USER MANUAL

GymVision

GymVision is a unique application that utilizes computer vision to provide you with live feedback and analysis while you perform a gym exercise in front of either an android camera or a webcam connected to a windows device. The application will provide feedback in a way that will help you improve your technique while also ensuring your safety to avoid injury during exercise.

Fawaz Alsafadi – 15380871

Ayman El Gendy – 15395461

Supervisor – Alistair Sutherland

May 14th, 2020

CONTENTS

1. INSTALLATION

1.1 ANDROID INSTALL

The application works for both android and windows desktop, too install the android application please follow these steps.

- Download the repo at https://gitlab.computing.dcu.ie/elgenda2/2020-ca400-template-repo and save it to your machine.
- Install android studio at the following link https://developer.android.com/studio.
- Navigate over to src/GymVisionAndroid in the repo files to open the project in android studio.
- Plug your android phone to your desktop using USB data cable and ensure that USB debugging is enabled on your phone.
- In the top toolbar in android studio you will see a green play button, press this to download the application to you android device.
- The app will then run on your phone when it has finished installing.

1.2 DESKTOP INSTALL

Alternatively, you can also use GymVision using windows desktop device and a webcam. Follow the below steps to install on windows.

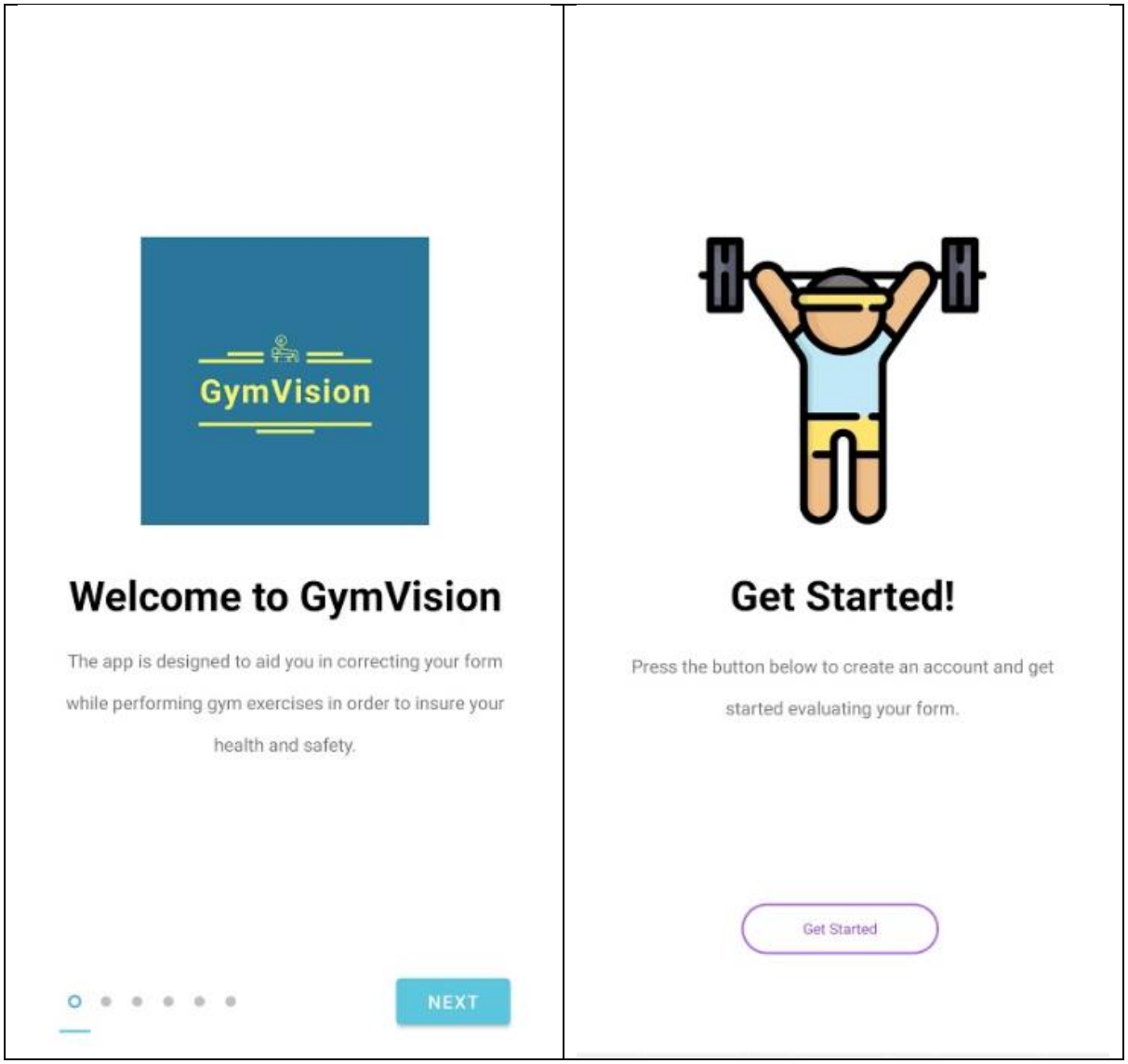
- Clone the project with "git clone https://gitlab.computing.dcu.ie/elgenda2/2020-ca400-template-repo"
- OpenPose Dependencies: Nvidia Cuda 10.0, cudNN and Visual Studio 2017 installed with Desktop Development with C++ option ticked (tick all the C++ modules in the options tab).
- Installing dependencies video tutorial
- Change directory to ../GymVisionDesktop/Ui and type the following commands
- Download the OpenPose library here and copy the elements of this folder into the GymVisionDesktop directory
- pip install -r requirments1.txt
- pip install -r requirments2.txt
- python homescreen.py

