

Software Design Description

Prediction of Diabetes Web App

CPSC 462

Professor: Dr. Lidia Morrison

Department of Computer Science

California State University, Fullerton

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Group 4:

Fulya Kocaman

Tilak Ghorashainee

Trinh Hoang

Spandhana Gandlkurma

Vyshnavi Reddy Kamballapally

Table of Content

Table of Figures	2
1.0 Introduction	3
1.1 Purpose	3
1.2 Scope	3
1.3 Overview	3
1.4 References	3
1.5 Definitions and Acronyms	4
2.0 System Overview	4
2.1 General Overview	4
2.2 Application Description	5
3.0 System Architecture and Architectural Design	5
3.1 Overview	5
3.2 Decomposition Description	6
3.3 Database Description	8
4.0 Human Interface	8
4.1 Overview of User Interface	8
4.2 UI Samples	10

Table of Figures

Figure 3.1.1 Interactive System Model of our Application	6
Figure 3.1.1 Architecture of our Application	8
Figure 4.1.1 User Interface of Diabetes Web App Home Page	9
Figure 4.1.2 User Interface of Diabetes Info Page	9
Figure 4.1.3 User Interface of Diabetes Result Page	10
Figure 4.2.1 Home Screen of Diabetes Web App	11
Figure 4.2.2 Input Information of Diabetes Web App	12
Figure 4.2.3 About Diabetes Info Page	13
Figure 4.2.4 Diabetes Info Page	14
Figure 4.2.5 Pre-Diabetes Info Page	14
Figure 4.2.6 No Diabetes Prediction Page	15
Figure 4.2.7 Diabetes Prediction Page	16

1.0 Introduction

1.1 Purpose

This software document describes the architecture and system design of the Diabetes Web App, a web application developed for our 462-group project. This software design document explains the components of our software and how it interacts with the user.

1.2 Scope of the problem

Diabetes is a common chronic disease. Diabetes is among the most widespread chronic diseases in the US. Early diagnosis can lead to lifestyle changes and more effective treatment. This app predicts diabetes as an essential first stage that can lead to helping patients improve treatment. This app is an important tool for public and public health officials. With the rapid development of machine learning, this diabetes prediction application can predict at higher accuracy and efficiently be used by anyone.

1.3 Overview

We all know how expensive healthcare is in the US. This free app gives users to be aware of their conditions in the comfort of their home instead of visiting the doctor's office and getting blood work done. This app provides an opportunity for everyone to see whether or not they have diabetes as often as they would like. This document is organized as follows; section 1 covers an overview of this document, system overview of the functionality, context, and design of our project is explained in section 2, section 3 goes deep dive into system architecture and human interface design will be covered in section 4.

1.4 References

- Software Design Description for Banker Buddy from Fall, 2014.
- Software Requirements Specification for Prediction of Diabetes Web App, Spring 2022.
- Lecture Notes and Slides by Dr. Lidia Morrison
- Learn more about BRFSS dataset: <https://www.cdc.gov/brfss/index.html>
- Download the BRSS Dataset:
<https://www.kaggle.com/code/alexteboul/diabetes-health-indicators-dataset-notebook/notebook>
- Learn how to implement Flask framework:
<https://www.youtube.com/watch?v=Koh6Bp33hVQ>
- Learn how to deploy a python app online using PythonAnywhere:
<https://www.youtube.com/watch?v=5jbdkOlf4cY>

1.5 Definitions and Acronyms

SDD - Software Design Document

SRS - Software Requirement Specifications

SVM - Support Vector Machine

HTM - Hypertext Markup Language

CSS - Cascading Style Sheets

UI - User Interface

2.0 System Overview

2.1 General Overview

Our system will collect the data from the user and analyze their data using our trained model. Our proposed model is trained by the Support Vector Machine (SVM) Algorithm, a supervised machine learning algorithm used for classification. Moreover, our web application is built using Flask, one of Python's high-performance web frameworks.

2.2 Application Description

The user will input their high blood pressure, high cholesterol, smoking, obesity, age, sex, race, diet, exercise, alcohol consumption, BMI, household income, marital status, sleep, time since the last check-up, education, health care coverage, and mental health. Our application will use the most accurate prediction by collecting the data from users who want to check whether they have diabetes. The system will predict one of 3 classes which are 0 is for no diabetes or only during pregnancy, 1 is for prediabetes, and 2 is for diabetes.

