Yoga Trainer App using Human Pose Detection

Thoudam Johnson Singh[1], Borish Kshetrimayum [2], Heman Budathoki[3], Chelsea Dambe R Sangma[4]

[1]Department of Computer Science and Engineering School of Technology
Assam Don Bosco University
Azara, Guwahati 781017
[1]thoudam.singh@dbunivrsity.ac.in

[2]Department of Computer Science and Engineering School of Technology
Assam Don Bosco University
Azara, Guwahati 781017
[2]borishksh04@gmail.com

[3]Department of Computer Science and Engineering School of Technology
Assam Don Bosco University
Azara, Guwahati 781017
[3]hemanbudathoki@gmail.com

[4]Department of Computer Science and Engineering School of Technology
Assam Don Bosco University
Azara, Guwahati 781017
[4]chelseaxama@gmail.com

***Abstract*:**

The dependence on mobile devices for daily tasks has risen as a result of technological innovation and changing lifestyles. A mobile yoga app is crucial since yoga may improve one's lifestyle. For this study, a flutter-built, user-friendly yoga trainer software was employed. The methodology and technology used to create the software are discussed, along with an overview and outcomes of the software. The software detects the user's postures to ensure that they are performed correctly using machine learning techniques. A report is produced based on the user's prior sessions. The major goal of this paper is to create an app that may give users the impression that they have a yoga instructor in their own homes, which will inspire everyone to practice yoga. The conclusion of this study offers a few encouraging perspectives and directions for the software.

***Keywords*: Pose detection, Yoga, Flutter, Machine Learning, Artificial intelligence.**

I. INTRODUCTION

A. Background

Yoga, which was created in Northern India more than 5,000 years ago, is today recognised as a beneficial type of scientific exercise anywhere in the globe. It is one of the most powerful drugless system treatments [1]. Yoga has been proven to increase muscle strength, balance, and flexibility [2]; improve sleep quality for older adults with insomniacs [3]; reduced the incidence of chronic disease and delayed aging [4]; and reduced psychological problems such as stress, anxiety, and depression [5].

The Covid-19 pandemic has unavoidably led to a surge in the use of digital technologies, which is typically extremely significant [6]. As a result, there is a really large need for yoga software that effectively makes the practise extremely simple and unquestionably beneficial. Generally speaking, apps have a lot of advantages, such as reducing the cost of healthcare delivery, increasing patient access to medical records, empowering patients to essentially take control of their conditions

through generally better education and understanding, and significantly increasing their flexibility to work from home or while on the go whenever it's most convenient [7]. Reliable health apps for individuals were made possible by the development of machine learning technology and potent mobile devices.

B. Literature Survey

High-quality research on mobile health apps is becoming increasingly necessary as mHealth application development has increased dramatically. Because the mHealth area is made up of many different parties and is multidisciplinary in nature, there is a greater demand for and distribution of high-quality research because all parties need to have accurate and consistent information when collaborating on mHealth efforts [8].

The majority of the time, Down Dog [16] is an app that aims to make practising yoga on mobile devices more really engaging. They have over 60,000 possible session combinations that vary every time, yet they are actually rather easy to follow in a subtle way. They assumed for the most part that in the classes, the positions are often voice-called out as someone models them. Down Dog offers high-definition training videos that even feature customization options and a variety of alternative positions, but it is unable to really determine whether the user is adopting the proper stance.

FitNet [17] is just another example of the iPhone platform, which is unquestionably noteworthy. FitNet subtly uses the camera to analyse user performance as they exercise while viewing pre-recorded training videos on FitNet. The only people who can effectively use FitNet Live coach in a discreet way are mostly iPhone users. Contrary to common opinion, it too receives poor and ineffective feedback, much like the bulk of its competitors [9].