2. INTRODUCTION

2.1 INITIAL LAUNCH SCREEN

For every initial launch of the android application the user will be presented with a set of slides that describe the functionally of the application and show the user the various screens within the app explain the various functions in the application and how-to asses the users exercise technique. For subsequent launches of the application this screen will no longer be shown to the user. There will be a total of 5 slides that focus on different screens of the application, the user can slide the screen to the left and right to go forward or back or press the next button as shown below in figure 1. Once the user has reached the last slide they can click the getting started button as shown below in figure 1 to be taken to the login screen.

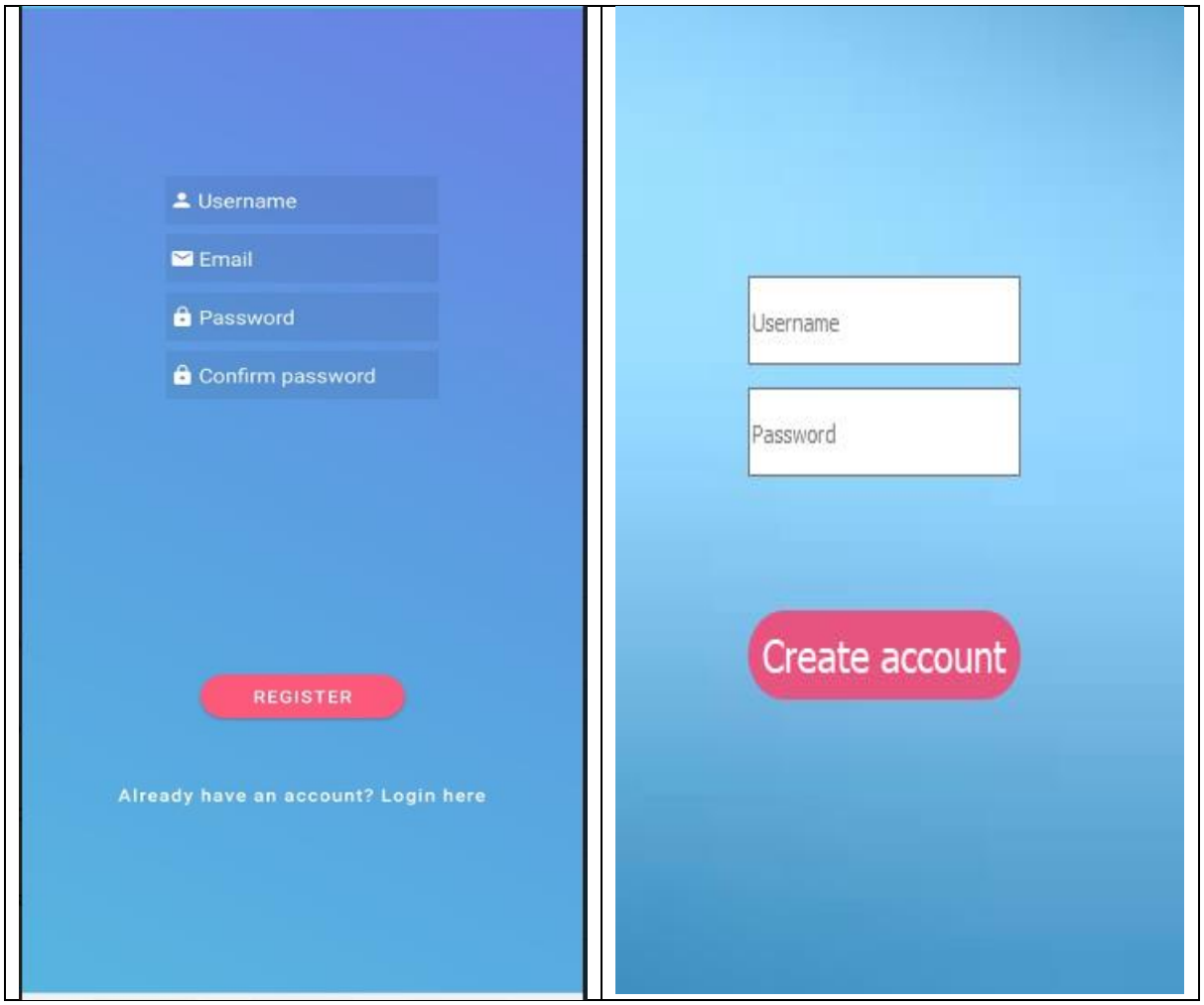
Figure 1



2.2 REGISTRATION

