Chapter 1:

INTRODUCTION

1.1 Introduction of the project

Anthropometry (from Greek ἄνθρωπος Anthropos, 'human', and μέτρον metron, 'measure') refers to the measurement of the human individual.).Today, anthropometry lays an important role in fashion industry, tailoring sector, industrial design, clothing design and architecture where statistical data about the distributing of the body dimension in the population are used to o optimize products. Changes in lifestyles, nutrition, and ethnic composition of populations lead to changes in the distribution of body dimensions (e.g. the rise in obesity) and require regular updating of anthropometric data collections. Currently customers have to visit to the tailors/designers shops to take the measurement which is done by using measuring tape and they take down the measurements of the individual customers in record books or paper, which has the high threat in terms of securing the customer information The existing system is time consuming and costly. Due to the manual systems in use, the whole process tends to be slow.

Our project is the Mobile Tailoring Application which mainly aims on developing an application which will help the tailor/designer to take the measurements of the customer and save the details of customer and the measured data under his/her name in the database. The prime use of this application to user is he/she can measure themselves without using traditional techniques within less time period and also has his/her details securely saved in the application. The user details are accessible to only to the user and the admin. This application tries to eliminate the physical way of taking body measurements which is very time consuming and non-convenient way to do so. The user will have to login to the application and drag camera on the live object to take the accurate measurement for it.

1.2 Purpose of the Project

Tailors use traditional manual systems to book in their clients. The clients have to travel to location of the tailor shop to get their measurement taken. In the existing system these measurements are written on papers or books which has a high threat in terms of security of their information i.e., can get lost, unauthorized people can easily access the information,

Data confidentiality and integrity not maintained, also there are no proper backups and whole process becomes tedious.

1.3 Problem Definition

1.3.1 Existing System:

Tailors take body measurements manually using measuring tape. And records the measured data on papers or book. This method has higher threat in terms of securing the customers information. Status of the delivery can be found out by contacting the tailor or by going to the location.

Disadvantages:

Tailor has to physically take the measurements which is time consuming and tedious work to do. If record book is lost then all the data is lost and track of the customer is lost and no customer wishes to visit the again to give measurements. Tailor has to repeat the procedure for every customer again and again.

1.3.2 Proposed System

The Mobile Tailors App is intended to provide complete and easy solutions for fashion industries and tailors. It will enable the users to determine the body measurement of the person as accurate as possible from the set of images/videos. The project is aimed to automate the tailoring sector which is manually maintained. After the automation this will mean better services and good keeping of records, data integrity, data security, quick search and also paperless environment. Every user of the system will have to log into the system using username and password so that security and authentication will be ensured. It will permit to register and deliver measurements to the tailor/user for the next process to follow.

1.4 Scope of the project:

It is also cost effective since it will cut down on travelling cost to get your measurements taken. Every user of the system will have to log into the system using username and password so that security and authentication will be ensured. It will permit to register and deliver measurements to the tailor/user for the next process to follow. Automate the current manual tailoring system and maintain a searchable customer, product database, maintain data security and user rights. To enable customers to send their measurements to their tailors for their clothes to be made.

1.5 Report Organization

This report has been organized as follows:

Chapter 1 will provide you with brief introduction of our project. You will be presented with the problem statement and the solution provided to the problem by our system and also the shortcoming of existing system being implemented. You will then be briefed upon over proposed system benefits and the scope of the project.

Chapter 2 is a Literature Survey of our project. It contains the intended features of our system and some materials and the technology being used.

Chapter 3 is the Software Specification requirements. It will explain the purpose and features of the application, the interfaces of the application, what the application will do, the constraints under which it must operate and how the system will react to external stimuli.

Chapter 4 will describe the Design aspect of our project. A number of diagrams like components, flow chart, use case, activity and data flow have been illustrated to provide you with a better understanding of the project and also help the designers in coding and building the system.

Chapter 5 will describe the Implementation phase of the project. All the technical details of the developed system are mentioned here.

Chapter 6 will describe the Testing phase of the system. All the test cases of the system along with their results

Chapter 7 is the Conclusion. A description of the project progress and future plan is found here.

Chapter 2:

LITERATURE SURVEY

2.1 Traditional methodologies:

Tailors take body measurements manually using measuring tape. And records the measured data on papers or book. This method has higher threat in terms of securing the customers information. Status of the delivery can be found out by contacting the tailor or by going to the location.

Disadvantages:

Tailor has to physically take the measurements which is time consuming and tedious work to do. If record book is lost then all the data is lost and track of the customer is lost and no customer wishes to visit the again to give measurements. Tailor has to repeat the procedure for every customer again and again.

2.2 Modern methodologies:

Every tailor has they own record book and has to be maintained. But it's time to move on ahead and think about mobilizing the records. This app is very useful to keep all the recorded of customer in just in your pocket, so every time when customer comes you just press button and show recorded

Disadvantages:

There is a fear about the accuracy of the measurements and also app may not work on old devices.

2.3 Technologies Surveyed:

Tensor Flow:

Starting in 2011, Google Brain built DistBselief as a proprietary machine learning system based on deep learning neural network. Its use grew rapidly across diverse Alphabet companies in both research and commercial applications. Google assigned multiple computer scientists, including Jeff Dean, to simplify and refactor the code base of DistBelief into a faster, more robust application-grade library, which became Tensor Flow. In 2009, the team, led by Geoffrey Hinton, had implemented generalized backpropagation and other improvements which allowed generation of neural networks with substantially higher accuracy, for instance a 25% reduction in errors in speech recognition. Tensor flow is a free and open –source software library for dataflow and

differentiable programming across a range of tasks. It is a symbolic math library, and is also used for machine_learning applications such as neural_networks. It is used for both research and production at Google. Tensor Flow was developed by the Google_Brain team for internal Google use. It was released under the Apache License 2.0 on November 9, 2015.

Tensor Flow is Google Brain's second-generation system. Version 1.0.0 was released on February 11, 2017. While the reference implementation runs on single devices, Tensor Flow can run on multiple CPUs and GPUs (with optional CUDA and SYCL extensions for general purpose computing on graphics processing unit). Tensor Flow is available on 64-bit Linux, macOS, Windows, and mobile computing platforms including Android and iOS.

Its flexible architecture allows for the easy deployment of computation across a variety of platforms (CPUs, GPUs, TPUs), and from desktops to clusters of servers to mobile and edge devices. Tensor Flow computations are expressed as dataflow graphs. The name Tensor Flow derives from the operations that such neural networks perform on multidimensional data arrays, which are referred to as tensor. During the Google I/O conference in June 2016, Jeff Dean stated that 1,500 repositories on GitHub mentioned Tensor Flow, of which only 5 were from Google.

In March 2018, Google announced TensorFlow.js version 1.0 for machine learning in JavaScript and Tensor Flow Graphics for deep learning in computer graphics. In Jan 2019, Google announced Tensor Flow 2.0. It became officially available in Sep 2019.

Tensor processing unit (TPU)

In May 2016, Google announced its Tensor Processing Unit (TPUs) an application -specific integrated circuit (a hardware chip) built specifically for machine learning and tailored for Tensor Flow. TPU is a programmable Al accelerator designed to provide high throughput of low-precision arithmetic (e.g., 8-bit), and oriented toward using or running models rather than training them. Google announced they had been running TPUs inside their data centre's for more than a year, and had found them to deliver an order of magnitude better-optimized performance per watt for machine learning. In May 2017, Google announced the second-generation, as well as the availability of the TPUs in Google compute Engine The second-generation TPUs deliver up to 180 teraflops of performance, and when organized into clusters of 64 TPUs, provide up to 11.5 petaflops. In May 2018, Google announced the third-generation TPUs delivering up to 420 teraflops of performance and 128 GB HBM. Cloud TPU v3 Pods offer 100+ petaflops of

performance and 32 TB HBM. In February 2018, Google announced that they were making TPUs available in beta on the Google cloud platform.

Tensor Flow provides stable Python (for version 3.7 across all platforms) and C, APIs and without API backwards compatibility guarantee: C++, GO, java, JavaScript and swift (early release). Third-party packages are available for C#, Haskell, Julia, R, Scala, Rust, OCaml and swift "New language support should be built on top of the C API. However, not all functionality is available in C yet." Some more functionality is provided by the Python API.
Among the applications for which Tensor Flow is the foundation, are automated image capturing software, such as Deep Dream. Rank Brain now handles a substantial number of search queries, replacing and supplementing traditional static algorithm-based search results

Real-time Human Pose Estimation in the Browser with TensorFlow.js

So what is pose estimation anyway? Pose estimation refers to computer vision techniques that detect human figures in images and video, so that one could determine, for example, where someone's elbow shows up in an image. To be clear, this technology is not recognizing who is in an image — there is no personal identifiable information associated to pose detection. The algorithm is simply estimating where key body joints are.

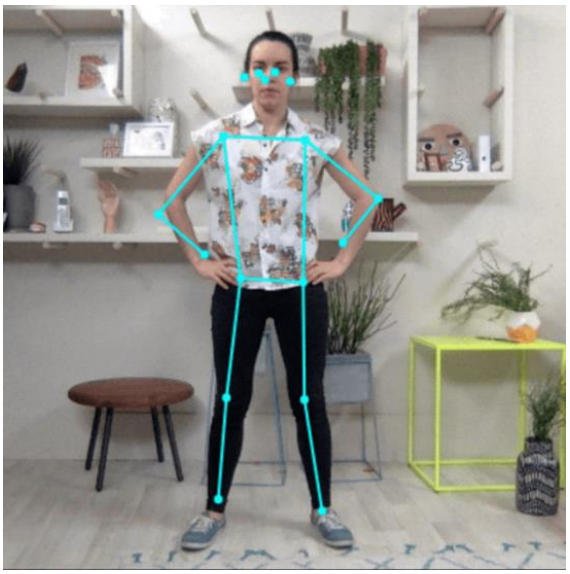

Fig 2.1 Pose estimation

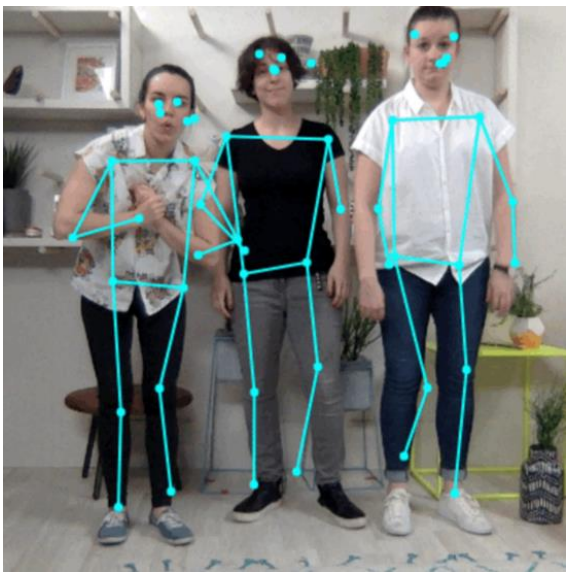

Fig 2.2 Posture estimation

Getting started with PoseNet

PoseNet can be used to estimate either a single pose or multiple poses, meaning there is a version of the algorithm that can detect only one person in an image/video and one version that can detect multiple persons in an image/video. Why are there two versions? The single person pose detector is faster and simpler but requires only one subject present in the image. We cover the single-pose one first because it's easier to follow. At a high level pose estimation happens in two phases:

An input RGB image is fed through a convolutional neural network.Either a single-pose or multi-pose decoding algorithm is used to decode poses, pose confidence scores, key point positions, or key point confidence scores from the model outputs. But wait what do all these keywords mean? Let's review the most important ones:

- Pose — at the highest level, PoseNet will return a pose object that contains a list of key points and an instance-level confidence score for each detected person.
- Key point Confidence Score — this determines the confidence that an estimated key point position is accurate. It ranges between 0.0 and 1.0. It can be used to hide key points that are not deemed strong enough.
- Key point Position — 2D x and y coordinates in the original input image where a key point has been detected.