3.0 System Architecture and Architectural Design

3.1 Overview

Designing an architecture for any software product produces a good software system by increasing system performance, efficiency, security, and maintainability. It is the primary artifact for conceptualizing, constructing, and managing the system under development.

In order to best implement our software, ensure reliability and uptime, and to maximize system performance, our group decided to go with an Interactive System. In an Interactive System, the interaction between a system and actor consists of a relatively

fixed sequence of actor requests and system responses. Often, the system interacts with only one actor during the process of a use case. In the case of diabetic prediction, the primary actor is the user, and the secondary actor is the machine learning module for diabetic prediction.

The following diagram describes the Interactive System Model of our Application:

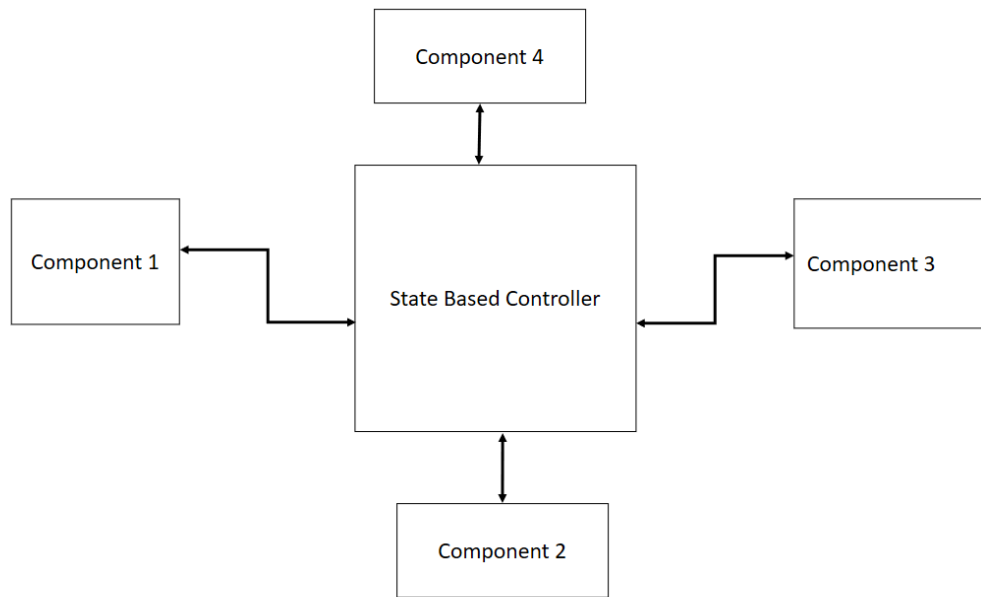


Figure 3.1.1 Interactive System Model of our Application

In our case, the State based controller represents the link to our web page within the application where the users check whether they have diabetes or not and can also view various information related to diabetics.

3.2 Decomposition Description

Component 1

The first component of the Application displays a home page where the users should fill in the details like High blood pressure, High cholesterol, Cholesterol check,

Body mass index, physical activity, etc. The web page takes the user's details, and when the users select the predict button, it displays the results and whether they are diabetic or not.

Component 2

The second component of our web page is the About tab, where the user is provided with sufficient information regarding diabetics. We also provided information on different diabetes types like type 1, type 2, and gestational diabetes. At last, we have attached a YouTube video that gives a clear understanding of what is diabetic.

Component 3

The third component of our web page is the Diabetes tab. It is a tab used mostly by users whose results are positive. This web page deals with the best practices to be followed in your day-to-day life if you have diabetes.

Component 4

The fourth component of our web page is the Prediabetes tab. By choosing this tab, you will get information related to prediabetes. It also recommends you follow a specific diet if you suffer from prediabetics.