When the user first downloads the application either the desktop or the android version, they will need to register an account in our database before they can begin to use the app's features. The same credentials will work across both platforms for seamlessly transition from desktop to android. They can do this by clicking the register/create account buttons as, shown below in figure 2, located on the register account page. To register the user must provide a username, a valid email and a password that is 6 characters long. For the android version shown on the left in figure 1 the user can alternatively login instead if they already have an account using the button at the bottom of the screen.

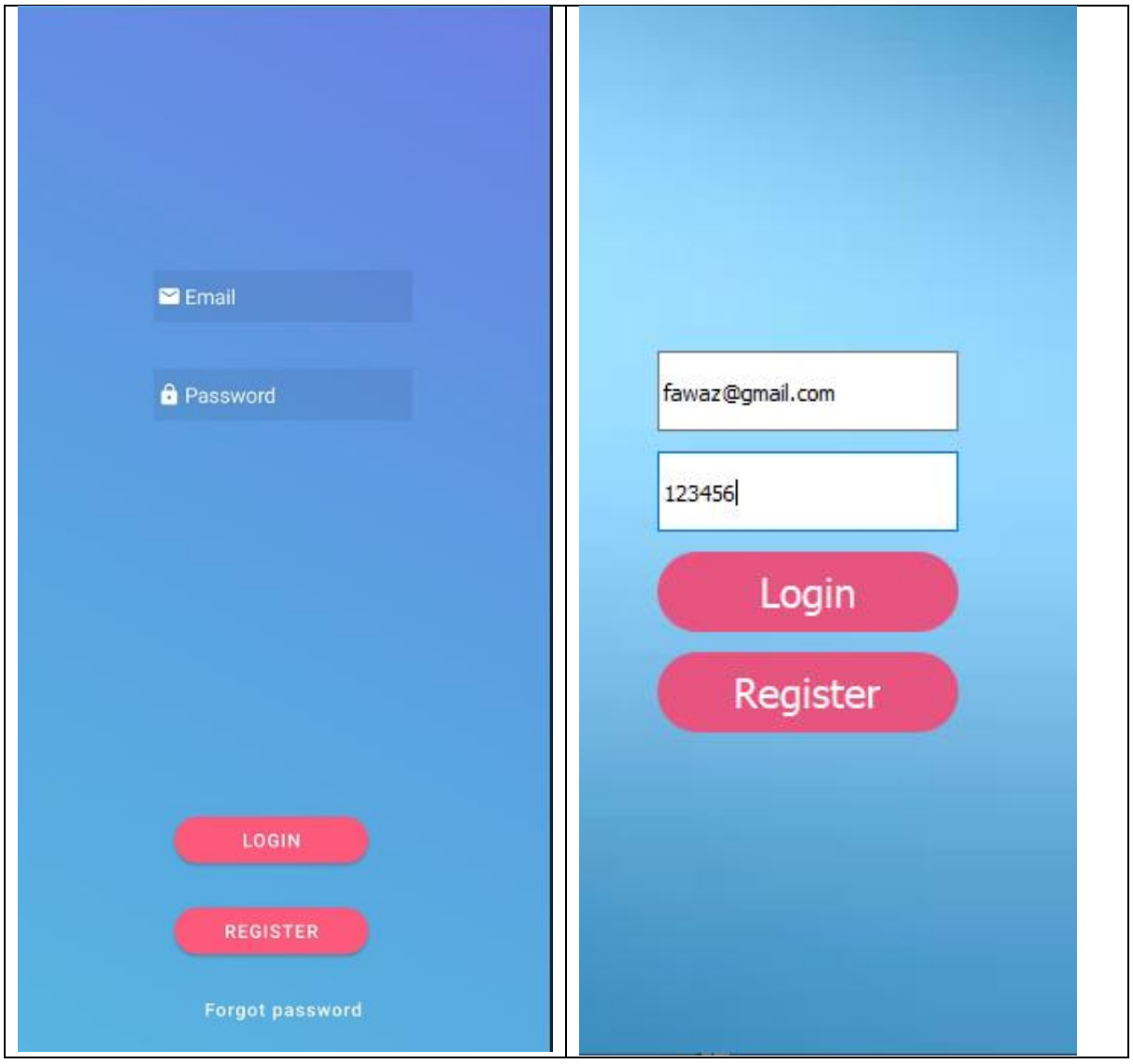
Figure 2



2.3 LOGIN

If the user has an account created in our system, they can simply enter their details in the text boxes available and click login as shown in figure 3 below. This will take them to the app's homepage. If the user enters the wrong details, they will be denied access and have to try login again.

