Software Design Document

Prepared by Newline

for the project Hypnos

Middle East Technical University

Department of Computer Engineering

Senior Design Project

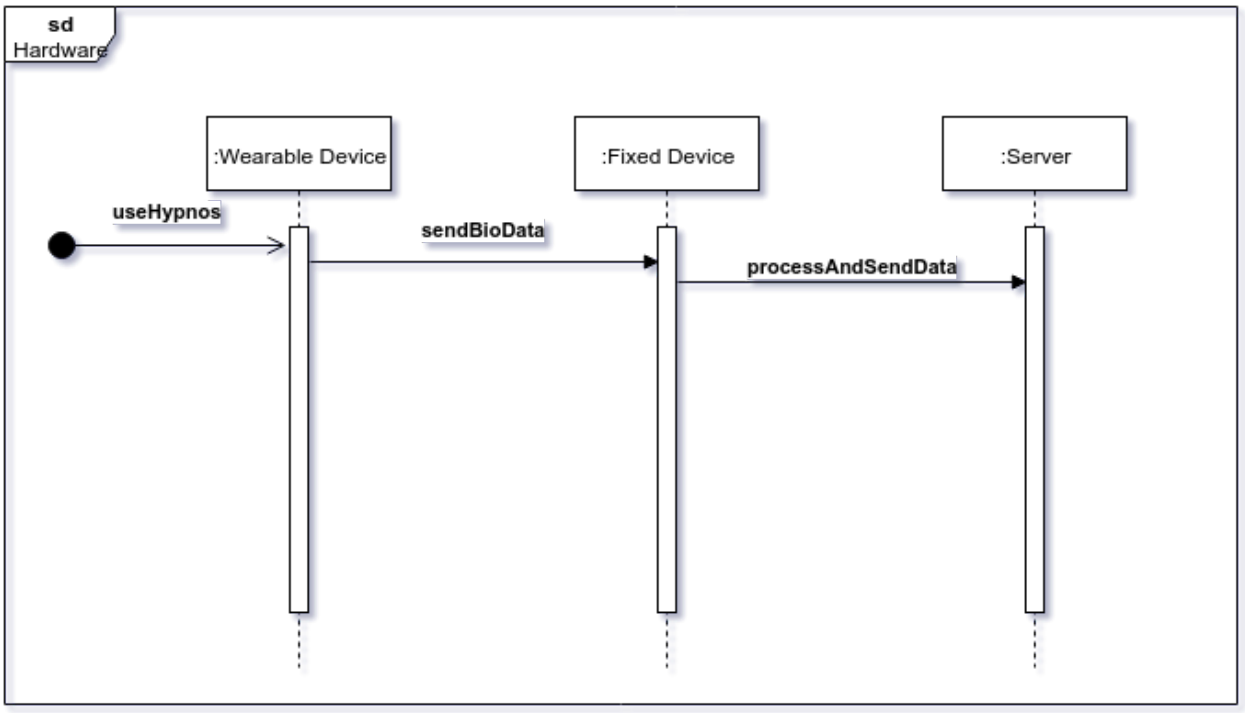
2015-2016

Functional Overview

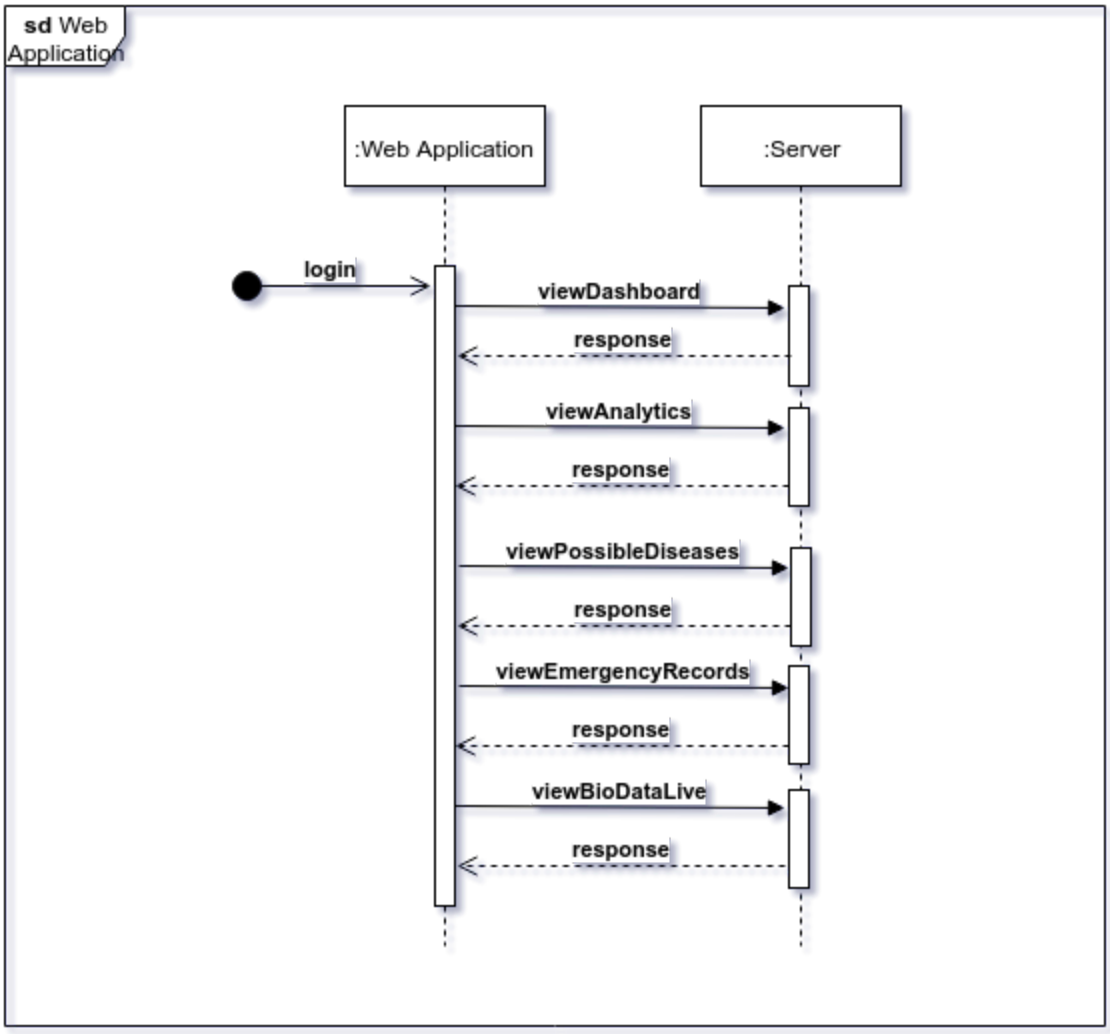
Main purpose of Hypnos is to track biodata from the user, analyse them on the cloud and return feedback to users. All components are shaped considering this main idea. Hypnos works with tracking biodata from the user. Biodata consists of heart rate, internal and external temperature, and body movement.

Before starting to sleep, users should start Hypnos from their phones. It will start tracking your body activity, ie. biodata, while you sleep. After you wake up, you can see feedback about your sleep from your phone or from web. These feedbacks are in the form of sleep scoring and disorder detection. As a secondary feature, Hypnos provides a smart alarm system, which will make use of sleep depth tracking on Hypnos, and wake you up in your light sleep. Furthermore, depending on the seriousness of your disorders, Hypnos can notify your close ones to alert them early. Users can give access to their data for their doctors. From web, doctors can see the users past data, or watch the data live.

