



MANIPAL INSTITUTE OF TECHNOLOGY
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SYNOPSIS

Creating Storybooks and Unit Testing for Medical Device Interface

**SUBMITTED
BY**

Jay Patel

210905294

Under the Guidance of:

Ankit Thaker

Manager, Software

**9th Floor, Crescent-2, Prestige Shantiniketan Campus -
Whitefield, Thigaralapalya, Hoodi, Bengaluru, Karnataka,
560067**

And

Tanuja Shailesh

Assistant Professor - Selection Grade

**Department of Computer Science and Engineering
Manipal Institute of Technology, Manipal, Karnataka – 576104**

EMPLOYMENT OFFER LETTER



January 31, 2025

Jay Dhaval Patel
Roll No: 210905294
Institute's name: MIT, Manipal

Subject: Offer of Employment from Baxter Innovations and Business Solutions Pvt. Ltd.

Dear Jay,

Further to our conversation, we are pleased to offer you the position of Intern Trainee in Medical Products & Therapies (MPT) under Infusion Systems. You will be based at Bangalore. As discussed, this offer will be subject to following terms and conditions:

1. You will be on a fixed term contract from February 3, 2025, to June 30, 2025. Your title during this period would be Intern Trainee. During this period, you will receive a Total Annual Compensation of INR 4,02,391 (Four Lakhs Two Thousand and Three Hundred Ninety One Only) The detailed Compensation Structure is mentioned in Annexure A and you will be governed by the same guidelines as that of an employee.
2. Post the completion of your fixed term contract, you will be offered a full-time position of Eng I, Software starting July 14, 2025. You will receive a Total Compensation of Rs. 1,200,809/- (Rupees Twelve Lakhs Eight Hundred and Nine only) per annum. This includes a variable pay component of Rs. 118,957/- (Rupees One Lakh Eighteen Thousand Nine Hundred Fifty-Seven Only). This will be disbursed to you as per the prevailing rules and guidelines of Baxter Innovations and Business Solutions Pvt. Ltd. The detailed Compensation Structure is mentioned in Annexure B.
3. This offer is valid provided you join us on or before February 3, 2025. Once you join the Company you will receive our Appointment Letter illustrating the standard terms and conditions of service with Baxter Innovations and Business Solutions Pvt. Ltd. This offer is also valid subject to your successful completion of your current engineering course.
4. As part of the joining formalities, you are requested to update, and upload requested information and documents on BaxLaunch Portal.

We are glad that very soon you will be part of our team. We look forward to your long and meaningful association with us.

Warm Regards,

For Baxter Innovations and Business Solutions Pvt. Ltd.

A handwritten signature in blue ink, appearing to read 'Arnab', with a horizontal line underneath.

Chakraborty, Arnab
Manager, HR R&D

1. INTRODUCTION

1.1 GENERAL INTRODUCTION TO THE TOPIC

Infusion Platforms are a modern system used in hospitals to safely deliver fluids and medicines to patients. It is designed to make sure that patients get the right amount of medicine at the right time. The platform includes devices which control how fast and how much fluid is given to a patient. It is used in many treatments, such as providing nutrients, delivering medications, or giving blood products. One of the main goals of the platform is to reduce human errors and improve patient safety. It also helps hospital staff by making the process easier and more efficient. The system keeps track of treatments and allows updates, making it adaptable to the hospital's needs.

To complement these infusion platforms, integrated connectivity solutions have been developed. These solutions provide hospitals with the ability to manage devices across multiple beds, rooms, floors, facilities, thus offering a centralized view of infusion activities. Through secure data transmission and real-time reporting, they enable healthcare administrators to monitor device usage, optimize resource allocation, and streamline clinical operations. Moreover, the data collected supports advanced analytics, offering valuable insights that aid in decision-making, risk reduction, and continuous improvement of patient outcomes.

In today's healthcare landscape, where precision, efficiency, and safety are paramount, such integrated systems play a vital role in delivering high-quality care while reducing operational complexities.

1.2 ORGANIZATION

Baxter International Inc. [1] is a global healthcare company specializing in medical devices and therapies across various domains, including Anaesthesia and Critical Care, Bio-surgery, Drug Delivery, Infusion Systems, IV Access, Nutrition, Renal Therapies, and Pharmacy Workflow. Founded in 1931 by Drs. Ralph Falk and Don Baxter, the company was a pioneer in the commercial production of prepared IV solutions. Over the decades, Baxter has played a key role in advancing healthcare, particularly in IV therapy, nutrition, respiratory support, hospital beds, and integrated care solutions. With a strong legacy of innovation and dedication to patient care, Baxter continues to make significant contributions to the healthcare industry. Its diverse product portfolio and global reach reflect its commitment to improving and sustaining lives while driving advancements in medical technology.