3.3 Database Description

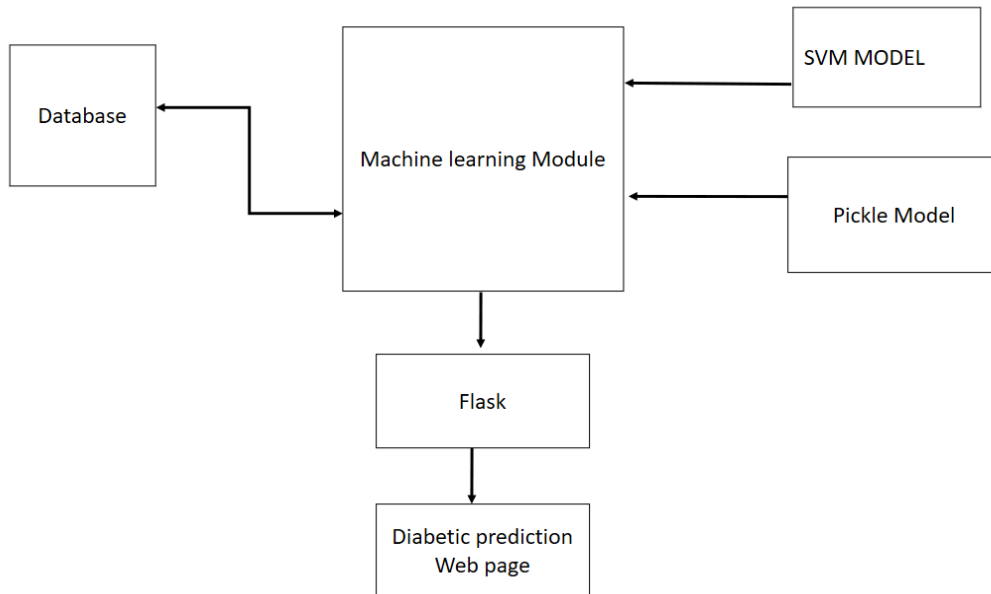


Figure 3.3.1 Architecture of our Application

4.0 Human Interface

4.1 Overview of User Interface

This application is intended for adults 18 or older who want to know whether or not they have diabetes. There are no gender restrictions or special skills required to operate this app. A user-friendly interface and informative data entry questions make the app very easy to use by everyone.

The user will input their age, high blood pressure, high cholesterol, smoking, obesity, diet, exercise, and Body Mass Index. Our application uses the most accurate prediction by collecting the data from users who want to check whether they have diabetes.

Figures 4.1.1, 4.1.2, and 4.1.3 show the User Interface for Diabetes Web App Home Page, Diabetes Info Page, and Diabetes Result Page, respectively.