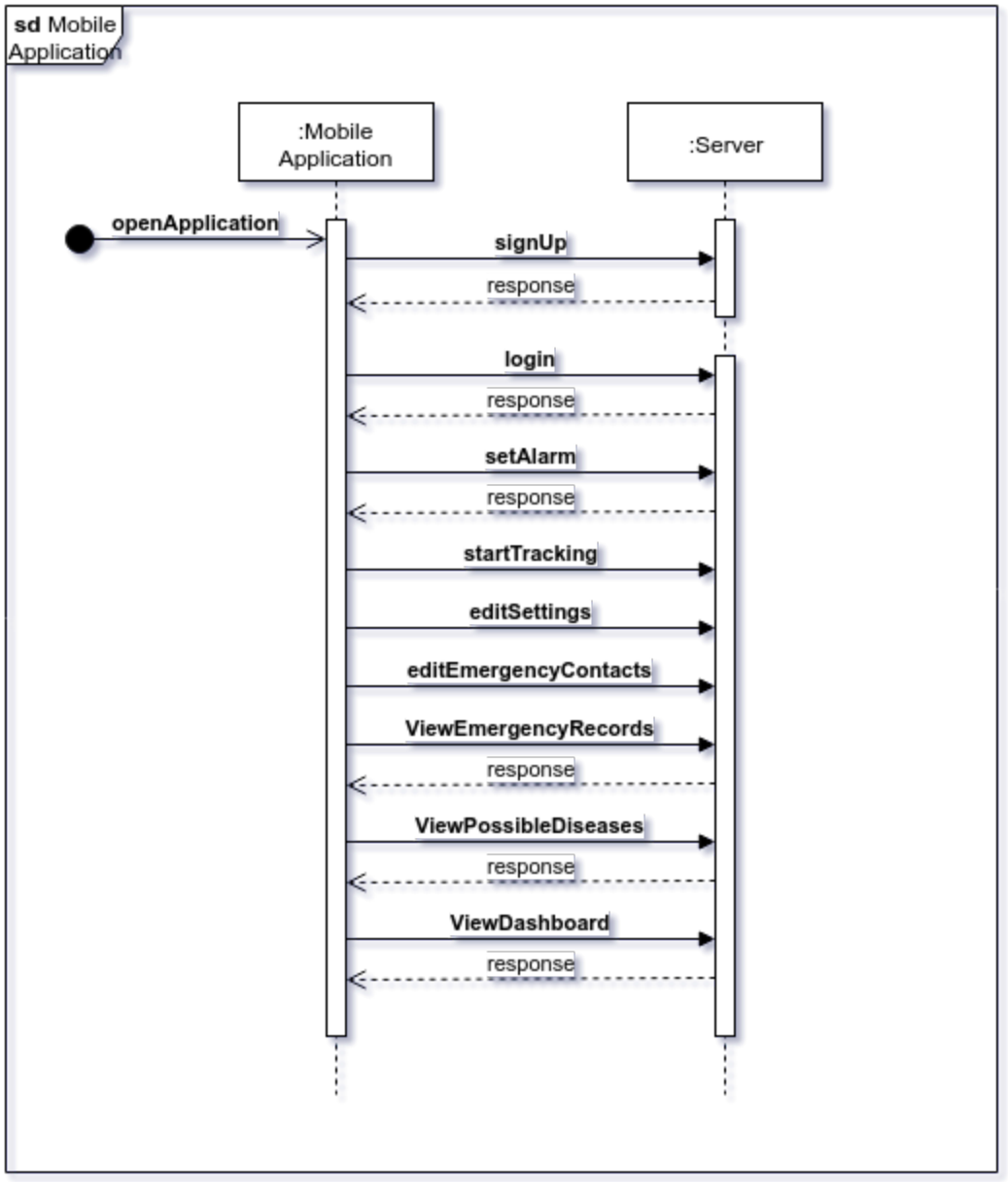
Interaction Overview Diagrams



Hardware Interaction Overview Diagram

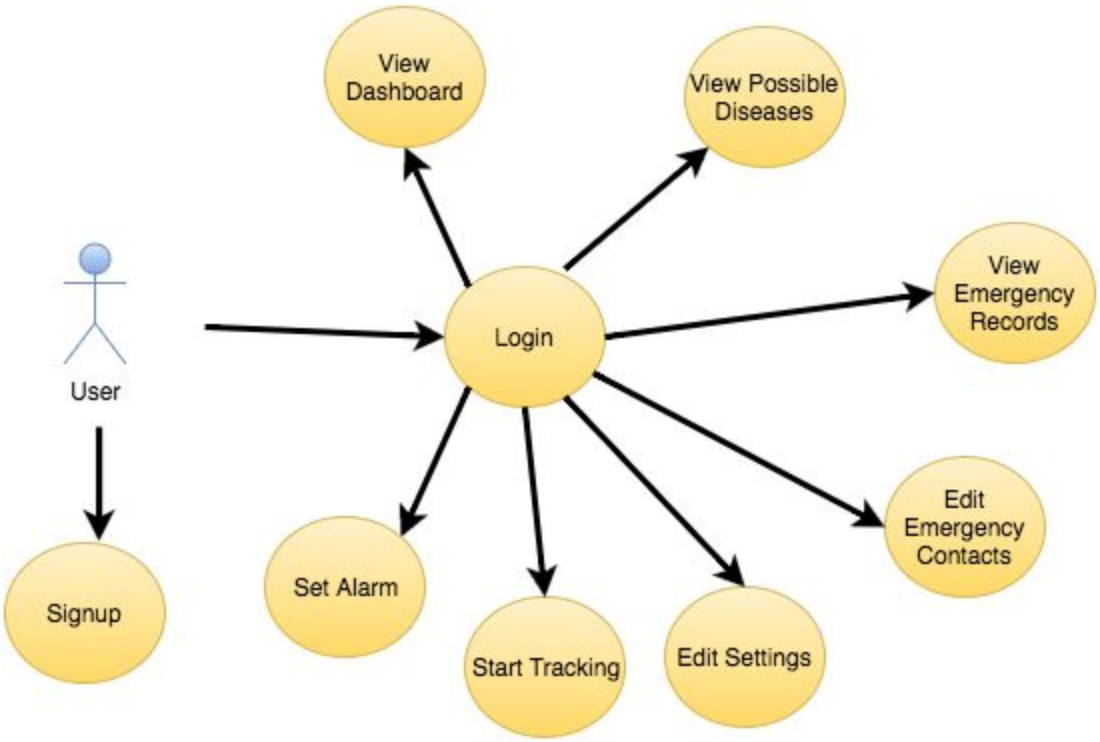