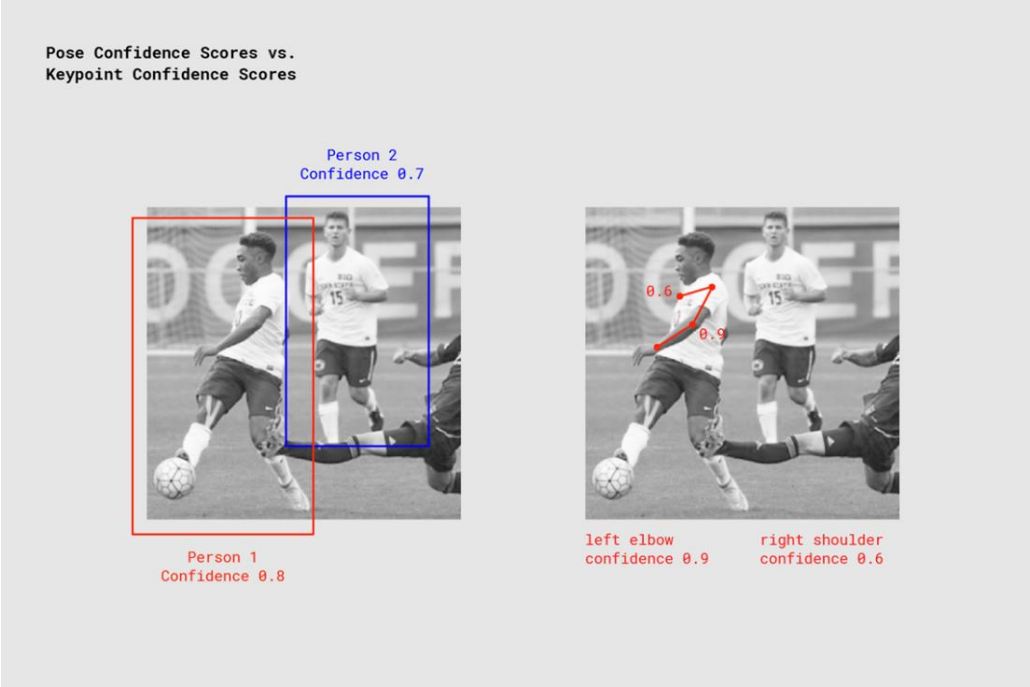

Fig 2.3 Body Detection

OpenCV:

Officially launched in 1999 the OpenCV project was initially an Intel research initiative to advance CPU-intensive applications, part of a series of projects including real-time ray tracking and 3D-Display walls. The main contributors to the project included a number of optimization experts in Intel Russia, as well as Intel's Performance Library Team. In the early days of OpenCV, the goals of the project were described as:

- Advance vision research by providing not only open but also optimized code for basic vision infrastructure. No more reinventing the wheel
- Disseminate vision knowledge by providing a common infrastructure that developers could build on, so that code would be more readily readable and transferable.
- Advance vision-based commercial applications by making portable, performance-optimized code available for free – with a license that did not require code to be open or free itself.

The first alpha version of OpenCV was released to the public at the IEEE Conference on Computer Vision and Pattern Recognition in 2000, and five betas were released between 2001 and 2005. The first 1.0 version was released in 2006. A version 1.1 "pre-release" was released in October 2008.
The second major release of the OpenCV was in October 2009. OpenCV 2 includes major changes to the C++ interface, aiming at easier, more type-safe patterns, new functions, and better implementations for existing ones in terms of performance (especially on multi-core systems). Official releases now occur every six months and development is now done by an independent Russian team supported by commercial corporations. In August 2012, support for OpenCV was taken over by a non-profit foundation OpenCV.org, which maintains a developer and user site. On May 2016, Intel signed an agreement to acquire Itseez, a leading developer of OpenCV.

OpenCV (Open source computer vision) is a library of programming functions mainly aimed at real-time computer vision. Originally developed by Intel, it was later supported by Willow Garage then Itseez (which was later acquired by Intel). The library is cross-platform and free for use under the open-source BSD license. OpenCV supports the deep learning frameworks Tensor Flow, Torch/PyTorch and Caffe programming language.

OpenCV is written in C++ and its primary interface is in C++, but it still retains a less comprehensive though extensive older C interface. There are bindings in python, java

and MATLAB /Octave. The API for these interfaces can be found in the online documentation. Wrappers in other languages such as C# Perl, and Ruby have been developed to encourage adoption by a wider audience. Since version 3.4, OpenCV.js is a JavaScript binding for selected subset of OpenCV functions for the web platform. All of the new developments and algorithms in OpenCV are now developed in the C++ interface

Applications:

- OpenCV's application areas include:
- 2D and 3D feature toolkits
- Ego motion estimation
- Facial recognition system
- Gesture recognition
- Human computer interaction (HCI)

Using OpenCV for body measurements:

Human body measurement using OpenCV on which an automatically measures human body using images these body part to be measured such as shoulder width , sleeve length, body length, waist length , which used in fitting custom clothing and after all it display measurement result which is required for custom clothing.

OpenCV is an open source C++ library mainly aimed at real time computer vision. In simple language it is library used for developing advanced image processing and computer vision applications. If person in standing position and facing towards camera. Then, we can divide the human body into head height. As per anatomical proportions, Human body is divided 8 * head height. Also, other body parts can be divided into the head unit. These ratio will be helpful to cut ROI of particular body part. After, you can find the joints positions by doing some processing on ROI. The sensor box will sit on the hand and will be defined as a constant size. This means that we can use the sensor as our scaling index for measuring how far and how long different points on the hand are.

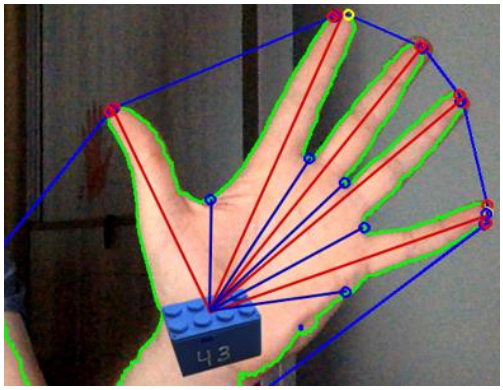

Fig 2.4 Object as reference

Fig 2.5 Coin as reference

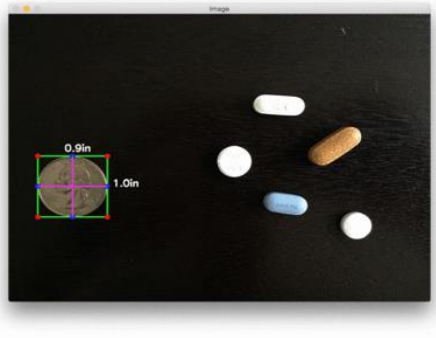

Fig 2.6 Measurements using coin.

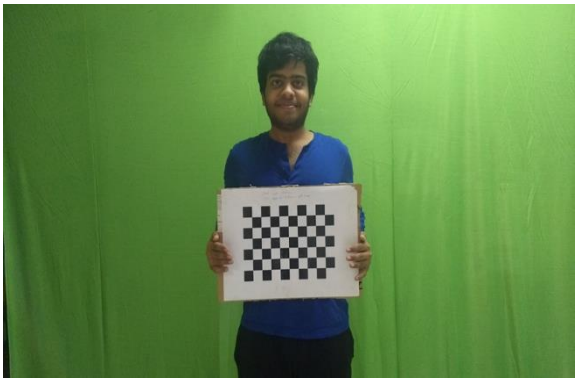

Fig: 2.7 Using checker board as references

Fig: 2.8 Wrist-to-shoulder measurement

Fig: 2.9 Side view for waist measurement

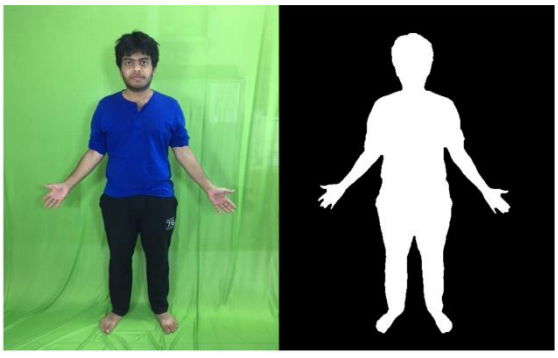

Fig: 2.10 Front view for chest measurement

AR Core:

AR Core is a software development kit developed by Google that allows for augmented reality applications to be built. AR Core uses three key technologies to integrate virtual content with the real world as seen through your phone's camera:

- Motion tracking allows the phone to understand and track its position relative to the world.
- Environmental understanding allows the phone to detect the size and location of flat horizontal surfaces like the ground or a coffee table.
- Light estimation allows the phone to estimate the environment's current lighting conditions.

Functions and Features

In addition to lighting estimation, motion tracking, and plane detection, any good augmented-reality SDK should have a few additional features integrated. As you might expect, neither AR Kit nor AR Core disappoint in this regard. Both platforms meet the following important AR development criteria:

- They incorporate 2D and 3D object tracking, which means that real-world objects can be used as markers to trigger augmented reality experiences.
- They both make clever use of anchors, which prevent AR content from being lost if the device user wanders away from the area mapped by the app.
- They can integrate with third-party tools, including the immensely popular Unity game platform.
- They will support smart glasses once the hardware comes into the market.
- They both support: world and facial tracking; geolocation and SLAM mapping technology; cloud and on-device marker storage.

Fig 2.11 Length measure using AR Core

Fig 2.12 Height measure using AR Core

How does AR Core work?

Fundamentally, AR Core is doing two things: tracking the position of the mobile device as it moves, and building its own understanding of the real world. AR Core's motion tracking technology uses the phone's camera to identify interesting points, called features, and tracks how those points move over time. With a combination of the movement of these points and readings from the phone's inertial sensors, AR Core determines both the position and orientation of the phone as it moves through space.

In addition to identifying key points, AR Core can detect flat surfaces, like a table or the floor, and can also estimate the average lighting in the area around it. These capabilities combine to enable AR Core to build its own understanding of the world around it. AR Core’s understanding of the real world lets you place objects, annotations, or other information in a way that integrates seamlessly with the real world. You can place a napping kitten on the corner of your coffee table, or annotate a painting with biographical information about the artist. Motion tracking means that you can move around and view these objects from any angle, and even if you turn around and leave the room, when you come back, the kitten or annotation will be right where you left it.

Technology	ARCORE	TENSORFLOW	OPENCV
Developed By	Google	Google Brain Team	Intel Corp
Written in	Java	Python ,C++ , CUDA	C/C++
Languages used	C#	Python	Python, C++,Java
Used for	Augmented Reality Related Applications	Machine Learning Libraries	Deep Learning
Operating System	Android / iOS	Linux, Marcos ,Windows	Cross-Platform

Table 2.1 Comparison of technologies

Technology chosen: AR Core

Upon going through the different technologies available, AR Core was chosen to be the technology used as it provides the developer an engine called UNITY Engine which provides the user an interface to work on .It provides a concept of AR Measure which in turn provide SDK's to facilitate the same. Whereas Tensor flow and OpenCV uses machine learning and Deep Learning respectively which requires a lot of time to develop and usually requires huge amount of datasets which ranges in gigabytes.

Besides learning machine learning and deep learning is a very long process and cannot be done in a limited amount of time as it contains lot of files and software's to be developed and requires a high end system most of the times. Tensor flow requires NVIDIA GPU to compute any process. AR Core can be executed using Visual Studio and debugged using inbuilt unity debugger.

Chapter 3

SOFTWARE REQUIREMENT SPECIFICATION

3.1 Introduction

The Mobile Tailoring App is intended to provide complete and easy solutions for fashion industries and tailors. It will enable the users to determine the body measurement of the person as accurate as possible from the set of images. This document is meant to discuss the features of the project, so as to serve so a guide to the developers on one and a software validation document for the prospective client on the other .the main users of the project are clients and systems administrators.

3.1.1 Intended Audience and Reading Suggestions

The intended readers of this document are the developers of the site, testers, website owner's managers and coordinators. The intended audience of this document are Tailors, Fashion designers and anyone who needs their body measurements to know their sizes for online shopping.

3.1.2 Product Scope

The project is aimed to automate the tailoring sector which is manually maintained. After the automation this will mean better services and good keeping of records, data integrity, data security, quick search and also paperless environment. Every user of the system will have to log into the system using username and password so that security and authentication will be ensured. It will permit to register and deliver measurements to the tailor/user for the next process to follow.

3.1.3 References

- https://krazytech.com/projects/sample-software-requirements-specificationsrs-report-airline-database
- https://www.academia.edu/12426471/ONLINE_TAILORING_MANAGEMENT_SYSTEM
- https://www.eziline.com/product/tailoring-management-system/
- https://www.google.com/search?q=arcore&oq=arcore&aqs=chrome..69i57.4275j0j7&sourceid=chrome&ie=UTF-8#

3.2 Overall Description

3.2.1 Product Perspective

A mobile tailoring application stores the following information.

