**Problem Statement Overview**

- Clinical trial data acquisition and pipelining is a messy and difficult process in the pharmaceutical industry.
- Data is often lost, misplaced, unsecure, or incomplete offering trouble for analysis of drug efficacy.
- These data pipeline shortcomings can delay the release of drug development and result in lost time and money for leaders in drug development.
- Using biometric wearable technologies, including sensors, heart rate monitors, and watches, Merck’s data management and acquisition of clinical trial studies can be streamlined.
- This project specifically focuses on creating a clean and consistent data pipeline stemming from wearable fitness technologies (Fitbit Watch, Apple Watch, Garmin Watch).
- Efficiency, clean data, low costs, patient privacy, and user preferences are the basis of this data pipeline.
- Our goal is to join and centralize patient information – thereby automating the collection of real-time information on clinical trial patients and providing new insight into the effects of drugs on physical and mental performance.

**Data Storage**

- We elected to store clinical trial biometric data using MySQL and Neo4J.
- Data schemas and scripts were written for the Apple Watch, Garmin Watch, and Fitbit Watch. Our focus while constructing this project’s data architecture was cost and timeliness.
- The cost for MySQL is around $5,000 while Neo4J is around $36,000; however, it is priced around $65 an hour so prices can be controlled by the user.
- Our queries performed in 0.016 seconds in MySQL, and 0.010 seconds in Neo4J. Neo4J ran faster; however, MySQL can work with more data points at one time.

**Visualization**

- Visualizing patient clinical trial data is crucial for understanding the effects of new medication.
- Data visualizations were made using R Shiny and accompanying packages like plotly and ggplot2.
- Our development features two Shiny dashboards; one for visualizations focusing on the population of the study and the other depicting individual patient data.
- Dashboards are connected to the database, allowing the graphs to update as new data is collected.
- Built mobile application and website to aid clinical trial data acquisition and visualization.

**Data Acquisition**

- Data acquisition is the first step in the data pipeline.
- Making use of existing APIs and frameworks, data is collected directly from user’s wearables accounts.
- For Fitbit device data, data is pulled via a series of requests using Fitbit’s open-sourced API and Selenium to run as a headless browser.
- User biometric data is saved both locally as a csv file and to the AWS database.
- Window’s Task Scheduler was used to run this process daily.

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