# HEALTHBOT FOR POLYCYSTIC OVARIAN SYNDROME

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***ABSTRACT***

*Polycystic ovarian syndrome(PCOS) is one of the predominant hormonal imbalances present in women of reproductive age. It needs to be diagnosed and treated at an earlier stage as it's inter-related to diabetes, high cholesterol levels, and obesity. This paper presents an application specially designed for women to help them keep track of their Body Mass Index, Blood Sugar, and Blood Pressure based on their age. The people diagnosed with PCOS(an endocrine disorder) can use this application to make their life easy since it helps follow certain exercises, diets, and timely reminders for water and medicines. It has features like the period tracker to track the user's menstrual cycle, find dieticians nearby, links to various PCOS supplements, users can track their moods during different menstrual phases and control their mood swings. Finally, the application has games to add that interactive touch.*

***KEYWORDS***

*Polycystic Ovarian Syndrome (PCOS), Android Application, Menstrual phases, Premenstrual Syndrome Mood swings.*

## 1. INTRODUCTION

In this project, Data Mining techniques like data collection, pattern tracking, and classification were used. Data collection from different sources plays a vital role in this project as HealthBot mainly focuses on making its users gain exclusive knowledge about Polycystic Ovarian syndrome. PCOS is a syndrome first described by Stein and Leventhal in 1935 [1-2]. In the USA, 4-12% of women of reproductive age are diagnosed with PCOS. PCOS is mainly due to the elevated androgens in women. Most symptoms include heavy periods, no or irregular periods, excess body and facial hair, pelvic pain, and so on. It can cause type 2 diabetes, mood disorder, obesity, endometrial cancer, and heart disease. It is named based on the cysts present in ovaries and is detected based on the ultrasound image. Treatment mainly includes weight loss and changing the lifestyle with a healthy diet by staying active. Previous works aim in detecting PCOS through machine learning and image processing techniques, while the goal of the proposed system is to know explicitly: What is PCOS, Dos, and Don'ts of PCOS, Treating PCOS, tracking menstrual cycle, Knowing User's Premenstrual syndrome moods and suggest them ideas to overcome mood swings, providing dieticians nearby for consultation, Supplements to treat PCOS, Weekly Exercises with reminders, Recipes for PCOS diet. Additionally, the application is also implemented with games for fun and making the user interactive. This application could help women learn more about PCOS and help them in keeping track of their lifestyle.

## 2. RELATED WORK

The work by Sharvari et al [3] explains the follicle recognition used for the detection of polycystic ovaries. Detection is made based on ultrasound image processing using parameters like BMI,

hormonal levels, menstrual cycle length, etc. This work mainly focuses on detection using various preprocessing techniques that include contrast enhancement and filtering, extracting feature using multiscale segmentation. More research [4] is done on the detection of ultrasound images rather than providing a solution to the disease. It is always the first part in any research to detect and diagnose if the disease exists, but it is also necessary to find a way to cure it which has been focused in our system.

The work by Palak Mehrotra et al [5] explains the automated screening of PCOS using machine learning techniques. Their algorithm differentiates between normal ovaries and the one with the cysts using certain metabolic features based on two-sample t-tests. Their classification is based on Bayesian and Logistic regression.

Now differentiating from the existing works, the main aim of my work is to have all the goodness of alleviating the discomfort amidst PCOS in a single app. This not only gives recommendations based on mood and current state of mind, but also provides various short-term and long-term solutions such as in-app stress buster games, easy navigation to the nearby available professional help etc. Topping these, my app also has a period tracking [6-7] and prediction model built natively with in the app. Also, suggests nearby dieticians using google map location [8]. To Sum it up, my work is addressing the issue by providing solutions to the post-traumatic stress experienced during PCOS.

To the best of our knowledge, our work is Novel. Although there are various applications for PCOS, there has been very less research work on software development for PCOS. Therefore, we did not find much material to compare the practicability of work compare to other related systems.

## 3. SYSTEM DESIGN

The HealthBot System is developed in Android Application with backend as Firebase [10]. The system uses the non-relational database Firebase for storing user information. Data is stored and retrieved from Firebase, making the system work efficiently as everything is on the cloud. Firebase provides various unique features for authentication, data storage, and Cloud Messaging (Push Notifications). Figure 1 describes the user's journey in the application.