Customer description:

- It includes customer name, address and phone number. And also his/her measurements. This is an easy way of keeping records of each customer and their orders.
- The database table will contain the details of each logged in customer along with the proper measurements of each body part.

3.2.2 Operating Environment

Operating system:

- iOS/ MacOS .

3.2.3 Design and Implementation Constraints

- The camera quality should be clear.
- Minimum of 2 GB of ram is required.
- Minimum iOS version required will be iOS 8.
- Minimum 1 GB RAM will be required for iPhones.

3.2.4 User Documentation

Steps:

- Upon installing the app the user is required to provide the authentication details.
- After registering user is required to login in order for future purposes.
- After selecting the part to be measured, camera opens with pointer.
- User has to drag camera on the mentioned body part from one point to another to get the accurate measurement.

3.3 External Interface Requirements

3.3.1 User Interfaces

Login Page

- This page will allow user to login into his/her account.
- If the user is having an account already, they will be ask to enter the email and password in order to login.
- If the user is not having an account, he/she will be directed to the register page by clicking create now option.

Register page

- The user will be directed to registration page.
- The user will have to fill his/her personal details and click the register button.
- The users account will be created.

Home page

- After the user logs in into their account, home page will have the options to view the profile, take new measurements.

Menu page

- The menu page will provide users different option such as profile, get measurements, how to use application, log out.
- Using which the can access their profile page, take measurements and log out

Get measurements

- Step 1: Adjust in the camera pointer
  The user will have to adjust the pointer and tap on the start and end point of the object.
- Step 2: Drag on object
  It has to be dragged on the human object/mentioned body part from one starting point till the end point to get the desired measurement of that part.

Fig 3.1 Login Page

Fig 3.2 Register Page

Fig 3.3 User Profile

Fig 3.4 Home Page

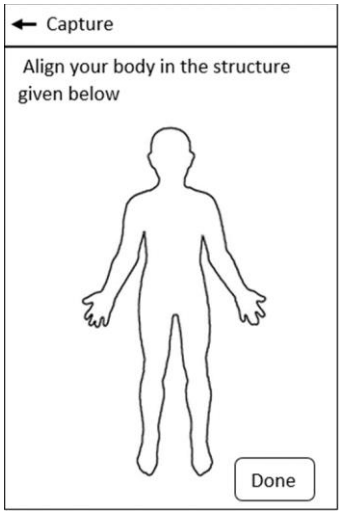

Fig 3.5 Measurement

3.3.2 Hardware Interfaces

- Requires iOS embedded phone with a proper working camera.
- Smart phone is mandatory.
- Minimum of 2GB Ram should be available in the phone.

3.3.3 Software Interfaces

- Database: Firebase Real-time database
- OS: iOS version 9 and above

- Tools: Xcode- iOS
  Xcode storyboard -UI
- Language: AR core and AR kit
  Swift

3.3.4 Communication Interface:

Since the app will be a mobile application internet can directly be used using the mobile data. But for business associations mobile internets won't be feasible therefore high speed modem can be used. This can be the communication interface used for the app.

3.4 System Features

3.4.1 Registration Module

Description and priority

It will help users and admin to create account in this system and organize and manage all the data from a single point. It secures users profile details and the measurement data with the help of user name and password he/she used to register.

The priority for this feature is highest that is 9.

Stimulus/Response sequences

Stimulus: The end user has to open the system.

Response: This system will display registration module.

Stimulus: End user have to enter his/her data and click the register button.

Response: System will send an alert message if registration was successful or not.

Functional requirements

Req-1: The system shall allow user to enter and save his/her data.

Req-2: The admin shall be able to view and retrieve the customer information but does not have access to alter their details .admin can delete the outdated data from the database.

Req-3: The user shall be able to view their profiles and updated the measurements by retaking it whenever they want

Req-4: The system shall allow user to update his/her data.

3. 4.2 Measurement module

Description and priority

Once the user is logged into the application, he/she can take the measurements by specifying the part they want to measure. Then drag on live human object to get accurate measurements.

Stimulus/Response sequences

Stimulus: User will click on camera icon.

Response: System will open a camera, will specify different fields to wish to measure.

Stimulus: User will select the field/body part to measure and drag the camera o live object to get accurate measurements

Response: System will response to it by providing he expected measurements.

Functional requirements

Req-1: The user shall drag on the live object correctly so as to get better results.

Req-2: The user measurement data shall be saved in the database under his/her name.

Req-3: The admin shall delete the outdated measurement details of the customer after getting notification.

3.5 Other Nonfunctional Requirements:

3.5.1 Performance Requirements:

- The phone will perform at its best on devices which 3 GB of Ram and Snapdragon processor 535
- Mediatek 510 or Exynos 675.
- For iOS devices any device which have iOS version above 9 i.e. iOS 9 will be able to run the app at its best.
- Compatible devices: Any higher version of iPhone after iPhone 5s.

3.5.2 Safety Requirements

- The app will be used to get the measurements of the person for which a video will be taken in various positions/angles. In order to ensure safety or privacy of the person, the video will be deleted soon after the measurements are found.

3.5.3 Security Requirements

- The Terms and Conditions will be displayed upon installing the app to which the user has to agree in order to enter the further credentials. This user data will be secure and won't be accessible to other users of the app.
- Personal information of a person which will be taken during registration will not be leaked to the third party.
- The Video or Photo taken through the app will be deleted after the measurements of the person is calculated.

3.5.4 Software Quality Attributes

- **Interoperability:**
  The app has to be interoperable i.e. it should work efficiently on both operating systems iOS and Android.

- **Maintainability:**
  Time to time updates will be provided to the user to fix the bugs.

- **Reliability:**
  The app should be reliable and it should not crash while the user is using the app. In case the internet connection is lost while doing the registration or Login the user's data will be stored till the last point.

- **Portability:**
  The app contains software that is written such that the source codes can be compiled for different platforms.

- **Testability:**
  App will be tested on lower versions of Android as well as on higher versions of android in order to see how app will perform on different specifications

Chapter 4

DESIGN PHASE

4.1 System architecture

A system architecture is the conceptual model that defines the structure, behavior and more views of a system. An architecture description is a formal description and representation of a system, organized in a way that supports reasoning about the structures and behavior of the system.

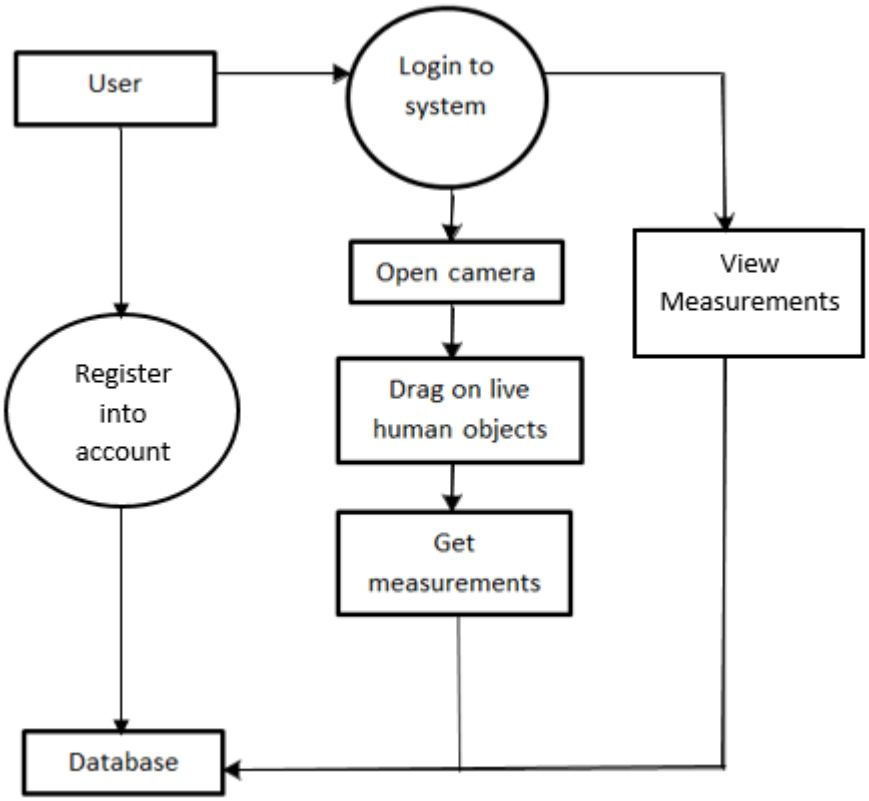

Fig 4.1 User Architecture

The above diagram explains the functionality of our project. The proposed system has two views, one for User and the other one for Admin. In user architecture, the user has to register into the account by entering the essential details required. Once the user gets logged in into the account, user has to open camera and drag on live human objects to get measurements which will get stored in the database. Or if the user doesn't wish to take measurements after getting

logged in, he/she can directly view his/her account which will again get updated accordingly.

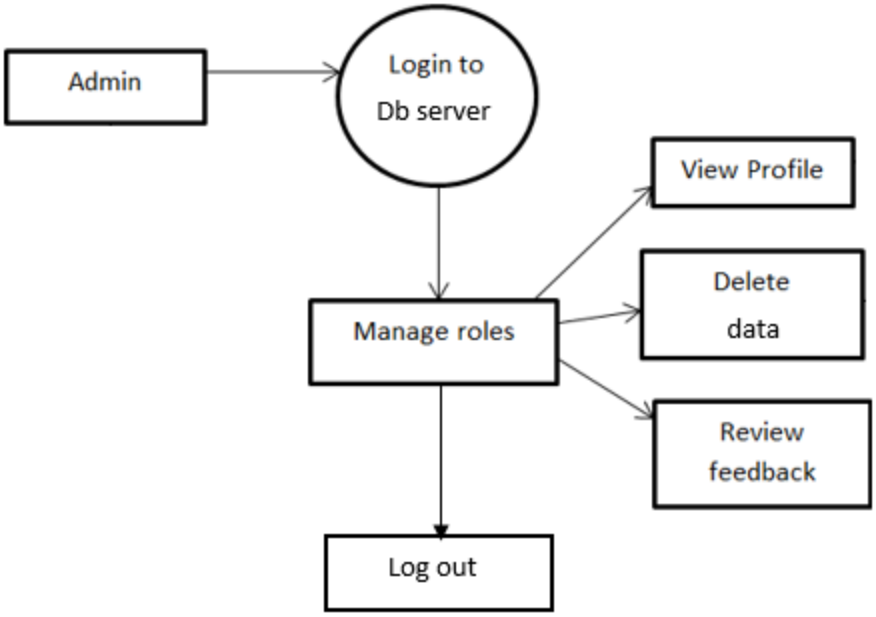

Fig 4.2 Admin Architecture

In admin architecture, the admin has to login to the database server where the admin will be able to perform the following roles: -

- Can view the all user profiles
- Delete measurements captured by the user
- Review feedbacks provided by the user and even delete them if necessary. All the performance gets updated in the database.

