## Abstract: Heart Disease Prediction Using Machine Learning

Heart disease remains one of the leading causes of mortality worldwide. Early prediction and diagnosis of heart-related conditions can significantly reduce the risk of severe complications and death. The traditional diagnostic process often relies on clinical expertise and manual evaluation, which can be time-consuming and subjective. In this project, we aim to develop an intelligent and automated system using Machine Learning (ML) algorithms to predict the likelihood of heart disease based on patient health records.

The proposed system leverages historical medical data consisting of various features such as age, sex, chest pain type, blood pressure, cholesterol levels, fasting blood sugar, ECG results, heart rate, and more. Using this data, machine learning models are trained to recognize patterns that correlate with the presence or absence of heart disease. By doing so, the system assists healthcare professionals in making faster and more accurate decisions.

### The project utilizes the following libraries and technologies:

- **Python** – As the primary programming language for implementation.
- **Pandas & NumPy** – For data manipulation and numerical operations.
- **Matplotlib & Seaborn** – For data visualization and exploration.
- **Scikit-learn** – For applying machine learning models such as Logistic Regression, Random Forest, Support Vector Machine (SVM), and K-Nearest Neighbours (KNN).
- **Flask** – For creating a simple web interface for user input and result display.

## The project design follows a systematic flow:

**1. Data Collection**: Using a standard heart disease dataset (e.g., UCI Heart Disease Dataset).

**2. Data Preprocessing**: Cleaning the data, handling missing values, encoding categorical variables, and feature scaling.

**3. Exploratory Data Analysis (EDA)**: Visualizing and understanding the distribution of features.

**4. Model Training and Evaluation**: Splitting the data into training and testing sets, applying multiple ML algorithms, and evaluating their accuracy, precision, recall, and F1 score.

**5. Model Deployment**: Deploying the best-performing model with a basic front-end for user interaction.

**Conclusion:** This project aims to build a reliable and efficient system capable of predicting heart disease with high accuracy. The expected output is a classification model that, given a patient's health parameters, predicts whether the individual is at risk of heart disease planning.