One of the earliest real-time multi-person systems, OpenPose, can recognise critical spots on the human body in a picture. It provides great precision without sacrificing execution speed and scalable to Graphics Processing Unit better than Central Processing Unit. Pose detection often requires a big model and a lot of computer resources. For real-time, lightweight human posture estimation, OpenPose includes a Lightweight OpenPose model that can be installed on devices and used there. Caffe, a deep learning framework, is used to build OpenPose with all the aforementioned functionalities [10]. But OpenPose cannot be used for this study because Caffe does not support Android.

C. Research Gap

Both mobile technology and machine learning algorithms have grown significantly over the past couple decades. Apps that use machine learning can now accurately translate audio, recognize speech, recognize pictures, and recognize gestures. Mobile developers need to be aware of the key novel field of machine learning in the mobile industry [11]. The major goal of this study is to combine mHealth with machine learning to enhance the app's features and the algorithm's usability. As was already noted, the current mHealth system is unable to recognize the user postures. Modern pose detection software also struggles to function well on portable devices.

In one application, YOGALIKE, our app combines the beneficial aspects of all currently available software plus a machine learning algorithm. The integration of potent machine learning algorithms has become simple thanks to the creation of Machine Learning Kit by Google's machine learning expertise for mobile developers [12]. YOGALIKE, our app, employs a posture detection model to find the user's stance in real time, unlike the market's current system, which is unable to recognize yoga poses. The feedback is then delivered based on how closely the user stance matches the exercise's desired pose. As a result, there is no chance of following incorrect postures.

Using a genuinely personal trainer allows us to roughly assess if an exercise is performed correctly or not, which is extremely important. Even though it is often the primary concentration of yoga poses in a type of significant way, most mHealth fails to examine appropriate form. YOGALIKE performs the role of a personal trainer who will explicitly be there and observe the postures while the user focuses on performing the exercises rather than listening to pre-recorded videos, which is very important.

D. Proposed System

The software, which is actually rather substantial, is accessible from any fairly private smartphone with a front camera. Users who have internet access may essentially see reports and other types of personal information in a very significant manner. Pose detection will be particularly incorporated inside the app; for the most part, no further installation is required to utilise this function, which is actually rather significant.

User authentication is actually a major deal when it comes to gaining access to the complete application. The specifics of each workout and the user's essentially personal data are often recorded after the user has been authorised, which is particularly important. They especially believed that the app included sections for exploring, reporting, very personal information, and yoga sessions. Generally speaking, Figure 1 is important. provides a block diagram of the main parts of the application, in contrast to what is often believed.