4.2 System Design

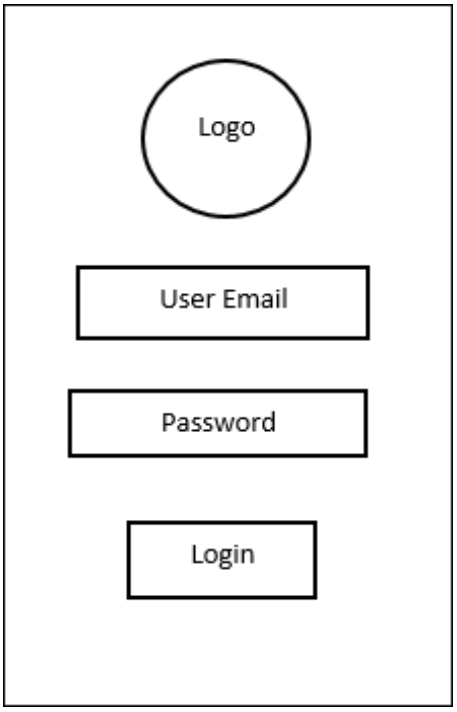

Fig 4.3 Login page

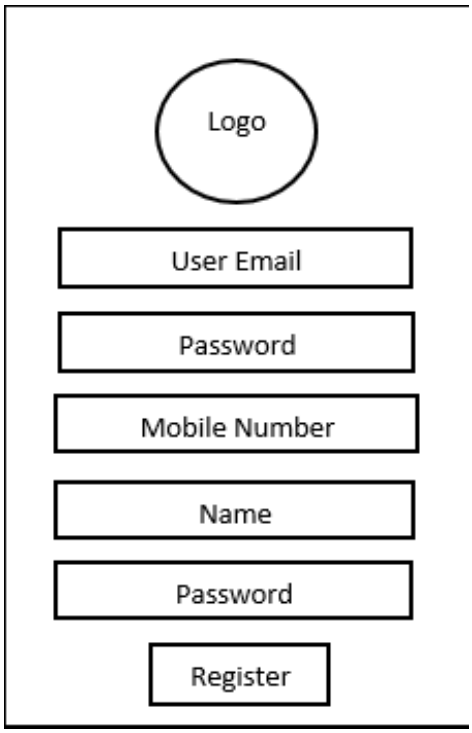

Fig 4.4 Registration Page

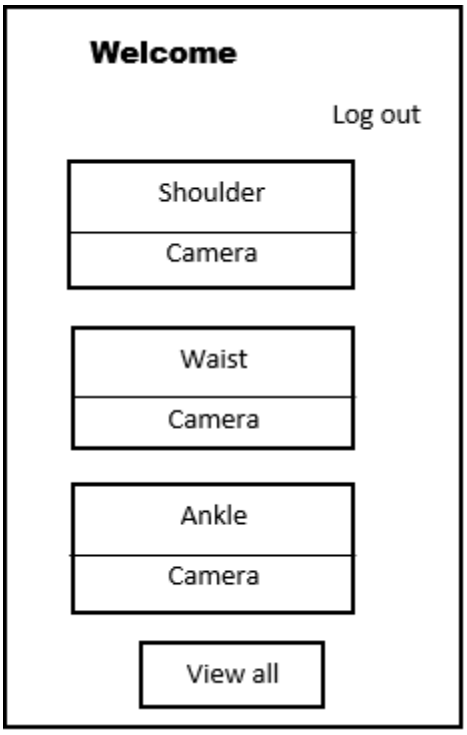

Fig 4.5 Home Page

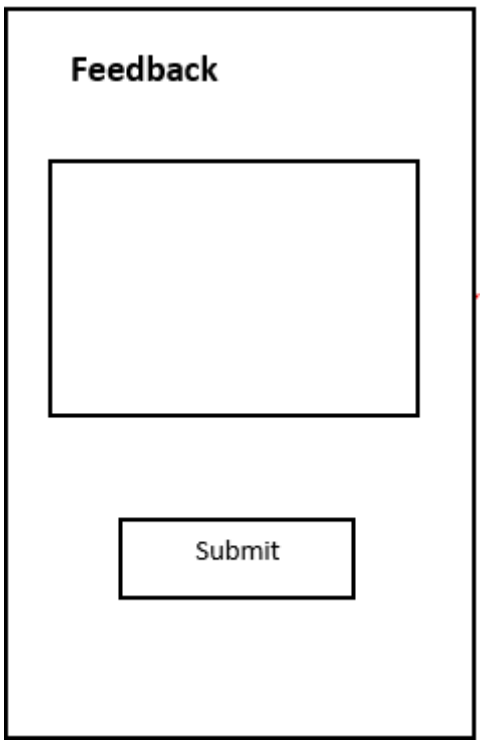

Fig 4.6 Feedback Page

4.3 Design Details

Use Case Diagram

Use case diagram is a behavioral UML diagram type and frequently used to analyze various systems. They enable you to visualize the different types of roles in a system and how those roles interact with the system. Use case diagrams are used to gather the requirements of a system including internal and external influences. These requirements are mostly design requirements. So when a system is analyzed to gather its functionalities use cases are prepared and actors are identified.

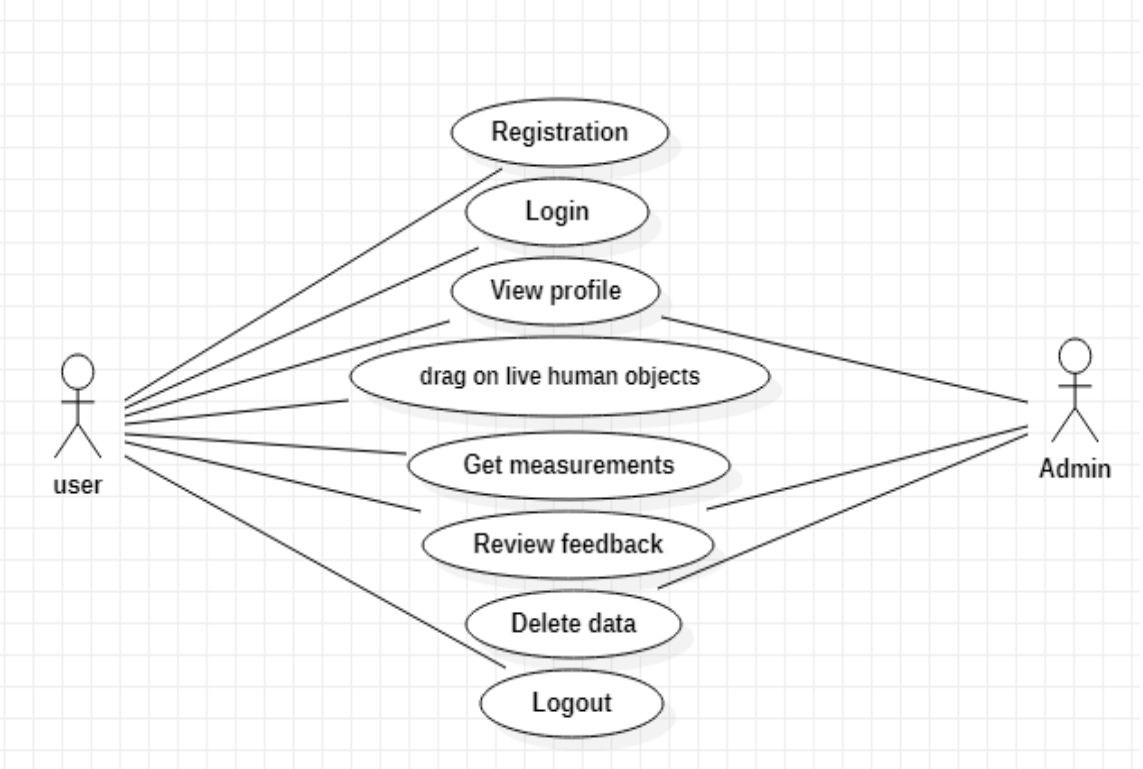

Fig 4.7 Use Case Diagram

In Fig 4.7 User has to register and log in into his/her account by entering required details that is username and password. Only valid users can use the application. User opens up camera to take measurements, he the drag on live human objects for appropriate body measurements. Measurements for appropriate human body parts are taken according to the fields provided in the application. Calculated measurements will be stored in the database. These measurements will be updated in the user's profile. User can view only his/her particular measurements. After getting the measurements, user can log out from his/her account.

Admin logs in into the database server so as to manage/ view all user's profiles to edit anyone's profile. Admin can delete data stored in the database. Admin also handles feedback given by the users regarding the performance or complains about the application and can even delete the feedback.

Sequence Diagram

A Sequence diagram is an interaction diagram that shows how process operate with one another and in what order. It is a construct of a Message Sequence Chart. A sequence diagram shows object interaction arranged in time sequence. It depicts the objects and classes involved in the scenario and the sequence of messages exchanged between the objects needed to carry out the functionality of the scenario. Sequence diagrams are typically associated with use case realizations in the Logical View of the system under development. Sequence diagrams are sometimes called event diagram or event scenarios.

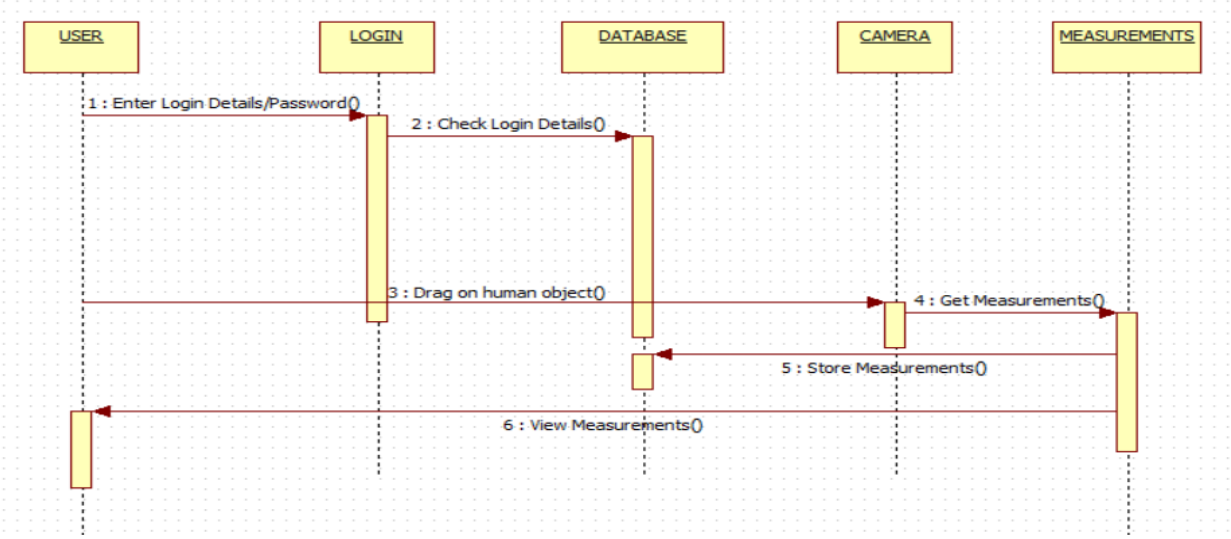

Fig 4.8 User Sequence Diagram

- To login into the account, user has to enter username and password and gets into his /her profile.
- To get measurements, user opens up camera and drag on live human objects. The calculated measurements are then stored in the database. User can view only his appropriate measurements.

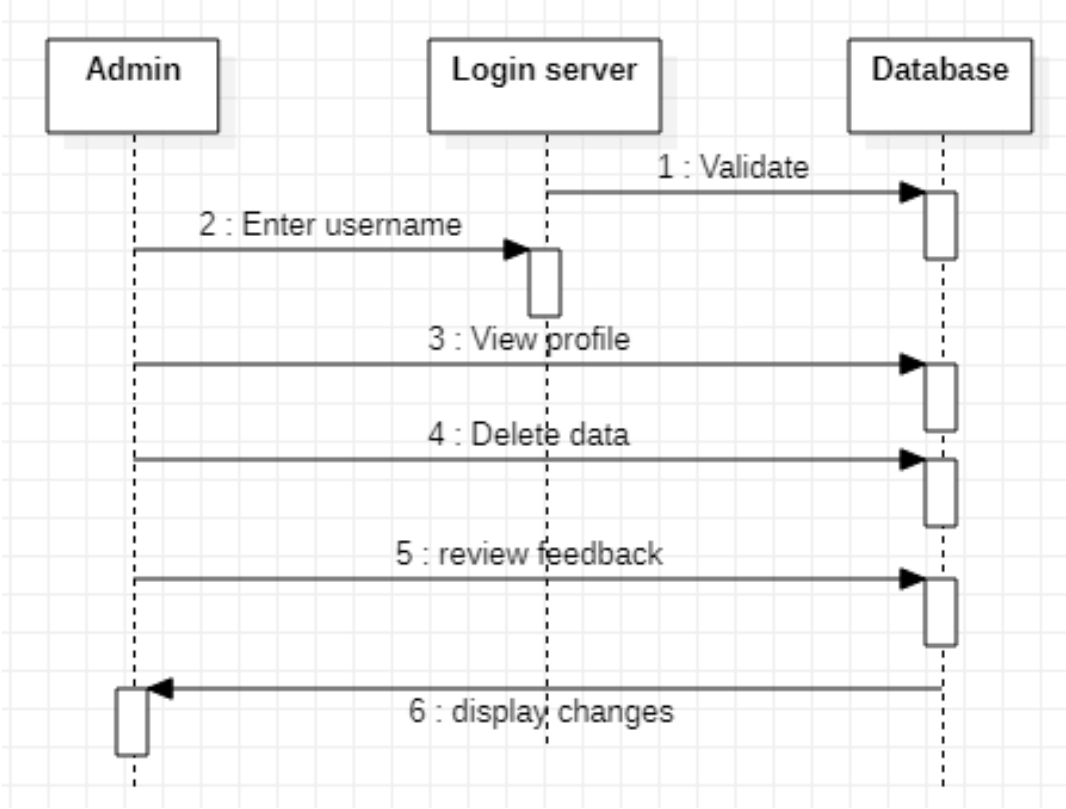

Fig 4.9 Admin Sequence Diagram

Admin: -

Admin logins into database server, he/she can then validate the details stored in the database.