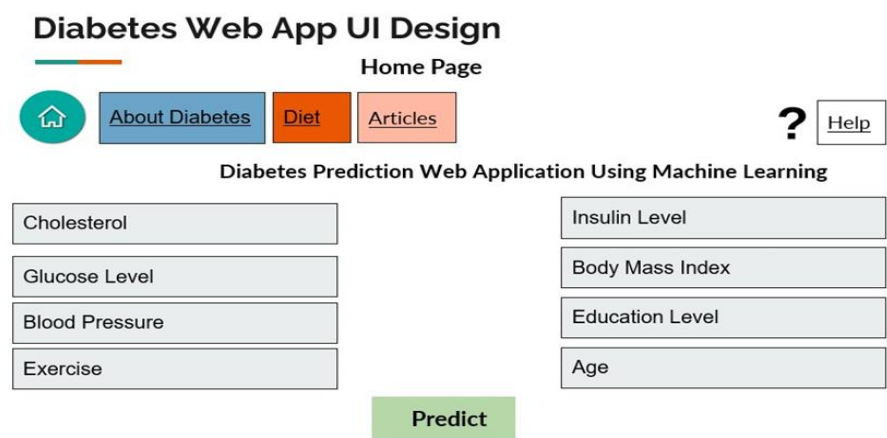


Figure 4.1.1 User Interface of Diabetes Web App Home Page

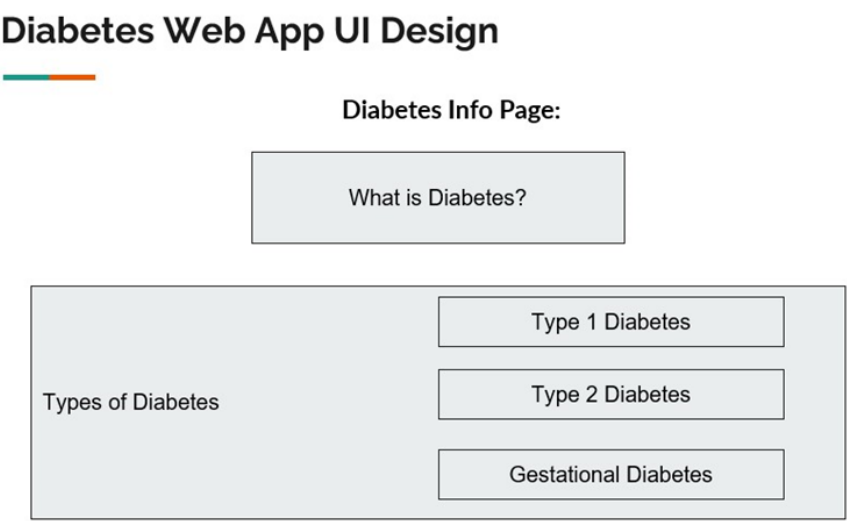


Figure 4.1.2 User Interface of Diabetes Info Page

Diabetes Web App UI Design

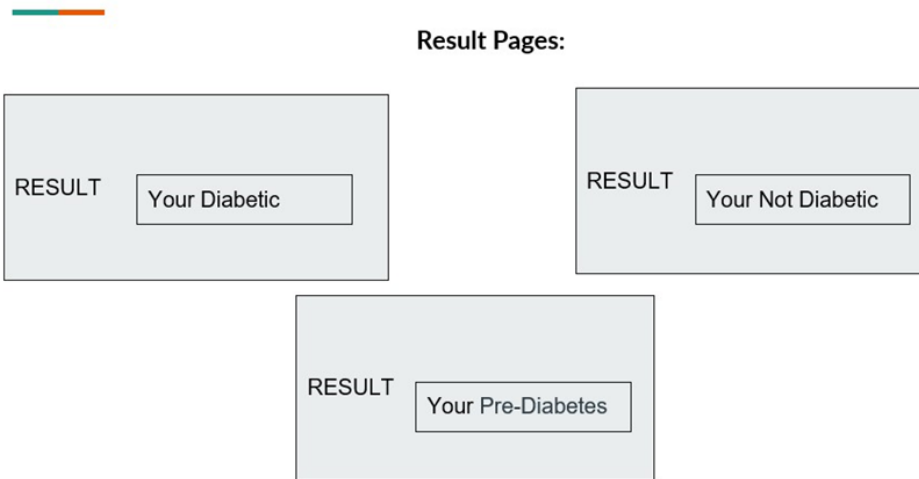


Figure 4.1.3 User Interface of Diabetes Result Page

4.2 UI Samples

1. Our Diabetes Web App can be reached by going to <https://diabeteswebapp01.pythonanywhere.com/> from any web browser. Figure 4.2.1 displays the home screen of our application.

The screenshot shows a web browser window with the URL `diabeteswebapp01.pythonanywhere.com`. The browser's address bar and tabs are visible at the top. Below the browser window, there is a dark navigation bar with links: [Home](#), [About](#), [Diabetes](#), and [Prediabetes](#). The main content area has a heading: **Please hover over each entry and answer all the questions matching your situation**. Below this heading is a vertical list of 20 input fields, each with a label: High Blood Pressure, High Cholesterol, Cholesterol Check (mm Hg), Body Mass Index (kg/m²), Do you Smoke?, Stroke, Heart Disease or Heart Attack, Physical Activity, Fruits, Veggies, Alcohol Consumption Level, Health Care Routine, NoDocBcCost, General Health, Mental Health, Physical Health, DiffWalk, Sex, Age, Education Level, and Income. At the bottom of the list is a large **Predict** button.