1.3 AREA OF COMPUTER SCIENCE

The development and functioning of modern infusion platforms and their supporting connectivity systems rely on several key areas of computer science:

1. **Embedded Systems:**

The infusion devices themselves run on embedded systems, which are specialized computing systems designed to perform dedicated functions. These systems manage real-time tasks like controlling the delivery of fluids and monitoring patient data.

2. **Networking & Communication Protocols:**

For seamless communication between medical devices and hospital record systems, strong knowledge of networking principles and secure communication protocols is essential. This ensures data is reliably transmitted without loss or corruption.

3. **Cybersecurity:**

Protecting sensitive patient data and maintaining the integrity of medical devices require robust cybersecurity measures. This includes encryption, authentication, secure firmware updates, and regular vulnerability assessments.

4. **Software Engineering:**

The user interface, system software, and backend services are built following best practices in software development, focusing on reliability, maintainability, and scalability. This involves design patterns, testing strategies, and version control systems.

5. **Data Analytics:**

Infusion platforms collect a significant amount of data related to therapy sessions. Analyzing this data helps improve treatment efficiency, detect anomalies, and optimize device usage. Skills in data processing, visualization, and statistical analysis are applied here.

6. **Human-Computer Interaction (HCI):**

Designing intuitive and user-friendly interfaces for healthcare professionals is essential. This area ensures that medical staff can interact with the systems easily and without errors, enhancing overall safety and usability.

1.4 HARDWARE AND SOFTWARE REQUIREMENTS

1.4.1 Hardware Requirements

Infusion Device Components:

Each infusion device is built with embedded processors or microcontrollers that handle real-time tasks such as controlling fluid delivery and monitoring device performance. These devices are equipped with display units—typically LCD screens or touch panels—that allow healthcare professionals to interact with the system easily. Additionally, they contain input components such as buttons and scanners to facilitate accurate data entry and patient identification.

Communication & Networking Infrastructure:

To ensure seamless integration with hospital networks and electronic medical record systems, the hardware includes communication modules like Wi-Fi, Bluetooth, or Ethernet interfaces. On the enterprise level, dedicated servers and networking equipment such as routers and switches are required to manage the continuous flow of data between devices and hospital IT systems.

Power & Safety Systems:

Infusion devices are powered by rechargeable batteries to guarantee uninterrupted operation, even during power outages. Safety-critical components, including sensors and actuators, are integrated to monitor the fluid flow and promptly trigger alarms or stop the flow of fluids through devices in case of major irregularities.

1.4.2 Software Requirements

Embedded Device Software:

The infusion devices run on embedded firmware, often using a real-time operating system (RTOS) to ensure timely responses to user inputs and safety events. This software manages essential functions like access of available drugs, dosage control, and alarm handling, ensuring the accuracy and reliability of fluid delivery.

Middleware & Integration Systems:

To connect infusion devices with hospital systems, middleware software is employed. This software supports healthcare communication standards and protocols, enabling smooth interoperability with electronic health records (EHR) and reducing manual data entry errors.

Device Management & Security Tools:

Enterprise-level software tools are used to remotely configure, monitor, and update devices. These tools provide role-based access control, ensuring that only authorized personnel can make changes. Security features such as data encryption, authentication, and audit logging are incorporated to protect sensitive patient information and comply with healthcare regulations.

Data Analytics & Compliance Software:

Finally, advanced software solutions are utilized to collect and analyze usage data from infusion devices. These tools offer insights into device performance, treatment efficiency, and compliance metrics, assisting healthcare organizations in optimizing clinical workflows and maintaining regulatory standards.

2. NEED FOR THE PROJECT

In modern healthcare environments, managing and monitoring medical devices across multiple hospitals and facilities requires efficient digital solutions. Hospitals deploy numerous medical devices, each of which continuously generates critical data related to medication delivery, device usage, and patient safety. This data is often aggregated and presented through centralized dashboards to provide healthcare administrators with actionable insights. However, ensuring that this information is displayed in a clear, user-friendly, and consistent manner is essential for effective decision-making.

To meet these needs, a standardized library of reusable UI components is necessary. Creating storybooks [2] for these components helps in building a well-organized, scalable, and maintainable user interface. It allows developers and designers to visualize and test individual components in isolation before integrating them into the larger dashboard system. Furthermore, incorporating unit testing ensures the reliability and correctness of these components, reducing the chances of errors in critical healthcare settings. Moreover, rigorous unit testing of each component helps to safeguard against potential failures, especially in environments where accuracy and reliability are non-negotiable.

The goal of the project is to streamline the development process, improve UI consistency, and enhance the overall usability of the platform that displays infusion device reports. By providing a reliable interface, healthcare organizations can better monitor device performance, analyze treatment patterns, and support clinical and operational decision-making efficiently. Ultimately, this project plays a vital role in delivering a seamless and dependable user experience, empowering healthcare professionals to focus on patient care rather than technical obstacles.

3. OBJECTIVE(S)

3.1.1 Development of Configuration Distribution Mechanism

Focused on designing and enhancing a system to securely distribute various configuration files to connected medical devices, ensuring seamless synchronization and operational consistency across the network. This helps hospitals manage multiple devices efficiently while maintaining standard settings across all units.