The role of the admin is to: -

- View profiles- Admin will be able to see the profiles of all the user that have logged in in this application.
- Delete data: - Once the measurements are taken by the user, which will be stored in the database. If the stored data is of no use, then he/she can delete the measurements of the user. This will be done by the admin.
- Review and delete feedback: - Feedback and complains from the users will be handled by the admin. Admin can even delete the feedback given by the user about the application.
- Admin can edit the measurements details of any particular user.

Activity Diagram

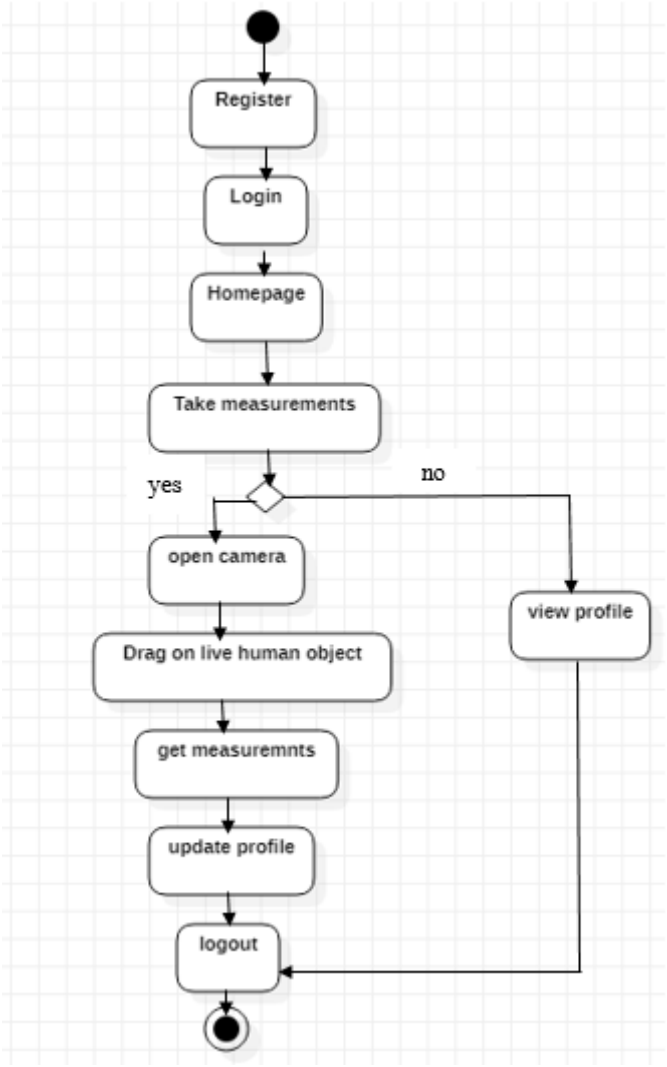

Fig 4.10 User Activity Diagram

Activity diagram for user

- After installing the application, the user has to register to make an account and then log in into the account by putting required details i.e. username and password. User then enter into the homepage. He will have an option whether to take measurements or no. If he opts for taking measurements, then he will have to open camera and drag on appropriate human body parts for appropriate body measurements or he will get to view the measurements stored. If the measurements are to be taken for the first time then he won't be able to view it, he then has to go to camera and take measurements.
- The measurements will be stored in the database and the profile will be updated with the

calculated measurements. The user can view his/her measurements from his/her profile. If user don't want to take measurements, then he can edit his profile accordingly and take measurements next time he/she logins in into the account. After getting the measurements, the user logs out the application. Only valid users will be able to use the application.

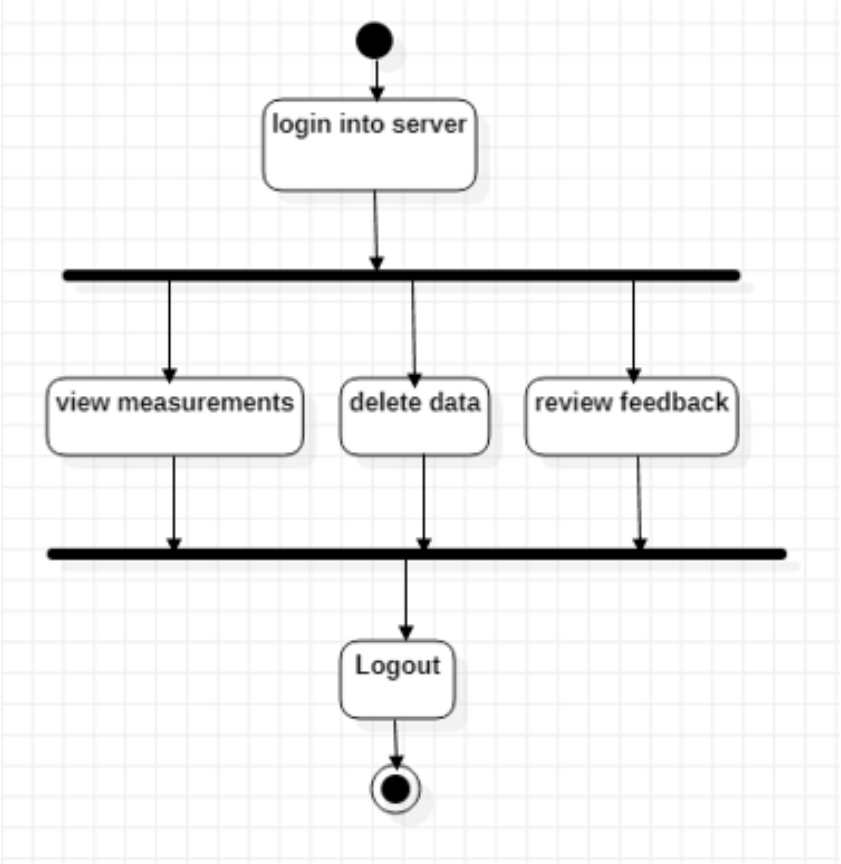

Fig 4.11 Admin Activity Diagram

Activity diagram for admin

Admin logs in into database server by entering required details. Admin can either view profiles of the users, it can delete data if not required and it can view and delete feedbacks from the user.

ER Diagram

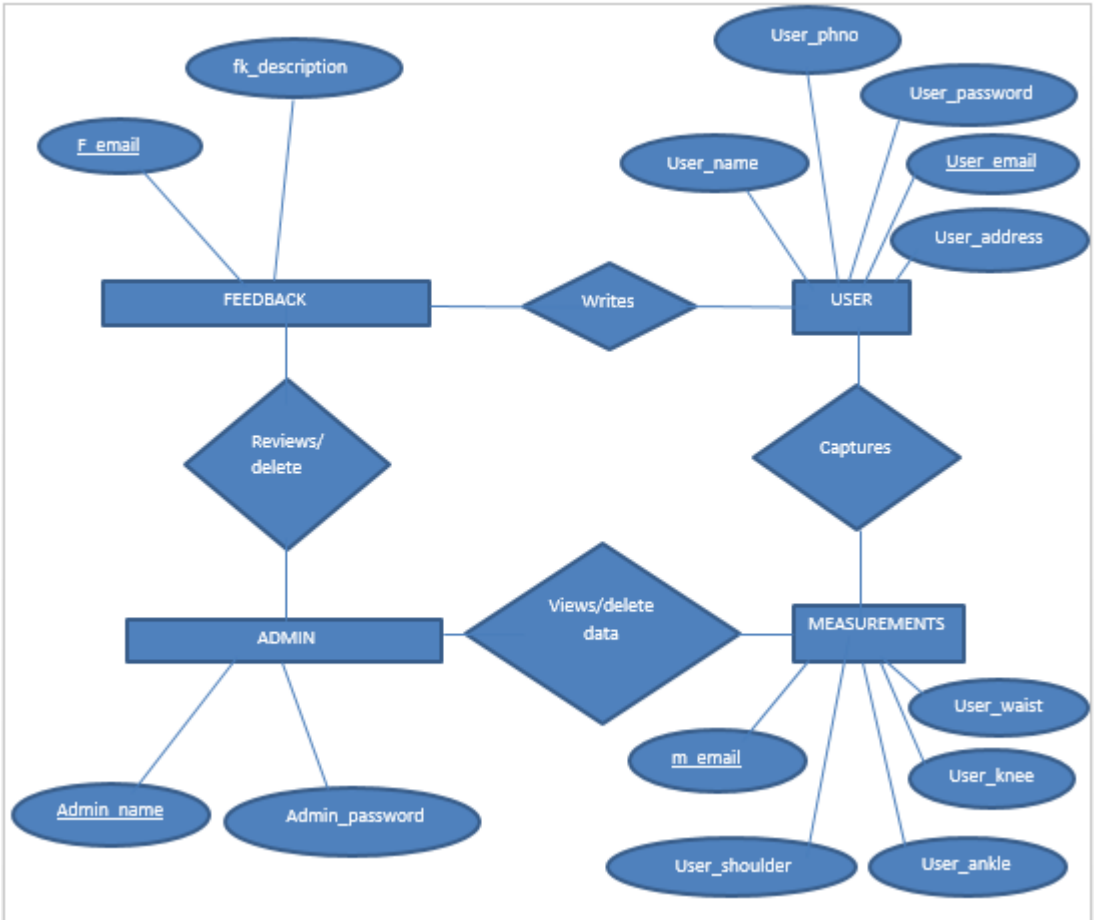

Fig 4.12 ER Diagram

An entity-relationship model is a data model for describing the data or information aspects of a business domain or its process requirements, in an abstract way that lends itself to ultimately being implemented in a database such as a relational database. The main component of ER models are entities and the relationships that can exist among them.

In the above ER diagram related to our project has 4 entities -user, measurements, admin and feedback. User captures measurements by dragging on live human objects. The captured measurements get stored in the database which can be viewed by the user. Admin can edit those measurements. There will be a measurements table that will stored the measurements. It will contain fields like user's shoulder, height, waist, ankle etc. There will also be a feedback space which will contain username and description. Users writes the feedback regarding the application

whether they like it ,how good is the product , what changes are to be made or what are the problems faced by the users while operating these application . On the other hand, admin can view and delete these feedbacks provided by the user and take actions accordingly.

Class Diagram

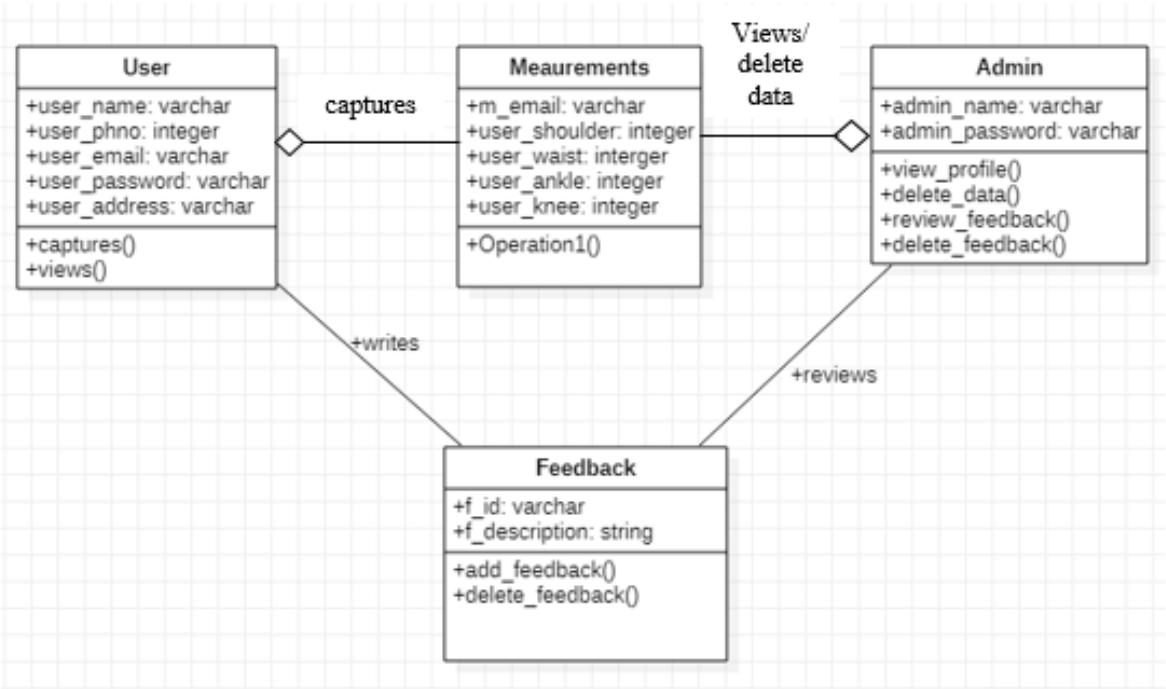

Fig 4.13 Class Diagram

Chapter 5

IMPLEMENTATION

5.1 Introduction

This chapter will explore the different aspects concerned with the implementation of our developed system. This project was concerned with the development and implementation of the mobile tailoring system. We began with analysis of the existing and proposed systems, the required software specifications, the design of the system to be developed, and now in this chapter we shall deal with implementation of the developed system.