Figure 4.2.1 Home Screen of Diabetes Web App

2. Figure 4.2.2 shows a sample of how a user can see the information of each data entry to input their values correctly.

The screenshot shows a web browser window with the URL `diabeteswebapp01.pythonanywhere.com`. The browser's address bar and tabs are visible at the top. Below the browser window, a dark navigation bar contains the links: Home, About, Diabetes, and Prediabetes. The main content area has a heading: "Please hover over each entry and answer all the questions matching your situation". Below this heading is a vertical list of 20 input fields, each with a light gray background and rounded corners. The fields are: High Blood Pressure, High Cholesterol, Cholesterol Check (mm Hg), Body Mass Index ((kg/m²), Do you Smoke?, Stroke, Heart Disease or Heart Attack, Physical Activity, Fruits, Veggies, Alcohol Consumption Level, Health Care Routine, NoDocBcCost (a dropdown menu), General Health, Mental Health, Physical Health, DiffWalk, Sex, Age, Education Level, and Income. A tooltip is visible next to the "NoDocBcCost" field, containing the text: "Was there a time in the past 12 months when you needed to see a doctor but could not because of cost? 0 = No 1 = Yes". At the bottom of the form is a large, light gray button with the text "Predict" in blue.

Figure 4.2.2 Input Information of Diabetes Web App

- Figures 4.2.3, 4.2.4, and 4.2.5 display the additional pages implemented for this app about diabetes, diabetes, and pre-diabetes pages, respectively.