Web Application Interaction Overview Diagram

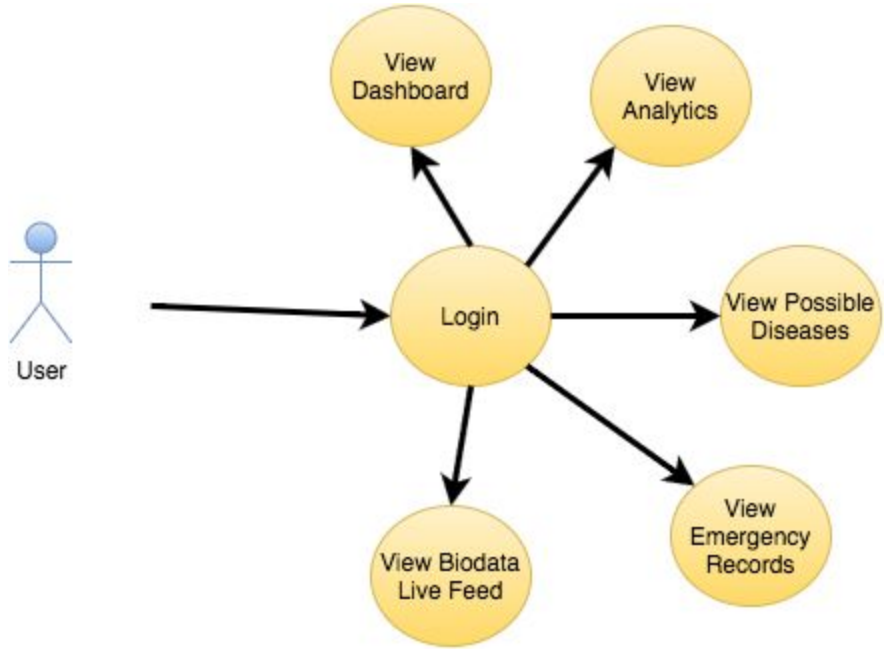


Mobile Application Interaction Overview Diagram

Use Case Diagrams



