipo Rechargeable Battery-KP-350926 Model* Sold by: Bussiness Market (seller profile) New Serial Number:	299.00

Delivery Address:
Manav Behl
H.no.-a1, Phase-5, Patang Plaza, Katraj
Bharati Vidhyapeeth Back Gate
PUNE, MAHARASHTRA 411043
India

Delivery Option:
Standard Delivery

Payment information

Payment Method:
Visa ending in 2460

Billing Address:
Manav Behl
E-406, Shekhar Enclave, Kanadia Road
Sanchar Nagar
INDORE, MADHYA PRADESH 452016
India

Item(s) Subtotal:	299.00
Shipping:	60.00
Total:	359.00
Grand Total:	**359.00**

To view the status of your order, return to Order Summary.

Please note: this is not a GST invoice.

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Figure 5.3: Amazon Invoice 3

5.2 Summary

The bills of materials for our health monitoring ring project are detailed in the attached Amazon invoices (Figures **??**, **??**, and **??**). The components listed in these invoices constitute the essential materials and equipment acquired for the successful implementation of our wearable health device.

Chapter 6

Project Timeline

6.1 Research and Planning (September)

The initial phase of the project, spanning September, primarily focused on extensive research. The team delved into relevant research papers, gaining insights into wearable health devices and exploring potential technologies. Simultaneously, the groundwork for the project's execution plan was laid out, considering the scope and objectives.

6.2 Discussion with Guide Dr. Arundhati A. Shinde (Mid-September)

In the middle of September, the team engaged in detailed discussions with the project guide, Dr. Arundhati A. Shinde. These sessions involved sharing the research findings, refining project objectives, and seeking guidance on the proposed execution plan. The inputs received during these discussions were pivotal in shaping the project direction.

6.3 Clinic Use Discussion (1st Week of October)

In the first week of October, the team extended the project scope by incorporating insights from a discussion with a doctor from Bharati Hospital. This interaction provided valuable perspectives on the clinical applications of the health monitoring ring,

influencing the project's design and functionalities.

6.4 Component Planning and Procurement (1st Week - 2nd Week of October)

Following the clinic use discussion, the team meticulously planned the components required for the health monitoring ring. This phase involved considering the specifications, compatibility, and availability of sensors and microcontrollers. By the second week of October, the team completed the procurement of essential components, marking a significant milestone in the project timeline.

6.5 Design and Prototyping (2nd Week - 4th Week of October)

With components in hand, the project transitioned to the design and prototyping phase. The team worked on defining the overall system architecture, considering inputs from research, guide discussions, and clinic use. Prototyping involved integrating sensors and microcontrollers to ensure seamless functionality.

References

[1] J. G. Fatema Vhora, "A comprehensive survey on mobile edge computing: Challenges, tools, applications," *Fourth International Conference on Computing Methodologies and Communication (ICCMC)*, 2020.

[2] M. H. R. Ejaz Ahmed, "Mobile edge computing: Opportunities, solutions, and challenges," *Future Generation Computer Systems*, pp. 59–63, 2017.

[3] Z. B. Pavel Mach, "Mobile edge computing: A survey on architecture and computation offloading," *IEEE Communications Surveys Tutorials*, vol. 19, pp. 1628–1656, 2017.