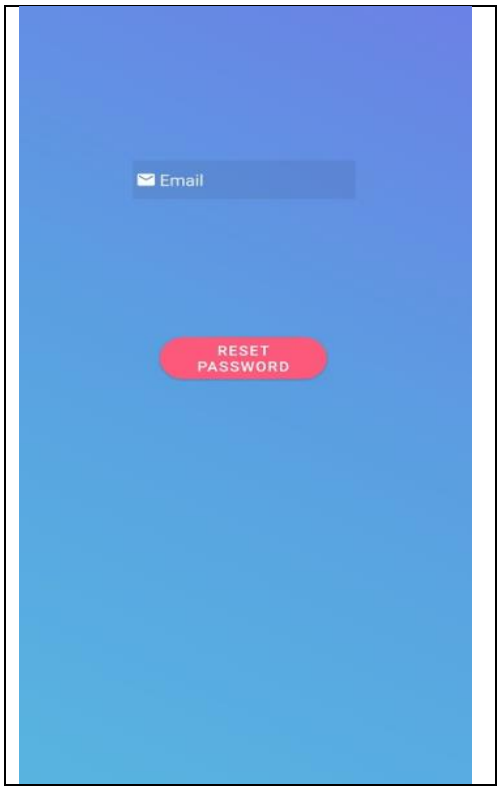
Figure 3



2.4 FORGOT PASSWORD

For the android version of the GymVision the user can navigate to the forgot password screen by clicking on the forgot password button at the login page. Here they can enter the email of their previously registered account and click reset password. This will send an email to the user with a link that they can use to change their password.

Figure 4



3. HOME PAGE AND NAVIGATION

3.1 HOME PAGE

When the user logs into the app, they will be brought to the home page, here if the user is new to the app they can click “How to perform a squat” to see a demonstration of an exercise, it is essential that the user understand how to use the application in order to ensure their safety while performing physical exercise later. If they are already familiar with the app they can click the burger icon in the top left to open the navigation drawer as show below in figure 5. The user can also log out of the application using the log out button in the top right corner of the screen.

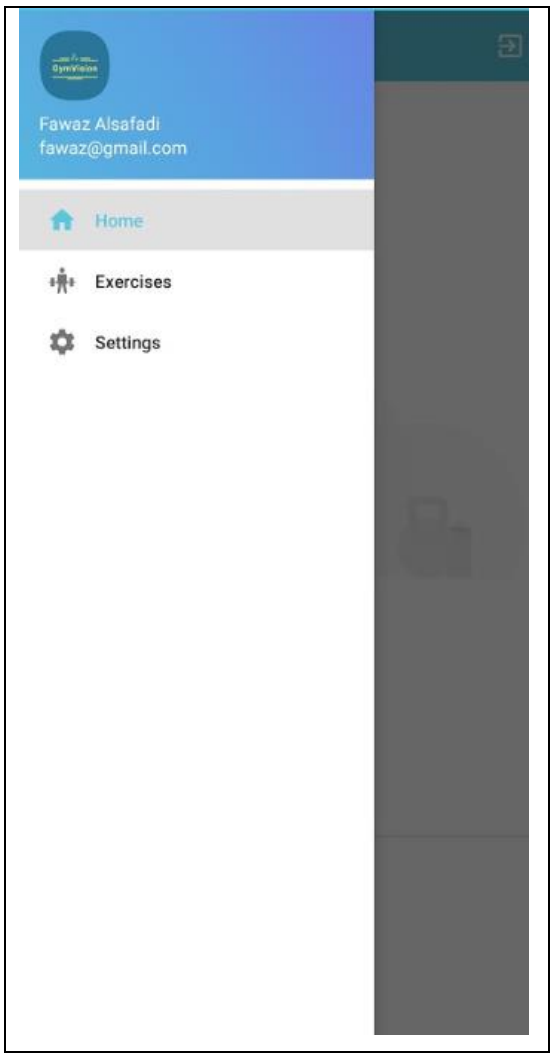
Figure 5

3.2 NAVIGATION

Using the navigation drawer as shown in the right screenshot in figure 6 the user can;

- Navigate to the settings page to manage their account.
- Navigate to the exercise screen which will contain a list of exercises they can do.
- Navigate back to the homepage.