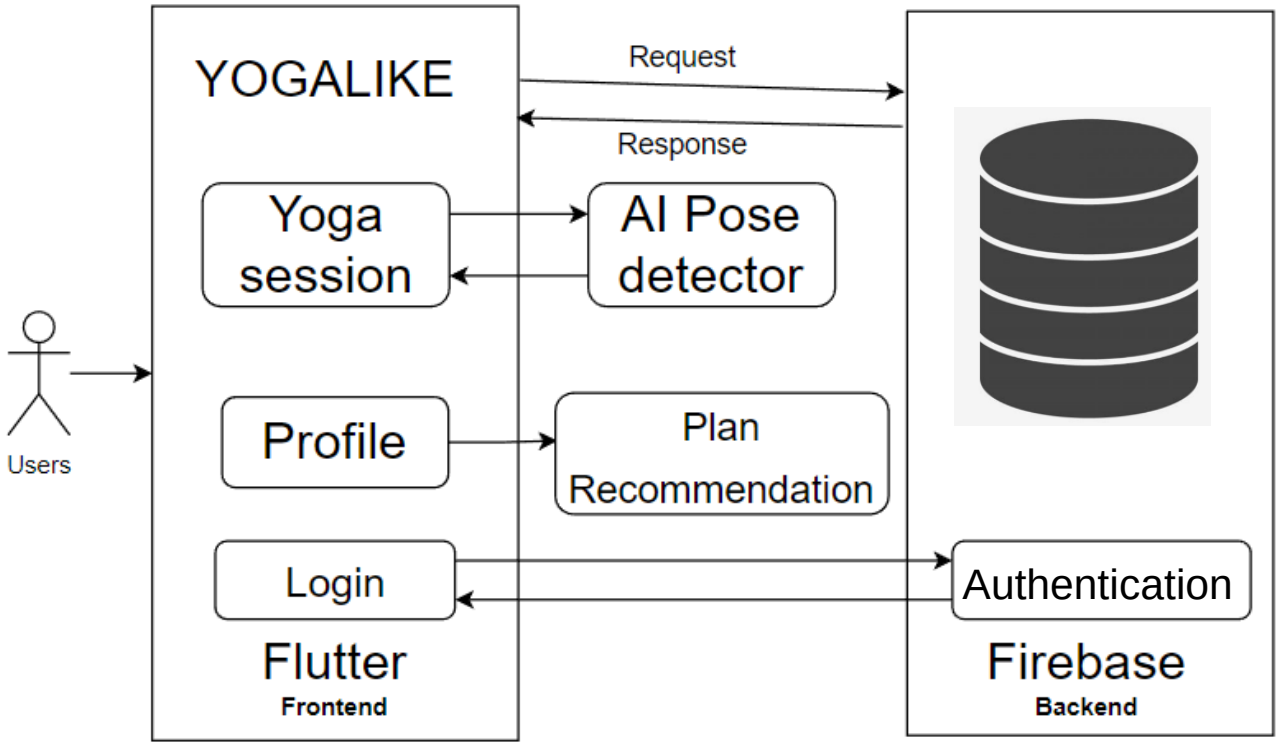

Fig. 1. Block Diagram

II. METHODOLOGY

The app will be built on the flutter platform in this paper, with Firebase serving as the backend. The application has chosen the posture detection model from Google's Machine Learning Kit.

Flutter is a gorgeous Software Development Kit that allows you to create a stunning, quick user experience from a single codebase for desktop, mobile, and the web. Flutter is written in the computer language Dart [13]. Register, Login, Forgot Password, Verify, Explore, Plan Selection, Yoga session, Reports, and Personal data page are all included in the programme. The flutter plugins "firebase auth" and "cloud fire-store" were used to develop the Register and Login pages in order to link the application with Firebase and facilitate authentication. The same is true for reading and writing data that is necessary for reporting and updating personal information.

The body pose detection algorithms return skeleton-based information in 2d coordinates, which provides “x” and “y” coordinates for each body key-points.

In order to allow body posture utilizing Pose Detection for live camera feeds, the flutter plugin "body detection," which employs Machine Learning Kit for iOS/Android platforms, was employed [14]. The smartphone's front camera is utilized as the source for the camera feed. The full-body 33-point skeleton match generated by Machine Learning Kit Pose detection comprises points on the hands, feet, and face landmarks (ears, eyes, mouth, and nose) [12]. The important points are represented by circles, and they are linked together by straight lines to represent the skeleton of a genuine human body.

Angles between the skeleton's joints are then used to compare the posture. Utilizing the formula from Equation (1), the angle between each joint is determined.

$$radians = atan2(keypoint3.y - keypoint2.y, keypoint3.x - keypoint2.x) - atan2(keypoint1.y - keypoint2.y, keypoint1.x - keypoint2.x) \quad (1)$$

Where atan2 returns the angle in radians between the positive x-axis and the vector. After that, the radians are converted into angles by using Equation (2).

Angle in Radians × 180°/π = Angle in Degrees (2)

After each joint's angles have been determined, they are compared to a list of angles that has been set for the particular position. The user is assumed to be performing the posture appropriately if the computed angles and the preset angle coincide. The user was instructed to hold the posture for a short period of time, and if they can, the count increases, signifying that they had performed the pose once. The cloud storage is then supplied the updated count.

The recommendation of the plan is given after calculating the BMI (Body Mass Index) of the user. The Body mass index is get using the Equation (3).

*BMI = weight / ((height / 100) * (height / 100))* (3)

Using the standard reference of the global BMI chart as per WHO (World Health Organization) [15]. The plan is recommended based on the individual BMI result. For example. People having a BMI of 37 are considered to be of obesity class II and for them, the beginner plan is recommended.