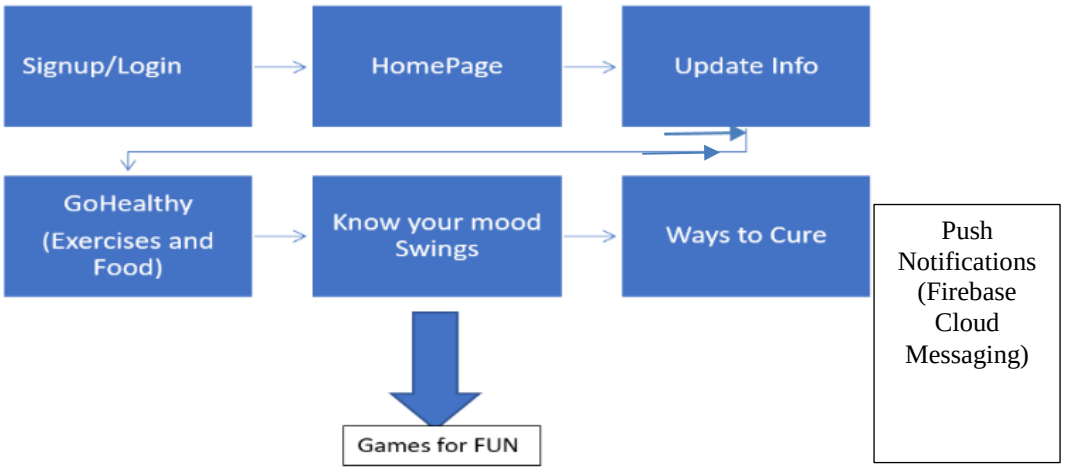


Figure 1. System Design

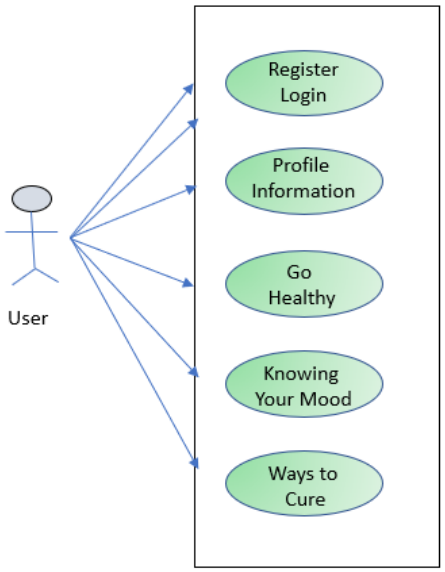


Figure 2. Use Case Diagram for User

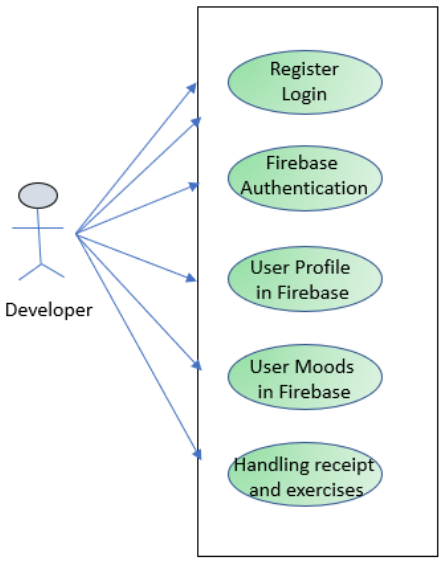


Figure 3. Use Case Diagram for Developer

Figures 2 and 3 explains the exact scenario of the application through use-case diagrams. These diagrams are used to clarify the application flow through the use case derivation for each functionality in a pictorial form.