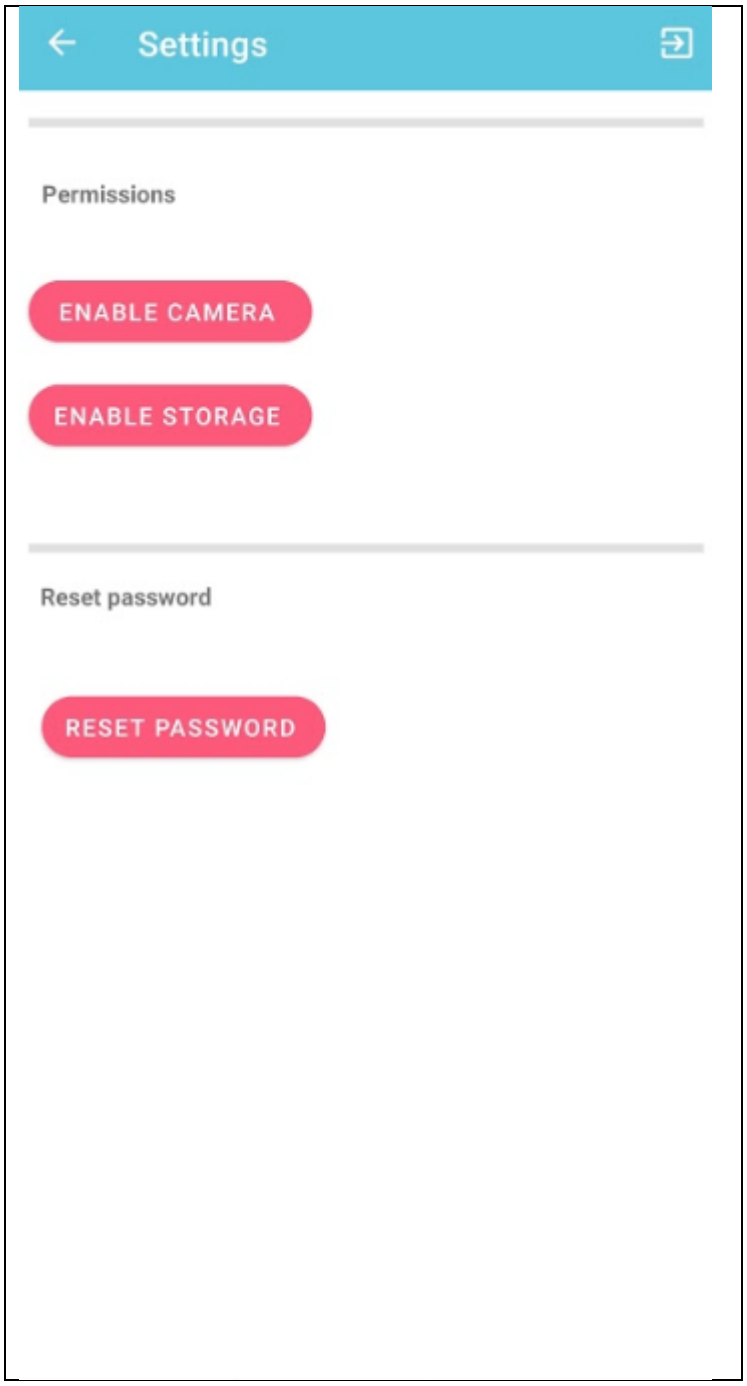
Figure 6



3.3 SETTINGS

The app will request permissions from the user when they first login, however if they decline at that time they can navigate to the settings page and enable them there. These permissions are required for the application to function.

