AI-Driven Medical Device Troubleshooting and Automation

Team
Clemence INGABIRE
Atabonfack Lorier Bernes
Mohammed Hardi Abdul Baaki
Ahmed Issah Tahiru

Faculty Advisor
Prof. Timothy Brown
Carnegie Mellon University Africa
timxb@cmu.edu

Problem Statement (Detailed)

Healthcare facilities rely on various medical devices to deliver quality patient care. However, many small to medium complexity devices, such as infusion pumps, patient monitors, and ultrasound machines, often break down and are left unrepaired for long periods due to the costs and logistical challenges of sending them to manufacturers. While these devices do not always require specialized manufacturer repairs, the repair process for third-party technicians can be inefficient due to several factors.

One major issue is the **lack of regulatory oversight** for third-party servicers, meaning these technicians are not held to the same safety and quality standards as original equipment manufacturers (OEMs) or their authorized servicers. Without access to proprietary repair manuals or diagnostic tools, third-party technicians often rely on outdated public information or instinct, leading to a **trial-and-error approach** that can extend repair times and increase the risk of further device damage. Additionally, **error logs and codes** provided by the devices are often ignored or misinterpreted by technicians, further complicating the troubleshooting process.

This lack of access to essential repair data and tools not only impacts repair efficiency but also poses a **potential risk to patient safety**. There have been documented cases where third-party repairs resulted in adverse incidents, underscoring the need for better control and accountability. A system that equips third-party technicians with real-time access to repair manuals, interprets error codes, and ensures repairs comply with FDA or other relevant health regulations is crucial to improving repair efficiency, reducing downtime, and maintaining the safety and effectiveness of medical devices.

Project Purpose and Goals

Project Purpose
The primary purpose of this project is to improve the efficiency and safety of medical device repairs by empowering third-party technicians with the tools and knowledge necessary to troubleshoot and repair devices accurately. This will help healthcare facilities reduce downtime, save costs, and ensure that critical medical devices remain operational. The system aims to guide technicians through diagnosing problems based on device error logs and manuals, reducing reliance on trial and error. Additionally, the solution will ensure compliance with health and safety regulations, mitigating the risks posed by unregulated repairs.

Problem Statement
Medical devices used in healthcare facilities, such as infusion pumps, patient monitors, and ultrasound machines, often break down and need repairs. Sending these devices back to the manufacturers for servicing is costly and time-consuming, leading to extended downtimes that affect patient care. While third-party technicians are often contracted for repairs, they frequently lack access to updated repair manuals and diagnostic tools, which forces them to rely on experience or trial and error. This process can further damage devices or delay repairs. Furthermore, third-party technicians operate without regulatory oversight, increasing the risk of unsafe repairs. A solution is needed that provides technicians with direct access to comprehensive troubleshooting information, reducing repair times and ensuring compliance with safety regulations.

Goals

1. **Improve Repair Efficiency**: Enable third-party technicians to quickly and accurately diagnose and repair medical devices by providing access to repair manuals, error codes, and guided troubleshooting.
2. **Reduce Downtime of Medical Devices**: minimize the time medical devices spend out of service, ensuring that healthcare facilities have consistent access to essential equipment.
3. **Ensure Compliance with Health Regulations**: Assist third-party technicians in following relevant safety and health regulations (such as FDA standards) during the repair process, ensuring that devices are serviced to meet the required safety levels.
4. **Minimize Repair Costs**: Reduce the financial burden on healthcare facilities by avoiding the need to send devices back to the manufacturers for repair.
5. **Empower Third-Party Technicians**: Provide technicians with real-time support and knowledge, ensuring they can perform repairs competently, with minimal reliance on guesswork.
