# Monitoring Heart Disease Using Mobile Applications

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## BACKGROUND & MOTIVATION

Heart disease has the highest mortality rate among all diseases in China and the prevalence is expected to increase within the next decade [1]. Traditional health care system is supply-based and organized around providers (hospitals, medical practices, clinics, *etc*.). In most parts of the world population is aging and becoming less healthy due to consumerism, unhealthy diet, and sedentary life style. Health care costs are rapidly rising and there is a trend of moving health care services to patient homes as much as possible. Technology-enabled infrastructure that connects providers, caregivers and patients and links multiple sources of data makes this possible. Simple collecting and connecting data is not sufficient, these data need to be coupled with medical knowledge and algorithms that help make timely and correct decisions about patient's health needs. New technologies include sensor systems [2,3], wearables [2,4], personal health records [5], and the connectivity of devices through Internet of Things [6,7]. Although these technologies offer a great promise, to date no system has been shown to accurately collect data [8] and truly integrated systems do not exist yet. ***We propose to develop and implement a system for monitoring heart disease through integration of wearable devices, medical knowledge and relevant algorithms, and personal health record.*** This system takes input from continuous activity monitoring device (smart watch), smart devices that are used several times a day (smart scale, blood pressure monitor, breathing rate and blood). The overview of the proposed system is shown in Figure 1.

## OBJECTIVES

This project focusses on applied computer science – we will use computer science techniques and methods to perform health monitoring (data collection, management and processing) and provide automated support for medical decision making through application of machine learning approaches [9] and generation of summaries, reports, alerts, and educational information for patients. These outputs will be sent to patients and health care providers, as necessary. The main aim of this project is to develop and implement a system for online analytics of heart-related monitoring data that will be used to predict complications, disease progression, therapy effects, and will promptly advise patient and health care provider about emerging risks. Our application will monitor several basic signs (weight, blood pressure, temperature, physical activity, heart rate, and sleep) and integrate these data into a decision-making system.