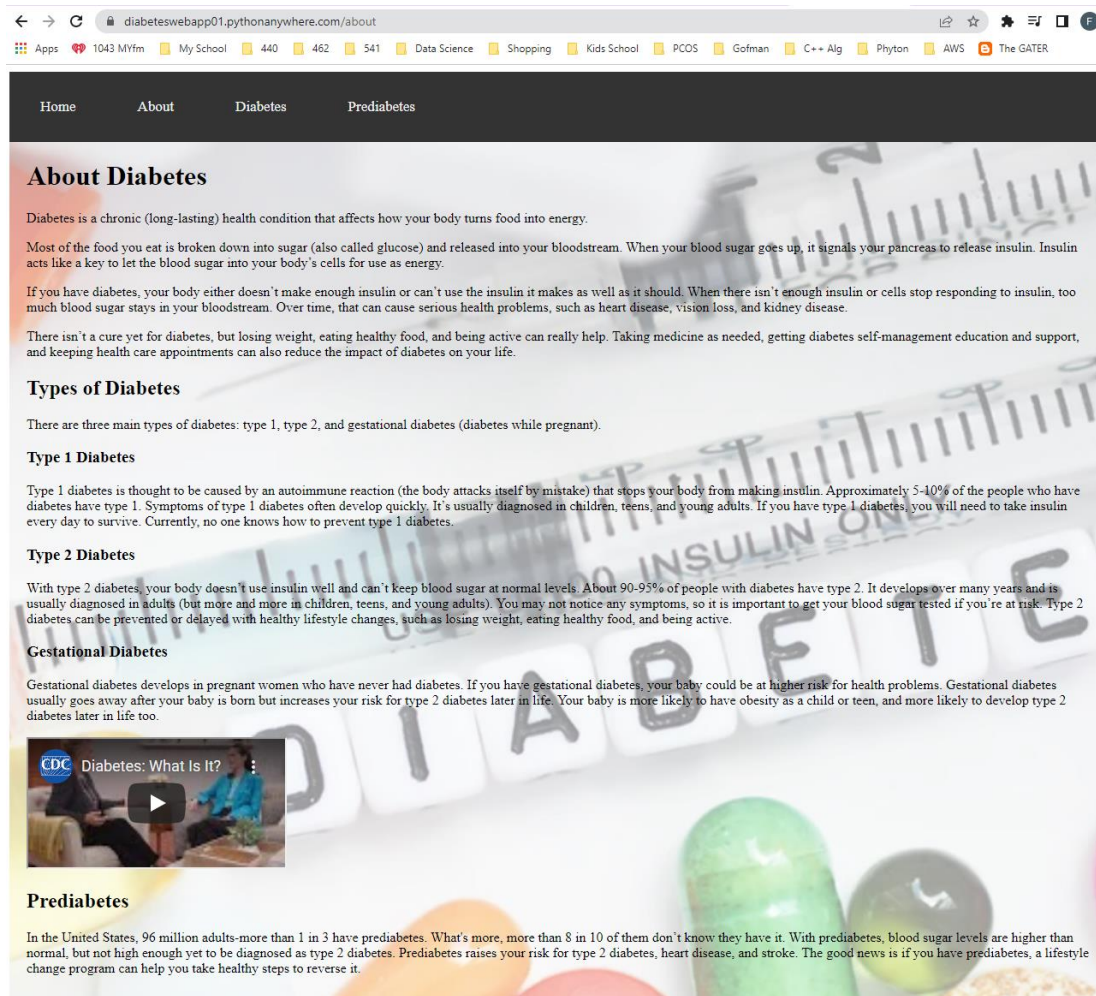


Figure 4.2.3 About Diabetes Info Page

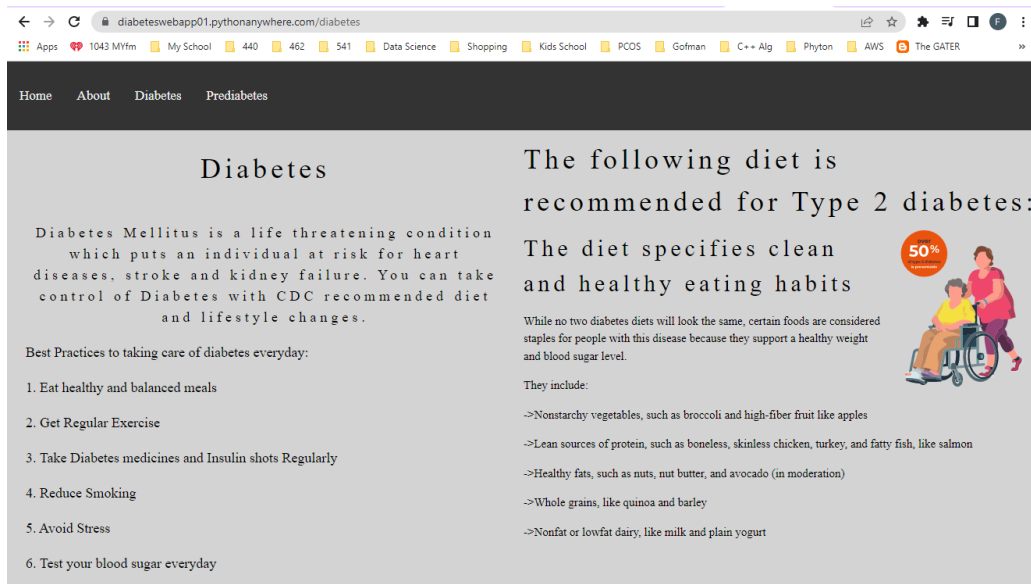


Figure 4.2.4 Diabetes Info Page

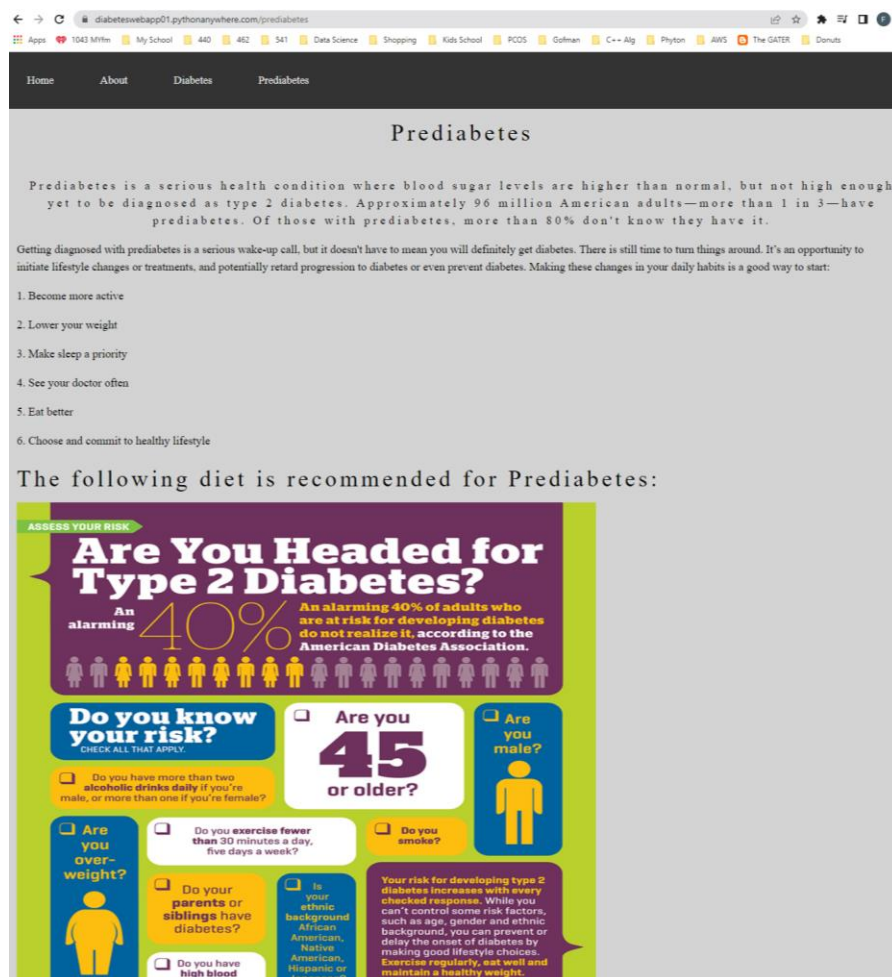


Figure 4.2.5 Pre-Diabetes Info Page

4. Figure 4.2.6 shows how our application predicts that you do not have diabetes.

The screenshot displays a web browser window with the URL `diabeteswebapp01.pythonanywhere.com/predict`. The browser's address bar and tabs are visible at the top. Below the browser window, a dark navigation bar contains links for [Home](#), [About](#), [Diabetes](#), and [Prediabetes](#). The main content area features a bold instruction: **Please hover over each entry and answer all the questions matching your situation**. Below this instruction is a vertical list of 20 input fields, each with a light gray border and a light gray background. The fields are labeled as follows: High Blood Pressure, High Cholesterol, Cholesterol Check (mm Hg), Body Mass Index (kg/m²), Do you Smoke?, Stroke, Heart Disease or Heart Attack, Physical Activity, Fruits, Veggies, Alcohol Consumption Level, Health Care Routine, NoDocBeCost, General Health, Mental Health, Physical Health, DiffWalk, Sex, Age, Education Level, and Income. At the bottom of the input fields is a large, light gray button with the text **Predict** in blue. Below the button, the prediction result is displayed in bold black text: **You don't have Diabetes!**

Figure 4.2.6 No Diabetes Prediction Page