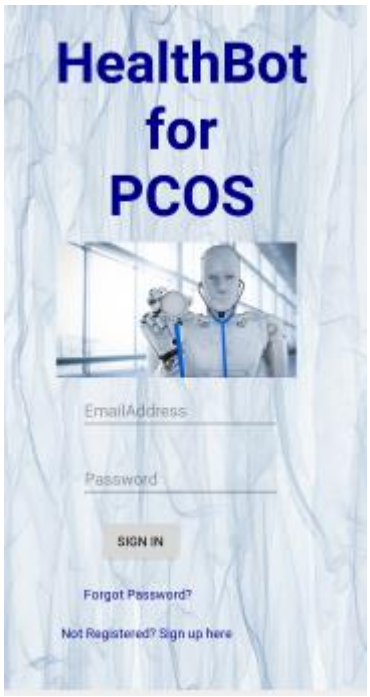


Figure 4. Login

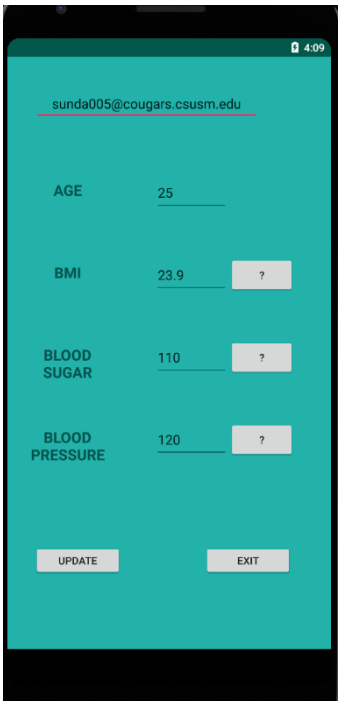


Figure 5. User Profile Information

## 4. SYSTEM FUNCTIONS

The application includes the following modules and sub-modules:

## 4.1. Sign Up/ Login

To use HealthBot, the user needs to register by providing an email address and set up a password. Once they sign up, the user needs to verify their email address to login with the email address and password. The user needs to login with the correct credentials.

Following are the validations made in the sign up/ login shown in Figure 4. This checks 5 different things: Checks if the user has entered an email that already exists, checks if the user has entered a valid email, checks if the user has entered an email that has already been verified, checks if the fields are empty, or if the password and email address match.

## 4.2. User Information

As shown in Figure 5, the user needs to enter the following details in the profile information page: Email address of the user, Age, Body Mass Index: The ratio of Height (in ft) to weight (in-lb), Blood Sugar and Blood Pressure: The normal blood pressure level is less than 120/80 mmHg, and the normal Blood Sugar level should be less than 140 mg/dL

Figure 6 shows the “Go Healthy” module gives you tips to be healthy with the following submodules. They include “PCOS”, “Recipes”, “Exercises”, and “Dos and Don’ts”. “PCOS” gives an idea of how it has affected women's fertility and reproductive health. “Recipes” gives the names, images, and URLs of the food that is good for women suffering from PCOS and does not affect your hormonal balance. "Exercises" include yoga for five days that are good for regularizing the menstrual cycle in women. On clicking the "view button", the user gets into the YouTube channel for videos referring to those yoga poses. "Dos and Don'ts" modules are certain to do’s and don'ts in every treatment. Those are discussed in the application for the user to know how to get rid of them quickly.