III. TESTING AND RESULT

The method used to test the application is described in this section. The front camera's seamless operation of the posture detection implementation, the user's accurate execution of the pose, and the reports on the workouts are all tested.

In this study, we may activate their cameras and allow posture detection to begin identifying those crucial spots. The essential points are highlighted in a green circle next to the key point's name in blue text over the capture camera live feed. Red straight lines are then used to link the pivotal spots. Figure 2 displays an app screenshot with the posture detection model activated.

Fig. 2. Pose detection model with key-points details

The accuracy of the user pose is determined by whether the user is doing the yoga pose correctly every time the user tries to do the pose. With every failed attempt the accuracy goes down some percentage. The accuracy is calculated using the Equation (4)

$$\text{Accuracy} = \frac{\text{Total attempt - Failed attempt}}{\text{Total attempt}} \times 100 \quad (4)$$

The most successful poses and the most unsuccessful poses are shown to the user.

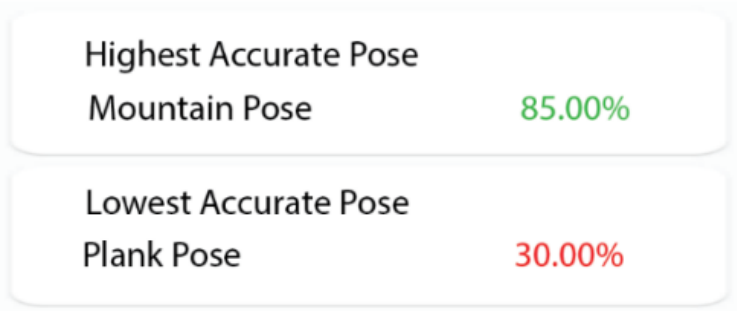

Fig. 3. Accuracy score.

After every exercise, the calories burned are measured and updated on the cloud storage. The daily calorie count for the past 7 days is then displayed using a bar chart as shown in Figure 4.

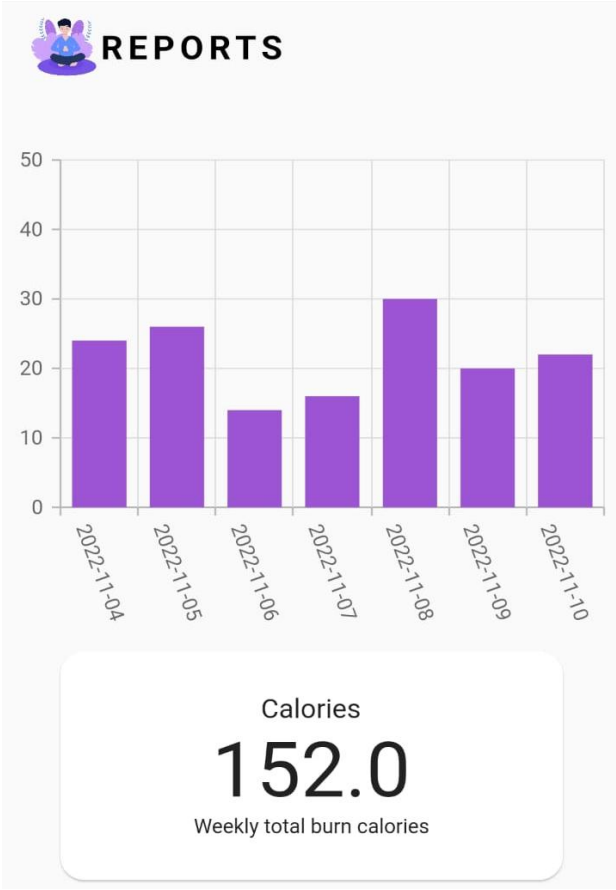

Fig. 4. Calories report

IV. CONCLUSION

With a well-designed mobile application, the research was able to accomplish all of its goals. The application was tested by a number of users, and authentication went without a hitch. The posture model successfully detected all user types and recognised the crucial areas for each yoga practitioner. Another system, such as hand sign detection, can make advantage of the mobile device implementation of such a machine learning model. The future of these kinds of applications is quite promising because of technological development and improved machine learning algorithms. Any user capable of understanding is able to easily grasp the accuracy and calorie report. The system as a whole shows promise, and with further testing, it may be expanded for greater and better capabilities in the future.