5. Figure 4.2.7 shows how our application predicts that you have diabetes.

The screenshot displays a web browser window with the URL `diabeteswebapp01.pythonanywhere.com/predict`. The browser's address bar and tabs are visible at the top. Below the browser window, a dark navigation bar contains links for [Home](#), [About](#), [Diabetes](#), and [Prediabetes](#). The main content area features a bold instruction: "Please hover over each entry and answer all the questions matching your situation". Below this instruction is a vertical list of 20 light gray rectangular buttons, each containing a question or health-related term. At the bottom of the list is a larger button labeled "Predict". Below the "Predict" button, a bold message states: "You have Diabetes, please consult a Doctor!".

← → ↻ `diabeteswebapp01.pythonanywhere.com/predict`

Apps 1043 MYfm My School 440 462 541 Data Science Shopping Kids School PCO

[Home](#) [About](#) [Diabetes](#) [Prediabetes](#)

Please hover over each entry and answer all the questions matching your situation

High Blood Pressure

High Cholesterol

Cholestrol Check (mm Hg)

Body Mass Index ((kg/m²)

Do you Smoke?

Stroke

Heart Disease or Heart Attack

Physical Activity

Fruits

Veggies

Alcohol Consumption Level

Health Care Routine

NoDocBcCost

General Health

Mental Health

Physical Health

DiffWalk

Sex

Age

Education Level

Income

Predict

You have Diabetes, please consult a Doctor!

Figure 4.2.7 Diabetes Prediction Page