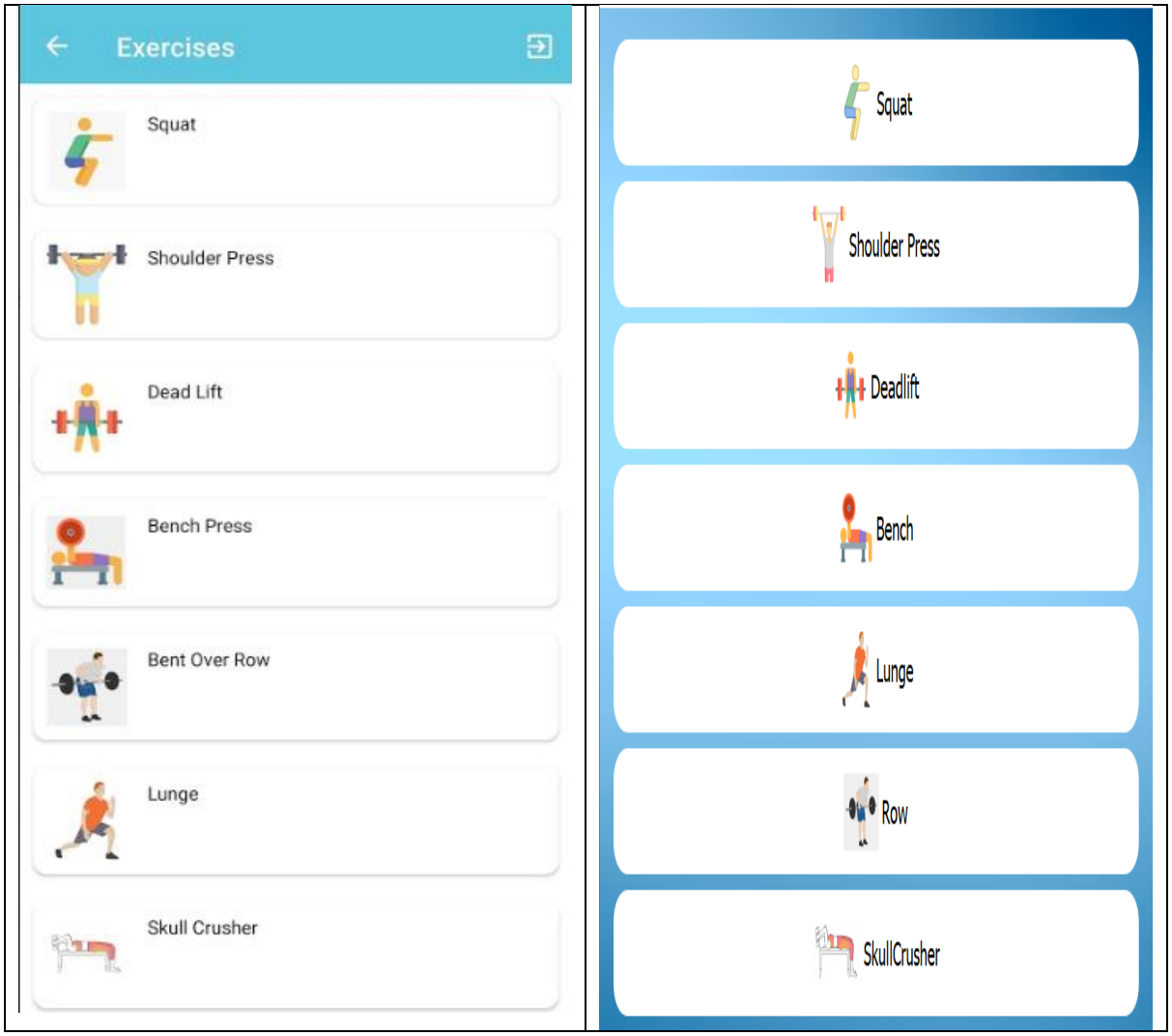
Figure 7



4. EXERCISES

When the user has navigated to the exercises screen they will see a list of seven exercises that they can choose from. The user should press the button of the exercise they want to analyse and stand in front of the camera in the starting position which is 2 meters away from the android camera of webcam attached to a windows desktop. For each exercise shown in figure 8 there are different checks to analyse all aspects of a technique, more information on these checks is provided below.

Figure 8



4.1 SQUAT

The squat exercise has 3 checks.

1. Checks that your hip has gone below your knees in the movement. This is to ensure you are squatting low enough.
2. This checks that your feet are aligned, this is important for correct balancing and helps evenly distribute the weight.
3. This checks that your knees don't go too far forward in the movement.

4.2 SHOULDER PRESS

The shoulder press exercise has 2 checks.

1. Checks that your forearm is in a vertical position.
2. Checks that your grip width is not too wide or too narrow. Helping to target the correct muscles for the movement.

4.3 DEADLIFT

Dead lift exercise has 2 checks

1. This checks that your grip is in the correct position.
2. Checks that your feet are in the correct stance for the movement.

4.4 BENCH PRESS

Bench press exercise has 2 checks

1. Checks that you are bringing the bar low enough to your chest to reach a full range of motion.
2. Checks that your elbows are down low and close to your sides, if they are too high up it can put serious strain on the shoulder.

4.5 LUNGE

Lunge exercise has 4 checks

1. Checks that your front knee does not go past your front toes.
2. Checks that your back knee is going low enough in the movement to fully engage the muscles.
3. Checks that your hip goes to at least front knee height in the movement
4. Checks that you are keeping your back aligned with your hip and not leaning too far forward

4.6 SKULL CRUSHER

Skull crusher exercise has 2 checks

1. Checks that your upper arms remain perpendicular to the floor throughout the whole movement.
2. Checks that you are bringing the weights close enough to your forehead to ensure proper activation of the triceps.

4.7 BENT-OVER ROW

Bent over row exercise has 2 checks

1. This checks that your grip is in the correct position.
2. Checks that your feet are in the correct stance for the movement.

5. LIVE CAMERA ACTIVITY

5.1 BEGINNING AN EXERCISE

To begin an exercise after an exercise selection was made, place the android device or desktop on a steady surface and stand back about 2 meters away. It is important to be in the starting position before the pose estimation and form analysis begins to achieve the most accurate results. Once ready click within the black circle at the bottom of the screen to begin the analysis as shown in figure 9.

5.1.1 TIMER

When the user clicks the exercise button, they will have to click the timer to begin the exercise countdown. The user must perform the exercise within this timeframe. Once the timer is over or the user manually stops the timer by clicking within the circle again, the exercise is finished and they are brought to the feedback page. In figure 9 on the left you can the timer waiting to be pressed, on the left you can see the timer ticking down and the blue arc indicating the remaining time.

Figure 9

5.2 RECEIVING LIVE FEEDBACK

An integral part of the application is that the user receives feedback on correct or incorrect technique while performing an exercise. Within the live camera activity when a user begins the exercise the application will provide the user feedback on their technique through text on the screen and audio feedback simultaneously. Dual modal delivery of feedback ensures that the application is accessible to all users.