## DESIGN
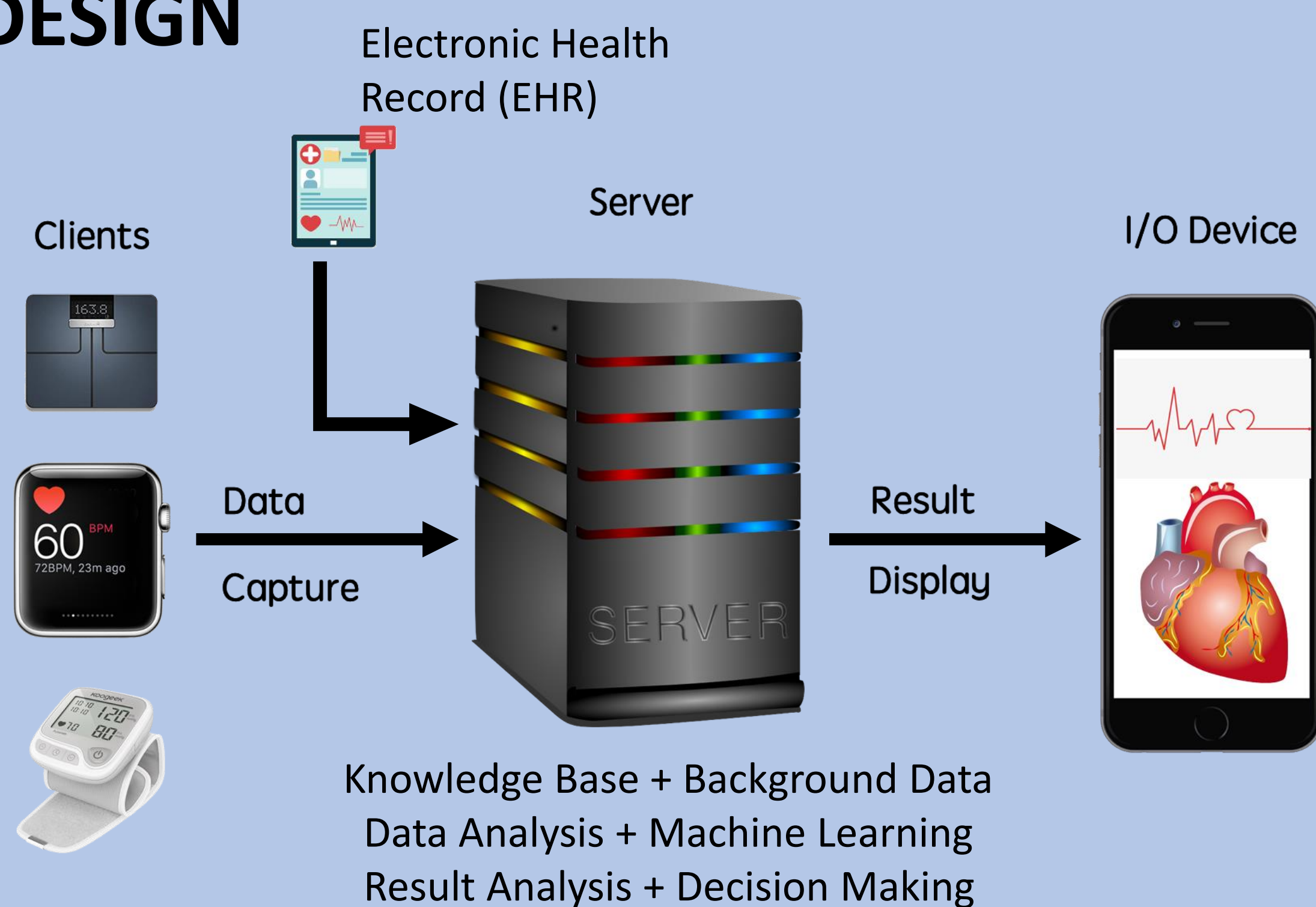


**Figure 1**. System Overview. The main parts of the system include sensor system (clients), EHR, Input/Output device, and central server. Central server is "the brain" of the overall system. It's function largely depends on automated algorithms.
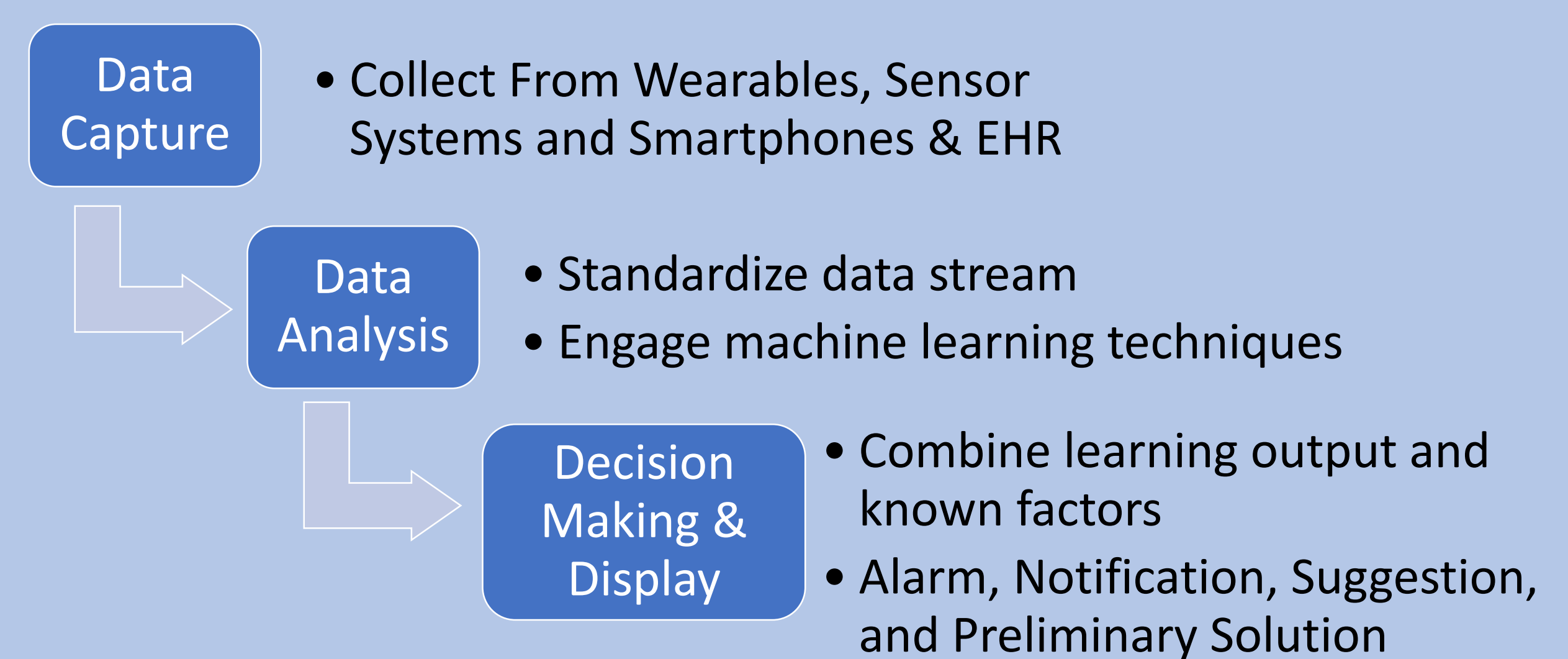


**Figure 2.** System workflow. The main parts include data capture, analysis, and decision making. Integration of these subsystem will require consideration of data standards, data protection, and reliability. Data analysis will depend on prediction and decision algorithms, while decision making needs to comply with medical standards of care.

## CHALLENGES

1. Existing solution using sensors (clients) show insufficient accuracy in heart health monitoring.
2. Data analysis can be challenging since the causes of heart disease vary creating a need for multidimensional analysis.
3. Machine learning framework should be developed using a rigorous software engineering approach to meet the requirements of accuracy, efficiency and data protection.

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