Mobile Use Case Diagram

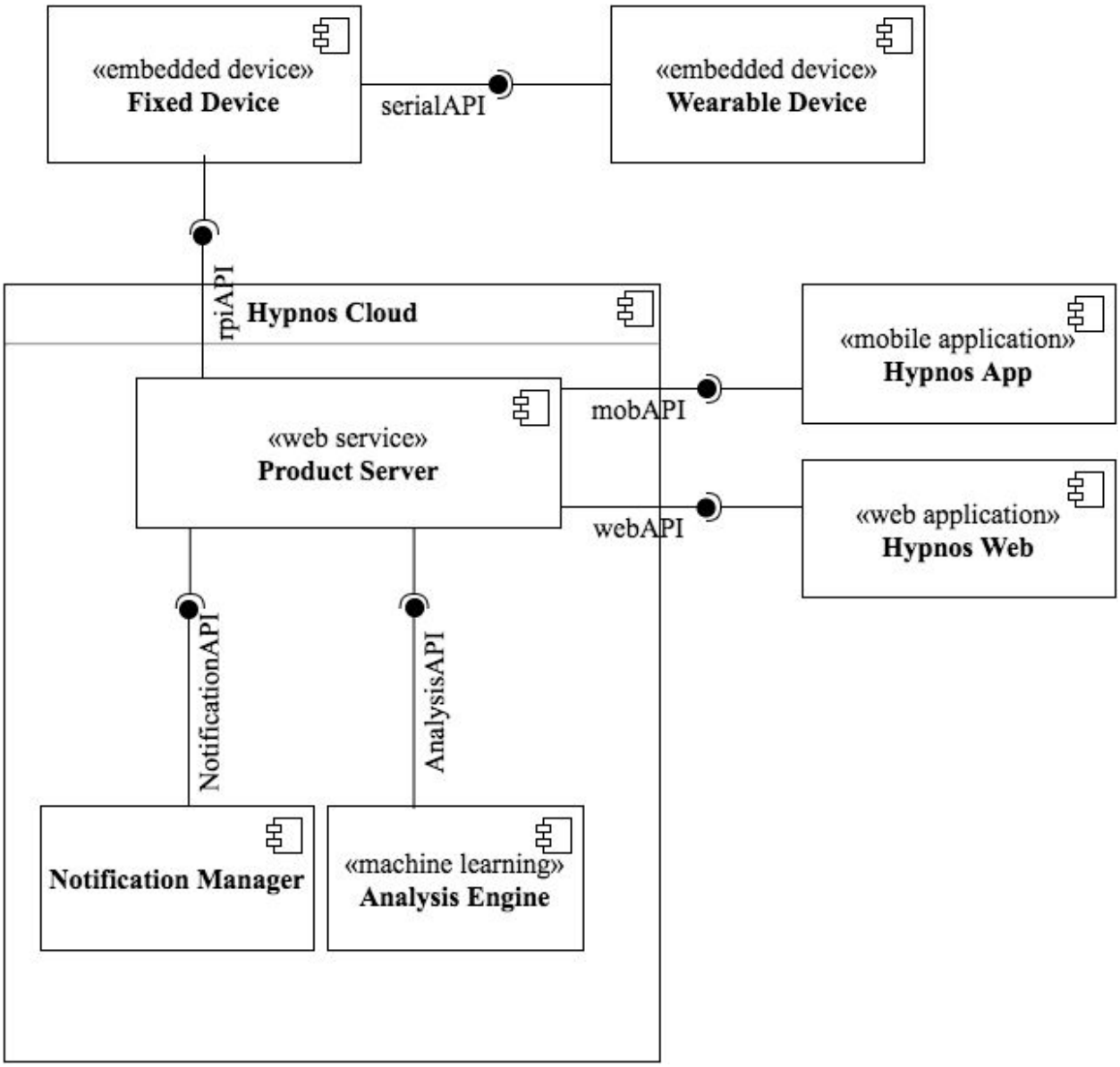


Web Use Case Diagram

Component Overview

Components of Hypnos carry out the following roles:

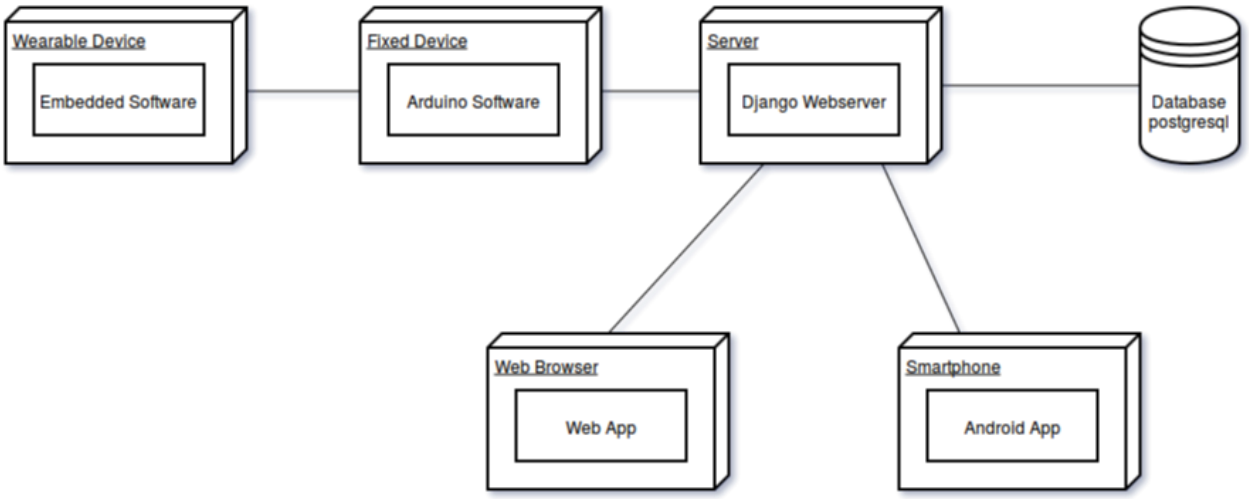
- Wearable device is responsible for gathering the biodata from the user, and sending them to the fixed device.
- Fixed device is responsible for receiving the data from the wearable device, storing the incoming data, and send them to the server for analysis. It also has a temperature sensor attached for external temperature measurement.
- Cloud server is the main storage unit for past user data. It's responsible for analysis of the users' biodata, and also it serves all the content to web and mobile application.
- Mobile application will be used to visualize and show daily user data, notifying the user about the possible disorders and controlling the tracking process. The app will be an easy to use platform suited for end users.
- Website will be used by users to see more detailed data than the mobile application. The main purpose of the website will be analysis of this data. It will be more suited for doctors that might wish to see how their patients sleep.



Component Diagram

Structural Overview

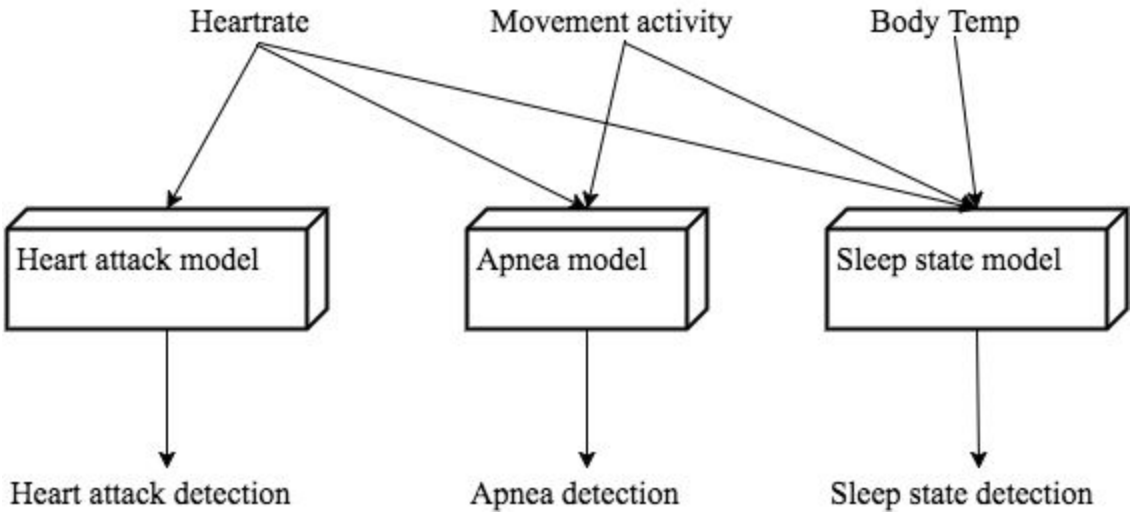
Infrastructure of Hypnos consists of five components: wearable and fixed device, cloud server, mobile and web application. Wearable device consists of an Arduino board, and three sensors attached to it for heart rate, temperature and body movement measurement. Fixed device consists of a raspberry pi and an external temperature sensor attached to it. Cloud server is a Django web service running on apache. Machine learning analysis engine is built on this server as well. Mobile application can be run on Android devices. Both mobile and web application are served content by the web service.



Deployment Diagram

Analysis Overview

We used some machine learning methods on the data we obtained from various sources. From the result of these trainings, we extracted some models to use in our system. Main purpose of these models are predicting the users' condition for various cases. These cases are currently heart attack, apnea and sleep phase detection. The models we trained are kept in the server and provided for biodata analysis on demand. Each model requires takes different combinations of bio data as input, and provide a different output. Combining these outputs with some fusion techniques, the system can predict the users' state in a scope.



Machine Learning Models