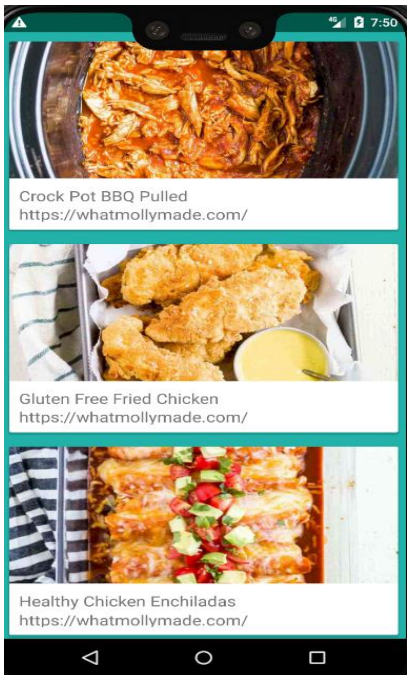


Figure 6. Diet Recipes for PCOS

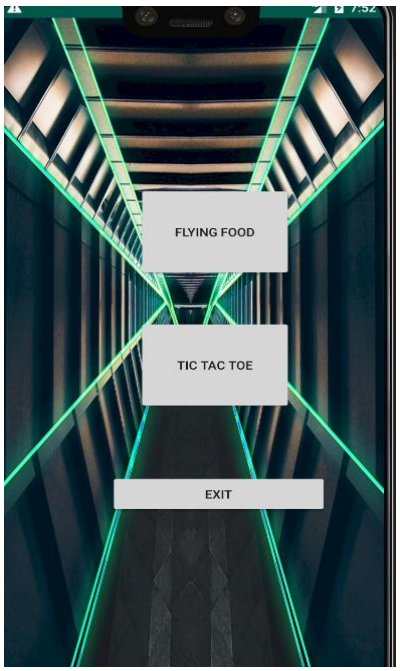


Figure 7. Games to Relax

### 4.3. Games

Two games in the application make the user turn on their fun mode: "Flying Food and Tic Tac Toe". Figure 8 shown the "Flying Food" game. It is another version of flying fish where the user clicks on the screen to make the fish fly, while in this game, the user needs to click on the screen such that the Pac-man eats the flying food. The user should make sure that the Pac-man eats only healthy food (carrot) and not Junk (Fried chicken). If the user makes the Pac-man eat fried food thrice, the user will lose the game. If the user makes the Pac-man eat Carrot, the user's score increases by 30 points. The increase or decrease in points is based on the collision between the Pac-man and the food. It is based on the decision tree algorithm for predicting the score.

Tic tac Toe" is a fun game for 2 players, X and O (See Figure 9). The users play on a 3 x 3 grid. Each player tries to make 3 in a row. If the player1 makes 3 in a row, then player1 wins; otherwise, player 2 wins.

### 4.4. Tracking user's Mood Swings

This module gets the user's mood information. This includes" happy, sad, anxious, or angry. Most of the women suffering from PCOS [11-12] have PMS mood swings during different phases of their menstrual cycle, so treating it based on psychic heal is important. A graphical representation of the phases [13-14] and their respective moods are given. Those who are not sure of their phases can trace it through the sub-module "Know Your Phase" (See Figure 10).