5.2.1 AUDIO FEEDBACK

When a user passes or fails one of the checks described above whilst performing the exercise, there will be a short audio message that will play alerting you of the success/failure. In the case of a failure it will provide short guidance on how to correct specific aspects of your form based on the check that failed.

Example:

If your feet are not aligned in a squat, the following audio message will be played:

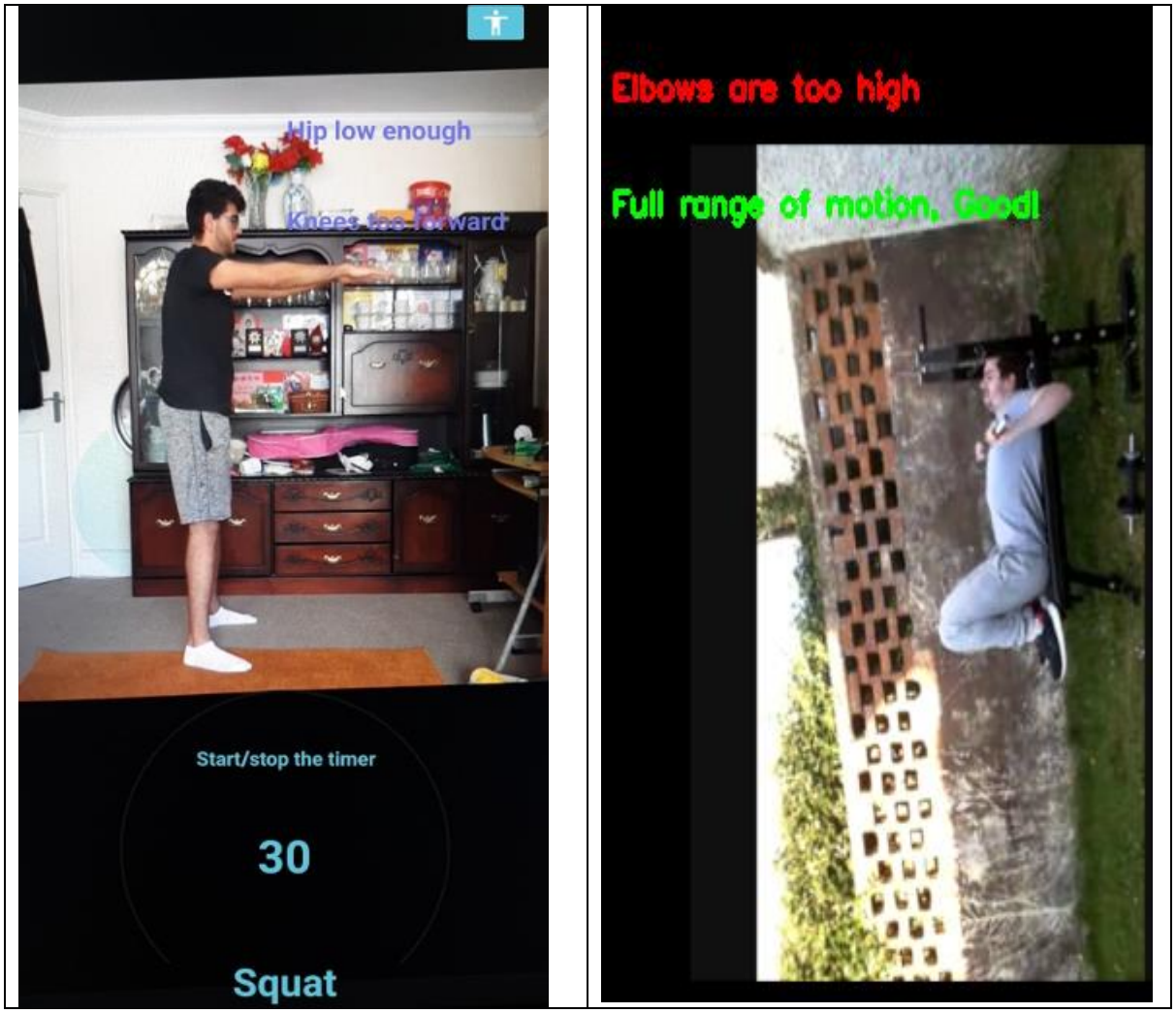
“Your feet need to be side by side”.

This type of feedback allows the user to receive feedback without the need to be able to see the screen, or assistance from a second person. There is audio feedback for every check and every exercise.

5.2.2 TEXT FEEDBACK

To make the application more accessible to all users, there will be textual feedback on the screen while you perform the exercise. This feedback will consist of short snippets of text telling you if you passed or failed specific checks. We soon realised that it may be difficult for people who are hearing impaired to use the app if it is on such a small screen in the distance. For this reason, we developed a lightweight desktop version with more focus on the visual feedback system. This allowed us to provide a platform for a wide range of people who want to exercise safely and use our application to do so.