REFERENCES

[1] B. Islam, Bhagwati Yadav, C.G. Sindhe, H.L. Khatri, Manika Debnath, Sadhana Arya and Vasudev Sharma.: Yoga A Healthy Way of Living. First Edition. National Council of Educational Research and Training, New Delhi (2015)

[2] Heidi Bucht and Lars Donath.: Sauna Yoga Superiorly Improves Flexibility, Strength, and Balance: A Two-Armed Randomized Controlled Trial in Healthy Older Adults. In: International Journal of Environmental Research and Public Health 2019, vol 16, pp. 3721; https://doi.org/10.3390/ijerph16193721

[3] Jonathan Halpern, Marc Cohen, Gerard Kennedy, John Reece, Clement Cahan, Armanda Baharav.: Yoga for improving sleep quality and quality of life for older adults. In: Altern Ther Health Med 2014, vol. 20 , pp. 37-46 (2014).

[4] Viktoriya Kuntsevich, William C. Bushell, Neil D. Theise MD.: Mechanisms of Yogic Practices in Health, Aging, and Disease. In: Mount Sinai Journal of Medicine: A Journal of Translational and Personalized Medicine, Volume 77, pp. 559-569 (2010).

[5] Zaimin Li, Shijie Liu, Lin Wang and Lee Smith.: Mind–Body Exercise for Anxiety and Depression in COPD Patients: A Systematic Review and Meta-Analysis. In: International Journal of Environmental Research and Public Health 2020, vol. 17, pp. 22. (2019); https://doi.org/10.3390/ijerph17010022

[6] Rahul De', Neena Pandey and Abhipsa Pal.: Impact of digital surge during Covid-19 pandemic: A viewpoint on research and practice. In: International Journal of Information Management 2020, vol. 55, pp. 102171. (2020); https://doi.org/10.1016/j.ijinfomgt.2020.102171

[7] John Moore.: The benefits of mobile apps for patients and providers. In: British Journal of Health Care Management 2012, vol. 18, pp. 465-467. (2012); https://doi.org/10.12968/bjhc.2012.18.9.465

[8] Phillip Ola and Caley Shimskey.: mHealth taxonomy: a literature survey of mobile health applications. In: Health and Technology 2015, vol. 4, pp. 299-308. (2015); 10.1007/s12553-014-0093-8

[9] Dane Lesley Brown and Mixo Ndleve.: Virtual Gym Instructor. In: SATNAC 2019: The Changing Face of Telcos in a Digital World. Fairmont Zimbali Resort, Ballito, South Africa (2019).; https://www.researchgate.net/publication/335378603_Virtual_Gym_Instructor

[10] viso.ai DEEP LEARNING, https://viso.ai/deep-learning/openpose/, last accessed 14/11/22

[11] Veeramani Ganesan.: Machine Learning in Mobile Applications. In: IJCSMC, Vol. 11, pp. 110-118. United States of America (2022).

[12] ML Kit, https://developers.google.com/ml-kit, last accessed 14/11/22

[13] Flutter, https://flutter.dev/, last accessed 14/11/22

[14] pub.dev body_detection 0.0.3, https://pub.dev/packages/body_detection, last accessed 14/11/22

[15] World Health Organization Newsroom, https://www.who.int/europe/news-room/fact-sheets/item/a-healthy-lifestyle---who-recommendations, last accessed 14/11/22

[16] DownDog. (2015), Yoga | Down Dog, https://www.downdogapp.com/

[17] Fitnet (2015), Fitnet, https://fit.net/