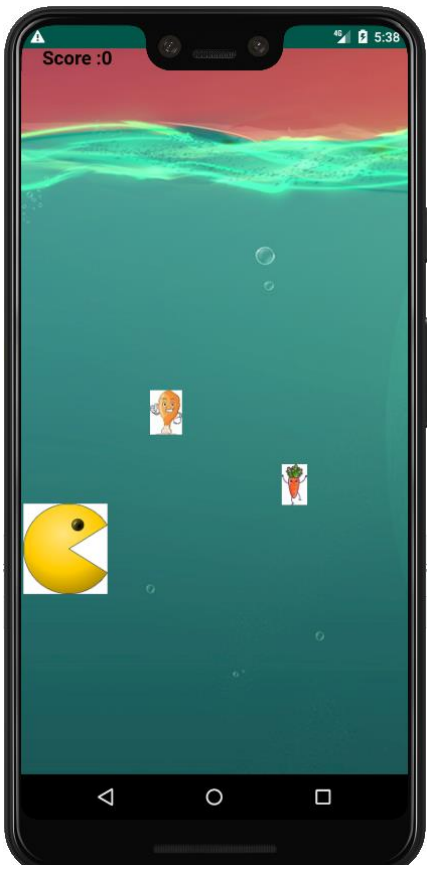


Figure 8. Flying food

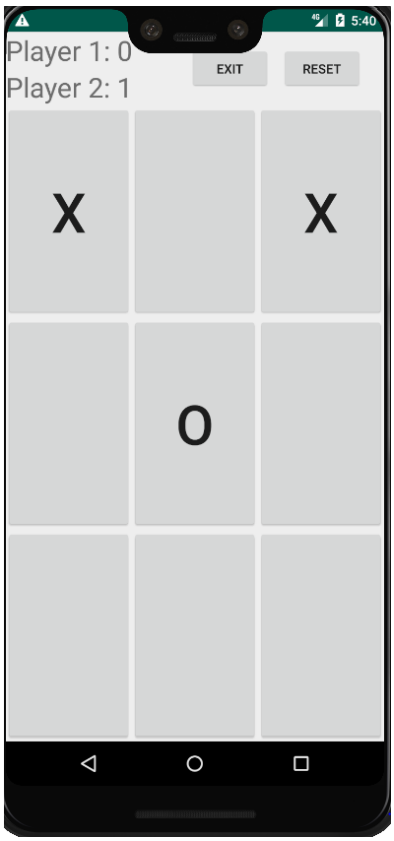


Figure 9. Tic Tac Toe

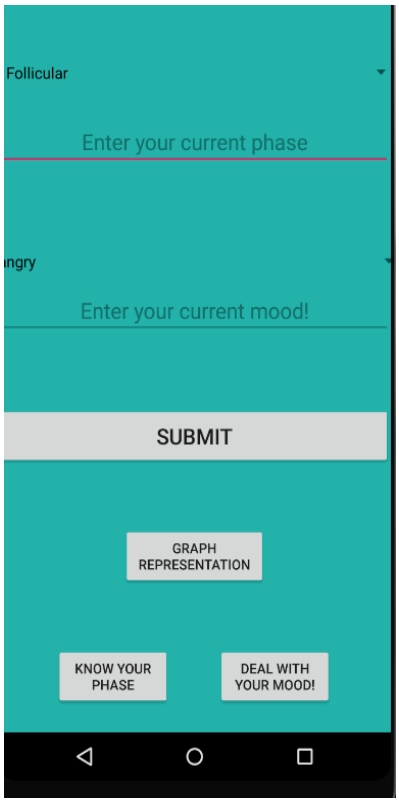


Figure 10. Tracking mood

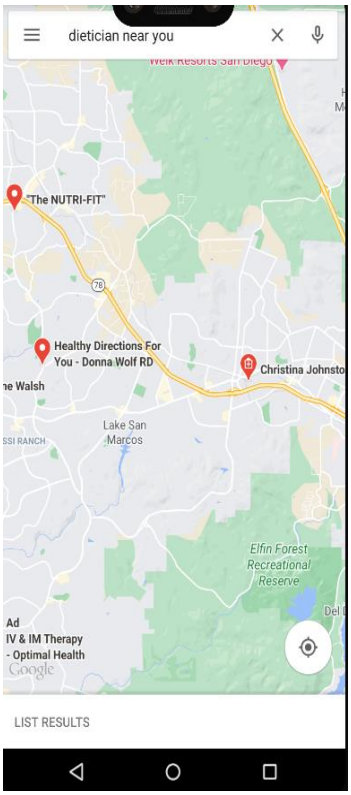


Figure 11. Dietician near me

There are four ways to treat women with “PCOS”: Dieticians nearby, Supplements, Adaptogen herbs, and Period Tracker. The "Dieticians nearby” module helps the user find the dieticians nearby. Google maps service [15] has been added to access this feature (See Figure 11). “Supplements” sub-module helps to search for supplements available in online retail stores like amazon that could heal PCOS quickly and help women reproduce. Another sub-module is called "Adaptogen herbs" which provides information about natural herbs that are good to be consumed. These herbs help in the following ways: Boosts fertility, Balances hormone, Lower cortisol levels, improves stress, prevent weight gain, Help reduce blood sugar, Reduce metabolic stress, and Anti-inflammatory agent.

Another important module is called “Period Tracker”. The period tracker keeps track of the user's menstrual cycle and helps them keep a note of their monthly periods. The application asks the following questions like “when was your last period”, “the duration, and the average length of periods" which calculates the next expected date of the period. This helps the user to work on their diet, exercise, and mood swings.

## 5. Conclusion and Future Work

Building this application from scratch was a great experience, in turn, discovering technologies like Android Studio and Firebase. Google firebase has various unique features which can be imported into the android studio as dependencies and enhance the mobile application. It was an enthralling experience to explore Google firebase and its features. This application is mainly for women suffering from PCOS problems and finding it hard to treat it. Since there is no definite way to cure PCOS completely, it can only be treated with a lifestyle change. The users need not download different applications for period tracking, water reminders, exercises, dieticians nearby,

and other features, instead, users can download HealthBot to access various features. A lot of learning about PCOS concerning biology and psychology was needed to implement each feature. Later, we integrated fun games so that the application is not just informative but interactive too.

The important aspect is that the system should meet all possible positive and negative test cases during the testing phase. So, the system was tested with all functionalities manually. Both positive and negative test cases were taken into account and tested with great intensity.

We can make a couple of elements like an open problem to improve this system. First, in the next implementation phase, a feature can be added to detect the disease from Ultrasound images. Second, we can have expert systems to diagnose and treat PCOS. In this system, the diagnosis and treatment are through research work and data collected from various sources, but this can also be converted into an expert system using certain experts from the gynecology field.

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