3.1.2 Remote Software & Firmware Update Distribution

Assist in building a process for distributing firmware and software updates over the network, aimed at keeping devices up to date without requiring manual intervention, improving efficiency and security. It minimizes device downtime and ensures the latest features and security patches are applied consistently.

3.1.3 Creation of Interactive UI Components using Storybook and TypeScript

Develop interactive storybooks for Vue.js UI components used in monitoring and analysis dashboards, promoting reusable, well-documented, and consistent front-end design practices with TypeScript[3]. This improves the development process by offering a clear reference for developers and enhancing user interface reliability.

3.1.4 Implementation of Unit Tests using Vitest

Create unit tests using Vitest to ensure the reliability and correctness of UI components, leading to better maintainability, scalability, and reduced chances of bugs in production systems. It supports early detection of issues, ensuring smooth performance and long-term stability of the interface.

4. METHODOLOGY

To successfully achieve the objectives of the project, a systematic approach must be followed. The process is divided into carefully planned stages to ensure secure configuration distribution, effective UI development, and robust testing.

The first step involves understanding the existing system architecture and identifying how configuration files, and firmware updates are currently managed. Based on this analysis, enhancements are proposed to streamline and automate the distribution process. Secure communication protocols are integrated to ensure that all distributed files and updates are transmitted reliably and safely across devices.

For the development of UI component libraries, the process begins with gathering requirements and understanding the data to be visualized on dashboards. Reusable UI components are designed and documented using storybooks, allowing developers to preview, test, and maintain a consistent interface across the platform.

To ensure quality, unit testing frameworks are set up in parallel. Tests are written for each UI component to validate functionality and catch potential issues early in the development cycle. Continuous integration pipelines are utilized to automate testing, ensuring that code changes do not introduce bugs.

Regular reviews and iterations are carried out, incorporating feedback from stakeholders and making improvements as needed. This iterative approach allows flexibility while ensuring progress aligns with the project's overall goals of enhancing efficiency, security, and user experience.

5. PROJECT SCHEDULE

- *February 2025*
 - Onboarding and Orientation
 - Introduction to various Baxter verticals.
 - Foundational of HTML, CSS, JavaScript, Vue.js, TypeScript, Vuetify.
- *March 2025*
 - Made a small project as Proof of Concept in Vue.js and TypeScript.
 - Hands-on exercises with storybooks in Vue.js.
 - Familiarization with existing codebase.
- *April 2025*
 - Submission of mid-term report & evaluation (3 Months project)
 - Develop interactive storybooks to document and visualize UI components available in the existing codebase.
- *May 2025*
 - Implement unit tests for the UI components documented in the storybooks.
 - Automated testing and integrate it into the development workflow.
- *June 2025*
 - Document testing processes, methodologies, and outcomes for future reference.
 - Submission of final project report & evaluation. (5 Months project)

6. REFERENCES

- [1] Baxter India. [Online] Available: <https://www.baxter.in/>
- [2] Storybook for Vue & Vite. [Online] Available: <https://storybook.js.org/docs/get-started/frameworks/vue3-vite>
- [3] TypeScript Documentation. [Online] Available: <https://www.typescriptlang.org/docs/>

PROJECT DETAILS

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|------------------------------------|--|-------------------|------------|
| <i>Student Details</i> | | | |
| Student Name | Jay Patel | | |
| Register Number | 210905294 | Section / Roll No | CSE B |
| Email Address | jay.patel2@learner.manipal.edu | Phone No (M) | 9909926646 |
| <i>Project Details</i> | | | |
| Project Title | Creating Storybooks and Unit Testing for Infusion Pump Interface | | |
| Project Duration | 5 months | Date of reporting | 03/02/2025 |
| <i>Organization Details</i> | | | |
| Organization Name | Baxter International Inc. | | |
| Full postal address with pin code | 9th Floor, Crescent-2, Prestige Shantiniketan Campus - Whitefield, Thigaralapalya, Hoodi, Bengaluru, Karnataka, 560067 | | |
| Website address | https://www.baxter.com/ | | |
| <i>External Guide Details</i> | | | |
| Name of the Guide | Ankit Thaker | | |
| Designation | Manager, Software | | |
| Full contact address with pin code | 9th Floor, Crescent-2, Prestige Shantiniketan Campus - Whitefield, Thigaralapalya, Hoodi, Bengaluru, Karnataka, 560067 | | |
| Email address | ankit_harish_thaker@baxter.com | Phone No (M) | |
| <i>Internal Guide Details</i> | | | |
| Faculty Name | Tanuja Shailesh | | |
| Full contact address with pin code | Dept of Computer Science & Engg, Manipal Institute of Technology, Manipal – 576 104 (Karnataka State), INDIA | | |
| Email address | tanuja.s@manipal.edu | | |