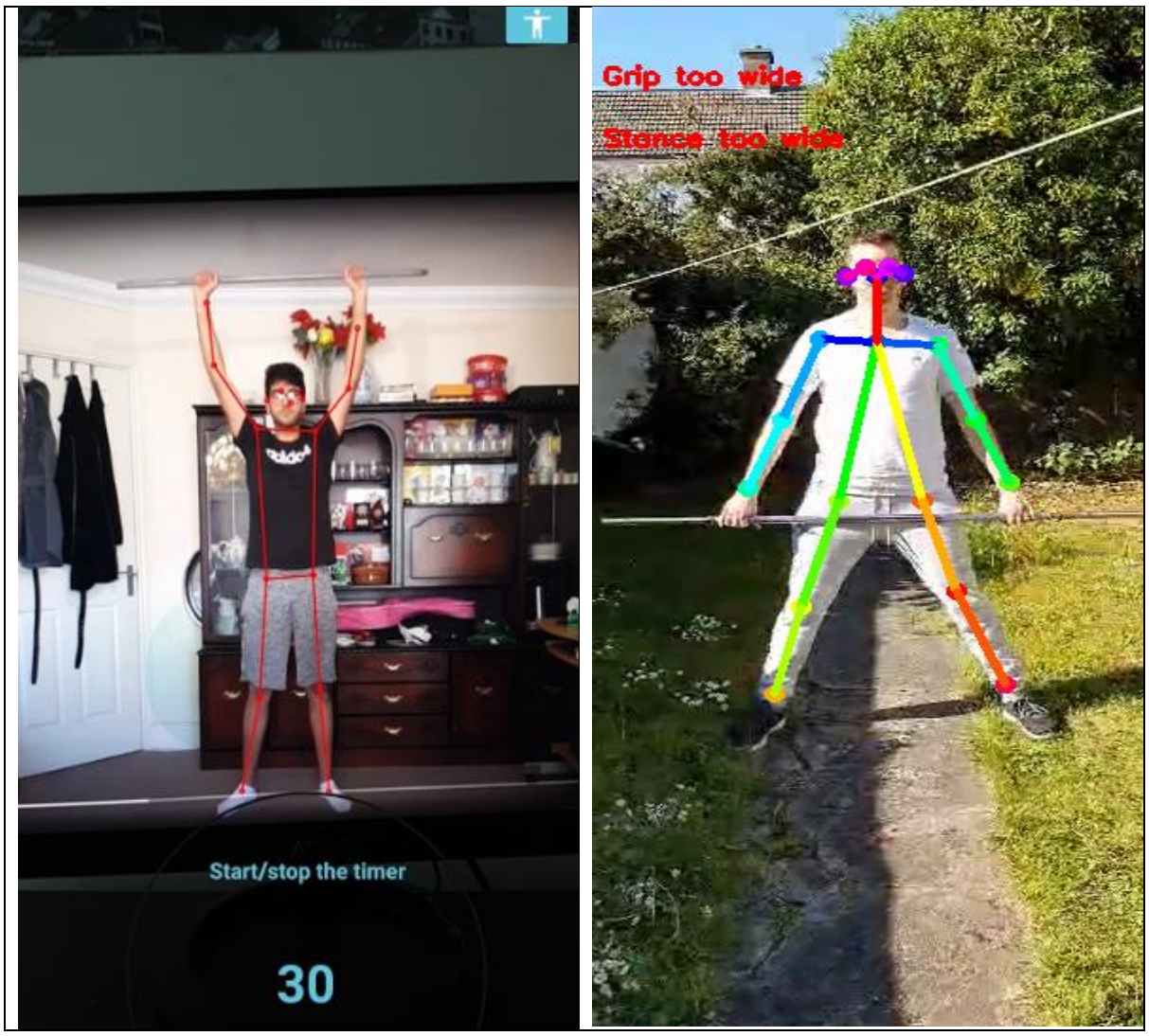
Figure 10



5.3 TOGGLE OVERLAY

While performing an exercise the user has the option of turning on the pose estimation and view in live time the tracking of their limbs and joints. This overlay can be switched on by clicking the button in the top right of the live camera screen as shows in figure 11 below. This function allows the user to test out the application and get a better idea of how far back to stand from the camera in order to ensure that the application is picking up the entire body and all the users limbs. While we recommend 2-meter distance some users may have different requirements based on their location and space available to them.

Figure 11



6. EXERCISE SUMMARY PAGE

REVIEWING YOUR TECHNIQUE AND INTERPRETING THE RESULTS

When the user has finished an exercise, they will be brought to a summary screen. This screen will allow the user to view their performance and see which checks they have failed. The summary screen will provide more in-depth detail on how to fix your form and improve your technique. The user can then take this new information and attempt the exercise again. If all checks passed as shows on the right in figure 12, they will receive a green tick and no recommendations to change will be given. The user can press either the red X or the Green Tick in order to return to the home page.

Figure 12