5.2 Description of Developed System

The main function of our system to get the required body measurements of the user for E.g. shoulder length, waist size etc.
It includes the ability to create user & admin profile, update/edit profiles, and get measurements as per user requirements.

5.2.1 Accessing the System

In general, the developed system has two main access levels which are:

- User
- Admin

All users are presented with the same login interface. User must login the system by means of valid username/password combination. During the process of user registration, system will ask the user to fill the details to create their profile. Once user is logged into the system, home page appears on which user gets to choose which body part he wishes to measure. On the home page there are several fields are mentioned like shoulder to shoulder, shoulder to waist, waist to ankle etc. User need to select any of those fields and tap on camera icon which will allow the system to take measurements next camera opens up with a pointer, which user has to move and tap on one end of the body part and move to other end of body and tap, the measurement from start to end poit will appear on the screen. By clicking upload in the top right, the calculated data etc. stored in database. Likewise user can take all his measurements and save them. System also allows user to write any feedback/suggestions about the application.

Admin has all the access to the view user's measurements feedback ad delete any of the measurements .Admin will log in into the database server that firebase for our system using his email and password.

5.3 Technical Details of Implemented System

5.3.1 System Installation

The system was developed and tested on a laptop running Mac OS and processor of Intel i7. It was developed on xcode 11.3 with the help of firebase as a backend. This application is compatible with iOS version 9 and above. This application can be installed only on mobiles having iOS operating system. It will be either installed through play store or directly from the android studio.

5.3.2 Firebase database

The Firebase Realtime Database is a cloud-hosted NoSQL database that lets you store and sync data between your users in real-time. It provides a real-time database and back-end as a service. The service provides application developers an API that allows application data to be synchronized across clients and stored on Firebase's cloud.

Firebase Authentication provides backend services, easy-to-use SDKs, and ready-made UI libraries to authenticate users to your app. It supports authentication using passwords, phone numbers, popular federated identity providers like Google, Facebook and Twitter, and more.

- **.auth ():** A firebase authentication class.
- **.createUser ():** Create a new account by passing the new user's email address and password. If the new account was successfully created, the user is signed in, and you can get the user's account data from the result object that's passed to the callback method.
- **.signin ():** It allows existing users to sign in using their email address and password.
- **.collection ():** To store the data the retrieve the data.
- **.signout ():** It allows current user to logout from the system.

5.3.3 Algorithms

MD5 Encryption

MD5 algorithm was used for password encryption. MD5 stands for Message Digest algorithm 5 is a widely used cryptographic hash function. The idea behind this algorithm is to take up a random data (text or binary) as an input and generate a fixed size "hash value" as the output. The input

data can be of any size or length, but the output “hash value” size is always fixed. Here is an example of MD5 Hash function at work:

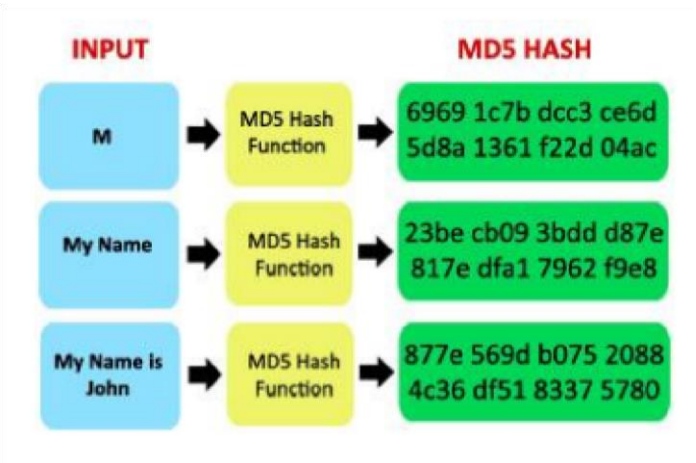

Fig 5.1 MD5 Encryption procedure

As can be seen from the above example, whatever input size is given, the algorithm generates a fixed size (32 digit hex) MD5 hash.

AES (128bit) Algorithm

The Advanced Encryption Standard (AES), also known by its original name Rijndael is a specification for the encryption of electronic data established by the U.S. National Institute of Standards and Technology (NIST) in 2001. AES is based on a design principle known as a substitution–permutation network, and is efficient in both software and hardware. AES is a variant of Rijndael, with a fixed block size of 128 bits, and a key size of 128, 192, or 256 bits.

AES operates on a 4 × 4 column-major order array of bytes, termed the state. Most AES calculations are done in a particular finite field.

The number of rounds are as follows:

10 rounds for 128-bit keys.

12 rounds for 192-bit keys.

14 rounds for 256-bit keys.

Each round consists of several processing steps, including one that depends on the encryption key itself. A set of reverse rounds are applied to transform cipher text back into the original plaintext using the same encryption key.

5.3.4 Pseudocode

- ***Login into the system***

Startup system

Enter username and password

On clicking the login button

Connect to database

Query database to know whether user credentials are correct

If not

Deny access and return login page with an error message

If correct

Check if credentials are for manager

If yes

Allow login

- ***Registration in the system***

Startup system

Enter all the details

Check if all fields entered are correct

If not

Alert message: Data is not formatted

If correct

Registration of new user successful

- ***Get measurements***

Home page

Select required field

Tap on Camera icon

Plot start and end point on object

Measurements appears

On clicking Upload

Connect to database

If not

Measure again

If yes

Data uploaded in DB

5.4 Screenshots of the Developed System

Refer to Appendix C fir the Screenshots of the developed system.

Chapter 6

TESTING

6.1 Introduction

Testing is very important and critical to the success of any project that aims at delivering working software. There are many types of testing that a system may be subjected to, however only the ones in the testing objectives will be carried out for this system.

6.2 Scope

The overall purpose of testing is to ensure the Employee Management System meets all of its functional and business requirements. The purpose of this chapter is to describe the overall test plan and strategy for testing the system.

6.3 Testing Goals

The goals in testing this system include validating the quality, usability, reliability and performance of the application. Testing will be performed from a black-box approach. Tests will be designed around requirements and functionality.

6.4 Confirmation Testing

Confirmation testing or re-testing: When a test fails because of the defect then that defect is reported and a new version of the software is expected that has had the defect fixed. In this case we need to execute the test again to confirm that whether the defect got actually fixed or not. This is known as confirmation testing and also known as re-testing. It is important to ensure that the test is executed in exactly the same way it was the first time using the same inputs, data and environments. Hence, when the change is made to the defect in order to fix it then confirmation testing or re-testing is helpful.

6.5 Regression Testing

During confirmation testing the defect got fixed and that part of the application started working as intended. But there might be a possibility that the fix may have introduced or uncovered a

different defect elsewhere in the software. The way to detect these 'unexpected side-effects' of fixes is to do regression testing. The purpose of a regression testing is to verify that modifications in the software or the environment have not caused any unintended adverse side effects and that the system still meets its requirements. Regression testing are mostly automated because in order to fix the defect the same test is carried out again and again and it will be very tedious to do it manually. Regression tests are executed whenever the software changes, either as a result of fixes or new or changed functionality.

6.6 Test plans and Results

The Test Plan is derived from the Requirements, Functional Specifications, and detailed Design Specifications. The Test Plan identifies the details of the tests, identifying the associated test case areas within the product are shown in the table below.

(Refer Appendix D for the test results of these test cases)

Tests case	Test purpose	Test condition	Expected outcome	Test result
Login constraint	Checks email and password in database	If user details are wrong or username not found, displays alert message	Grant access to the application main system.	User successfully logs into the system upon submission of login credentials
Registration constraint	Checks email and password	If email already exists in the system, then displays alert message.	New user should be successfully registered in the system.	New user successfully get registered into the system.
Email format	Checks email format	If user has typed wrong email format, then displays alert message.	Alert message when email format is wrongly typed.	User gets an alert message when email format is wrong.
Password constraint	Checks passwords during registration	Password should be 6 characters log or more.	When condition is not satisfied, alert message is displayed.	User get alert message when password is less than 6 characters.

Table 6.1 Test cases and their results

Chapter 7

CONCLUSION AND FUTURE SCOPE

In this report, a mobile tailoring application has been presented. The core reason for the establishment of a mobile tailor application is to enable the customers and administrators in a convenient, fair and timely manner of interaction. It was emphasized on the basic steps, consequently taken during the project's development course as a particular attention was turned to the basic operative function performed upon the data into database. Traditional techniques to take body measurements using measurement tape is time consuming and had threats in terms securing customers details. The existing system is time consuming and costly. Due to the manual systems in use, the whole process tends to be slow.

Our project is the Mobile Tailoring Application which mainly aims on developing an application which will help the tailor/designer to take the measurements of the customer and save the details of customer and the measured data under his/her name in the database. The prime use of this application to user is he/she can measure themselves without using traditional techniques within less time period and also has his/her details securely saved in the application. The user details are accessible to only to the user but can be viewed y admin, cannot be edited by admin.

As a future work, some additional things could be implemented and integrated into the application code making it much more reliable and flexible such as a measurements according to clothing styles of male and female, size recommendation by training the model using different datasets. This enhancement of the project will eliminate the traditional techniques of getting body measurements. The training should be provided to all the members of the staff in the tailor/designer shops to get used to the system. This being a new system, some members of the staffs, management will get threatened that the computerized tailoring management system will replace their jobs.
We would recommend that management of the tailor shop to educate the staff on how this app will operate and how it will supplement their efforts that is customers will only visit them during clothes collection. They should also know how to login using username and password which should be kept confidential.

REFERENCES

- https://krazytech.com/projects/sample-software-requirements-specificationsrs-report-airline-database
- https://www.academia.edu/12426471/ONLINE_TAILORING_MANAGEMENT_SYSTEM
- https://www.eziline.com/product/tailoring-management-system/
- https://www.google.com/search?q=arcore&oq=arcore&aqs=chrome..69i57.4275j0j7&sourceid=chrome&ie=UTF-8#
- https://developers.google.com/ar/discover/supported-devices
- https://en.wikipedia.org/wiki/TensorFlow
- https://www.tensorflow.org/
- https://www.google.com/search?rlz=1C1EKKP_enIN746IN746&sxsrf=ACYBGNQIRSHrzu7Qpv355TSoGlw2vFfIlQ%3A1577336066183&ei=Aj0EXoPzCtGS9QOGjL2wCg&q=opencv+for+body+measurement&oq=opencv+for+body+measue&gs_l=psy-ab.1.0.33i160l2.4557.16723..19127...7.2..0.1058.13244.3-1j4j3j8j2.....0....1..gws-wiz.....0i71j0j0i20i263j0i22i30j0i22i10i30j0i8i67.0qSQmN8XKko#
- https://www.google.com/search?rlz=1C1EKKP_enIN746IN746&sxsrf=ACYBGNQIRSHrzu7Qpv355TSoGlw2vFfIlQ%3A1577336066183&ei=Aj0EXoPzCtGS9QOGjL2wCg&q=opencv+for+body+measurement&oq=opencv+for+body+measue&gs_l=psy-ab.1.0.33i160l2.4557.16723..19127...7.2..0.1058.13244.3-1j4j3j8j2.....0....1..gws-wiz.....0i71j0j0i20i263j0i22i30j0i22i10i30j0i8i67.0qSQmN8XKko#

APPENDICES

Appendix A:

Life Cycle Model

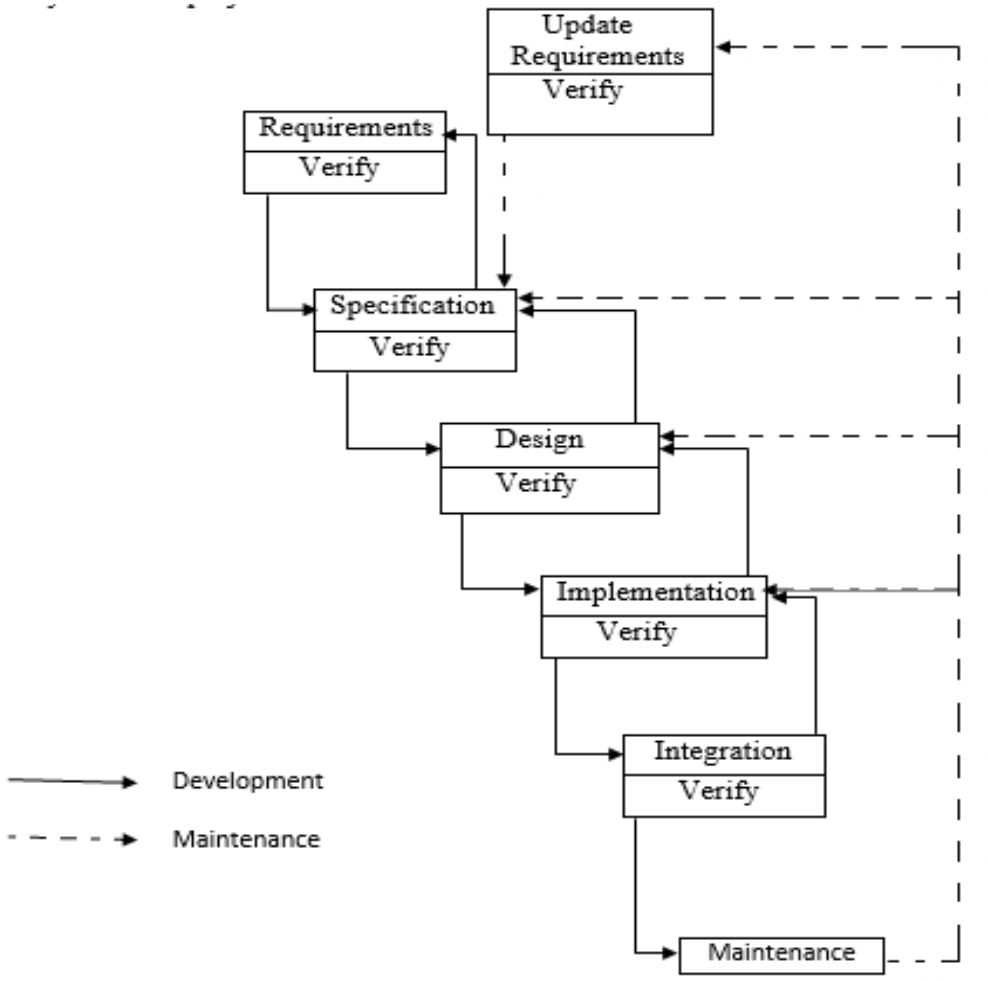

Fig A.1 Waterfall Model

It is a unique model which is followed by most of the companies. In fact certain features of Waterfall attracts the top executives to adapt it. Some of the unique features are:

1. It can be implemented for all size projects.
2. It leads to a concrete and clear approach to software development.
3. In this model testing is inherit in every phase.
4. Documentation is produced at every stage of model which is helpful for people who are involved.

There are various phases can be maintained to waterfall model:

(i) Preliminary Investigation 1.

(ii) Requirement Analysis

(iii) System Design

(iv) Coding/Implementation

(v) Integration and Testing

(vi) Maintenance

One important thing of the Waterfall Model is that at each phase a conscious decision is taken whether to continue the project or to stop it.

Phase 1→Preliminary Investigation 1:

It is the starting phase of project. Actually it is the job of top executives. The aim of this phase is not develop system but to investigate the problems or to take decision for new requirements. When the executives are taking decisions on a project they take various factors into consideration like technology, time, budget and many more things. When the agreement has been done to continue with the project the second phase of the SDLC is implemented.

With respect to our project, we have studied and compared the different technologies that could be used to get the body measurements.

Phase 2→ Requirement analysis:

This phase is concerned about collection of requirement of the system to be developed and also this process involves generating document and requirement review. The output of this phase is a formal requirement document i.e. software requirement specification.

According to our project, the tailor needs the body measurements to be taken for further processing, which have been supported by SRS in our documentation.

Phase 3→ System Design:

The design phase of our project has been shown by various Software Engineering diagrams:-

1) Use case: - It gives the actions or steps defining the interaction between a role and a system to achieve a goal. It consists of actors and relationships between use cases.

In our project, we have two actors namely User and Admin and various use cases to show functions to be performed by them.

2) ER diagram: - It gives entity relationships among entities. We have shown four entities namely User, Admin, Measurements and feedback, each of which contains a unique primary key to represent each entity. It also gives relationships that can exist between entities. Each entity has its own attributes.

With respect to our project, the User entity writes the feedback which is reviewed by the admin. Admin can also view or delete data of the measurements which are captured by the user.

3) Class diagram: - It describes the structure of our system by showing system's classes, their attributes, operations and relationships among them.

In our class diagram, we have four classes which are based on ER diagram. Each class contains attributes and operations to be performed by that class. For example, User class can view and capture measurements. It can also write feedback about the application.

Admin class can review or delete feedback and even view/delete data of the captured measurements.

Feedback class contains operations like add and delete feedback. User can add feedback about the application and delete operation will be performed by the Admin. User is not allowed to delete the feedback. Measurements class contains its attributes like shoulder, height, waist, knee etc. It has no operation because after taking measurements, it cannot be used for any further process in our project. It can be used for sending it to the tailor for stitching clothes which will be implemented in future enhancement.

4) Activity diagram: - It depicts the behavior of our system. It tells the activities to be performed by our user and admin throughout the application.

We have two activity diagrams .One for User and other for Admin.

User Activity diagram tells us about the activities to be performed by the user throughout the process. User can take measurements or view profile whereas Admin Activity diagram will tell us about the activities or actions to be performed by the admin. Admin can view, delete data, review or delete feedback.

5) Sequence diagram: - It gives the order in which objects in the system will function. We have two sequence diagrams used for our project, User and Admin sequence diagram.

In user sequence diagram, sequential actions of user are shown. User has to login into the account. By dragging on live human objects, he/she will get the measurements which will be stored in the database. We have five lifelines in our User sequence diagram namely User, login, database,

camera, and measurements. Communication between objects is depicted using messages. The messages appear in a sequential order on the lifeline. We represent messages suing arrow.
In admin sequence diagram, we have three lifelines namely Admin, database login and admin database. Various messages are used to show the actions to be performed by the lifelines.

Below phases will be implemented in the further process.

Phase 4→ Coding/Implementation:

In this phase programmer starts his coding in order to give a full sketch of product. In other words system specification is only in to machine readable compute code. But sometimes it is tough for coding people to maintain the design. So for the reason examination and re-examination of the requirement statement is necessary. Whenever any deviations would always approved either by PL or by client.

Phase 5→ Verification:

In this all programs (models) are integrated and tested to ensure that the complete system meets the software requirements. The testing is concerned with verification and validation. Apart from this Unit testing and Integration testing is done in order to test all classes and functions etc. Integration testing is done by including unit together with other unit a testing them whole.

Phase 6→ Maintenance:

In this maintenance phase the software is updated to:
-Fulfill the changing customer need
-Adapt to accommodate change in the external environment
-Correct errors and fix bugs.
-Enhance the efficiency of the software.
With respect to our project, our application will be maintained by our team as per the customer's requirements.

Appendix B:

1. iOS Application:-

iOS is a mobile operating system created and developed by Apple Inc., exclusive for its hardware. It is the operating system that powers many of the company's mobile devices, including the iPhone and iPad Tough. It is the world's second most widely installed mobile operating system, after android. It is the basis for three other operating system made by Apple: iPadOS, tvOS and watchOS

2. Swift:-

Swift is a general purpose, multi-paradigm, compile programming language developed by Apple Inc. for iOS, iPadOS macos, tvOS and Linux. Swift is designed to work with the Apples Cocoa and Cocoa Tough frameworks. It is built with the open source LLVM complier framework and has been included in code since version 6 released in 2014. On Apple platforms, it uses the Objective-C runtime library which allows, Objective-C, C++ and Swift code to run within one program.

3. Xcode storyboard:-

A storyboard is a visual representation of the user interface of an iOS application, showing screens of content and the connections between those screens. Xcode provides a visual editor for storyboards, where you can lay out and design the user interface of your application by adding views such as buttons, table views, and text views onto scenes.

In addition, a storyboard enables you to connect a view to its controller object, and to manage the transfer of data between view controllers. Using storyboards is the recommended way to design the user interface of your application because they enable you to visualize the appearance and flow of your user interface on one canvas.

4. Xcode:-

Xcode is an Integrated Development Environment (IDE) for Mac OS containing suite of software development tools developed by Apple for developing software for macOS, iOS, iPadOS, watchOS and tvOS. First released in 2003, the latest stable release is version 11.4 and is available via Mac App Store free of charges for macOS Catalina users.

Appendix C:

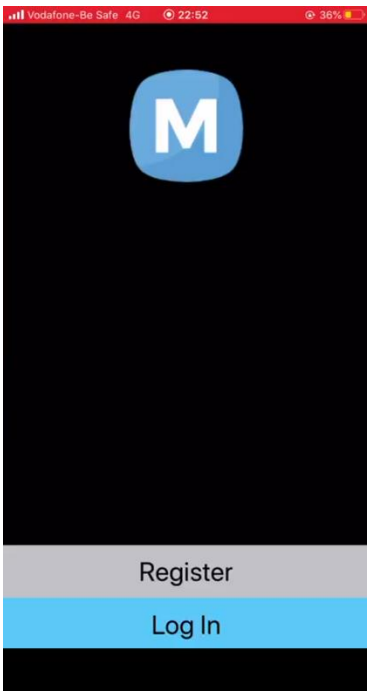

Fig C.1 Main page

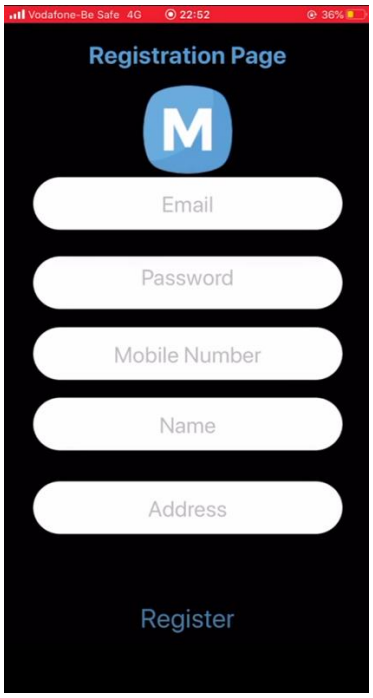

Fig C.2 Registration Page

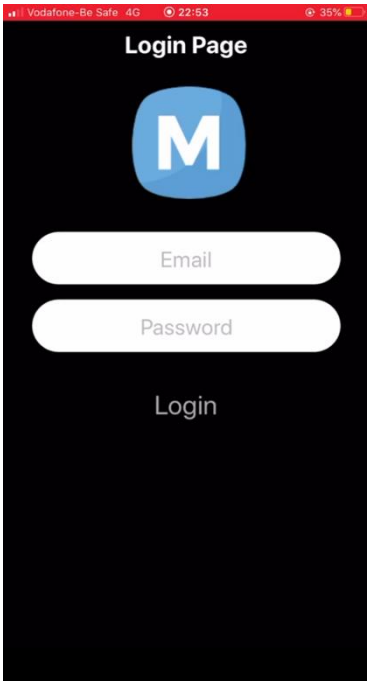

Fig C.3 Login Page

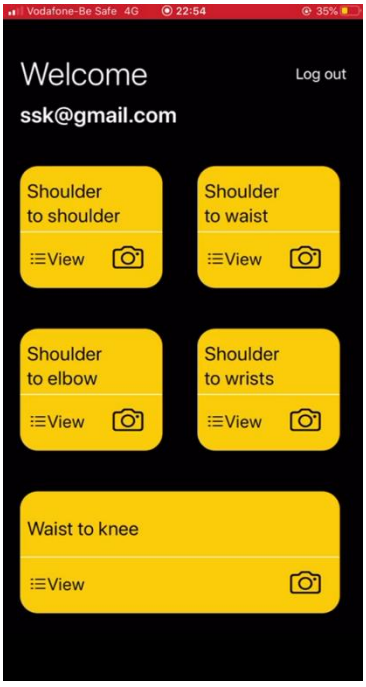

Fig C.4 Home page

Fig C.5 Camera Pointer

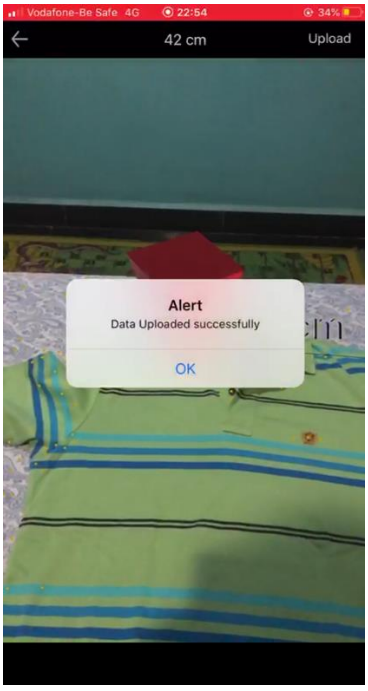

Fig C.6 Data uploaded

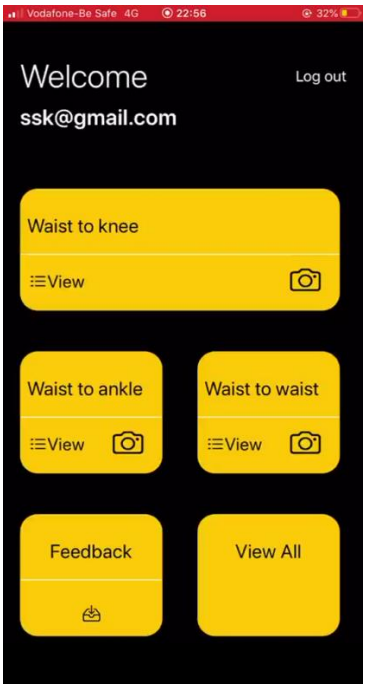

Fig C.7 Home page

Fig C.8 Measurments view

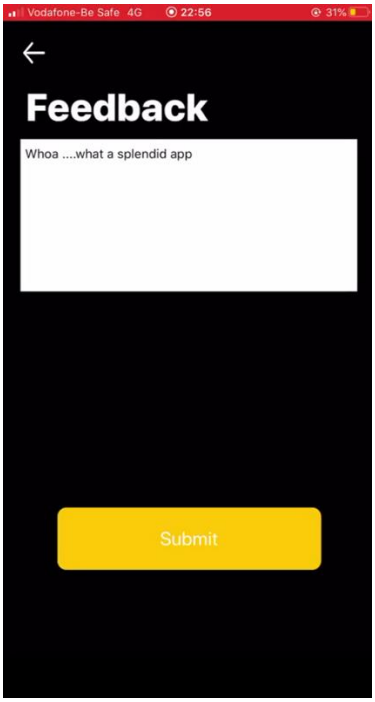

Fig C.9 Feedback Page

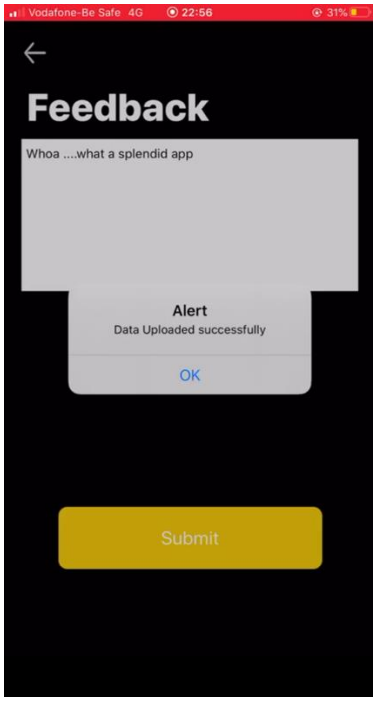

Fig C.10 Feedback stored

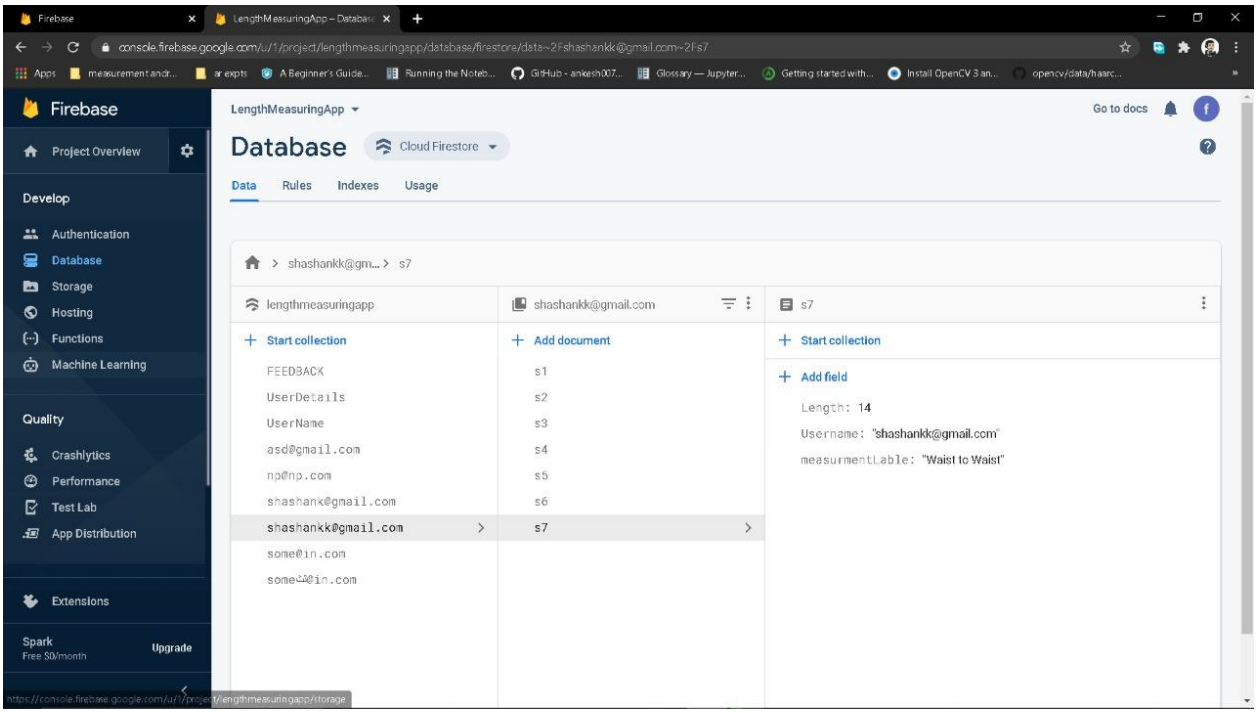

Fig C.11 Admin access to Database

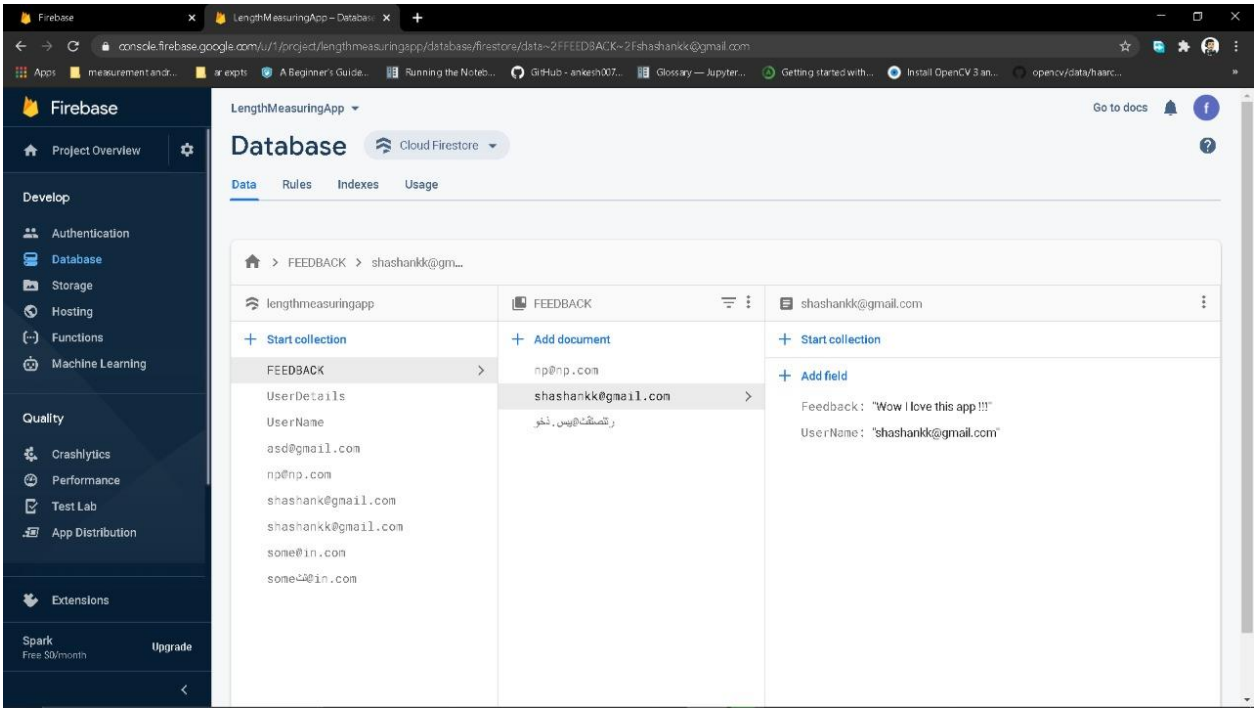

Fig C.12 Admin Viweing Feedback

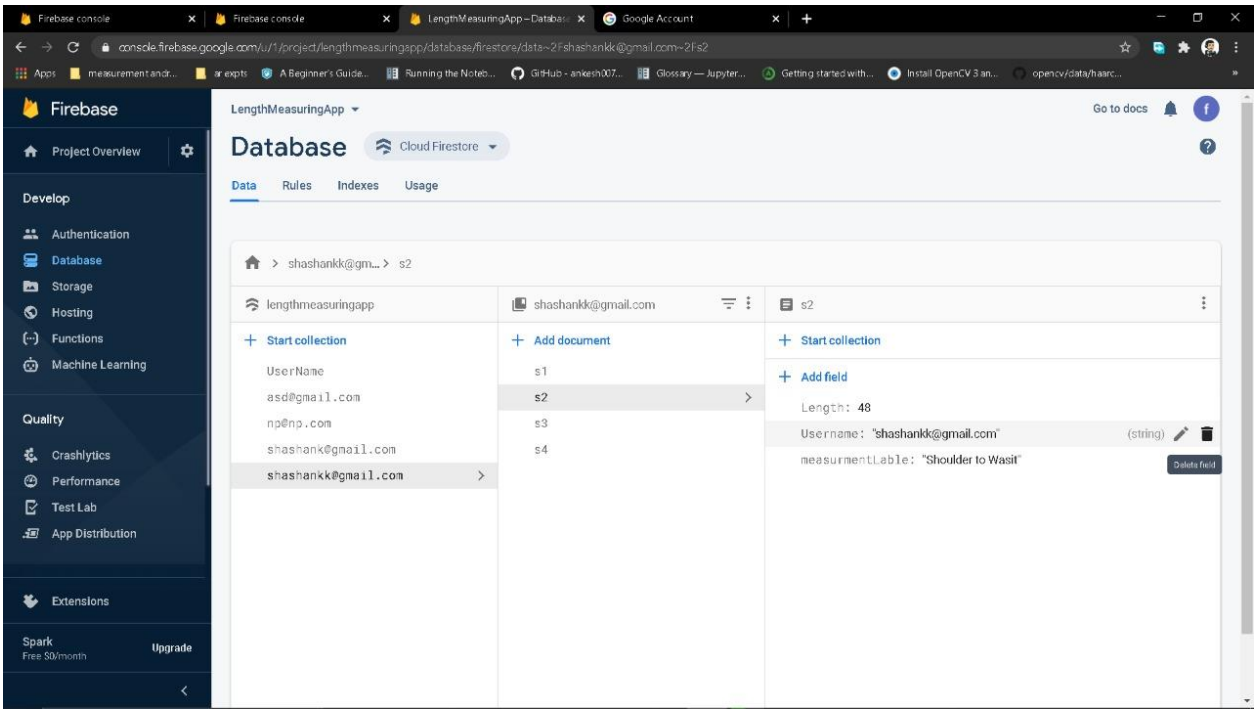

Fig C13 Admin deleting the data

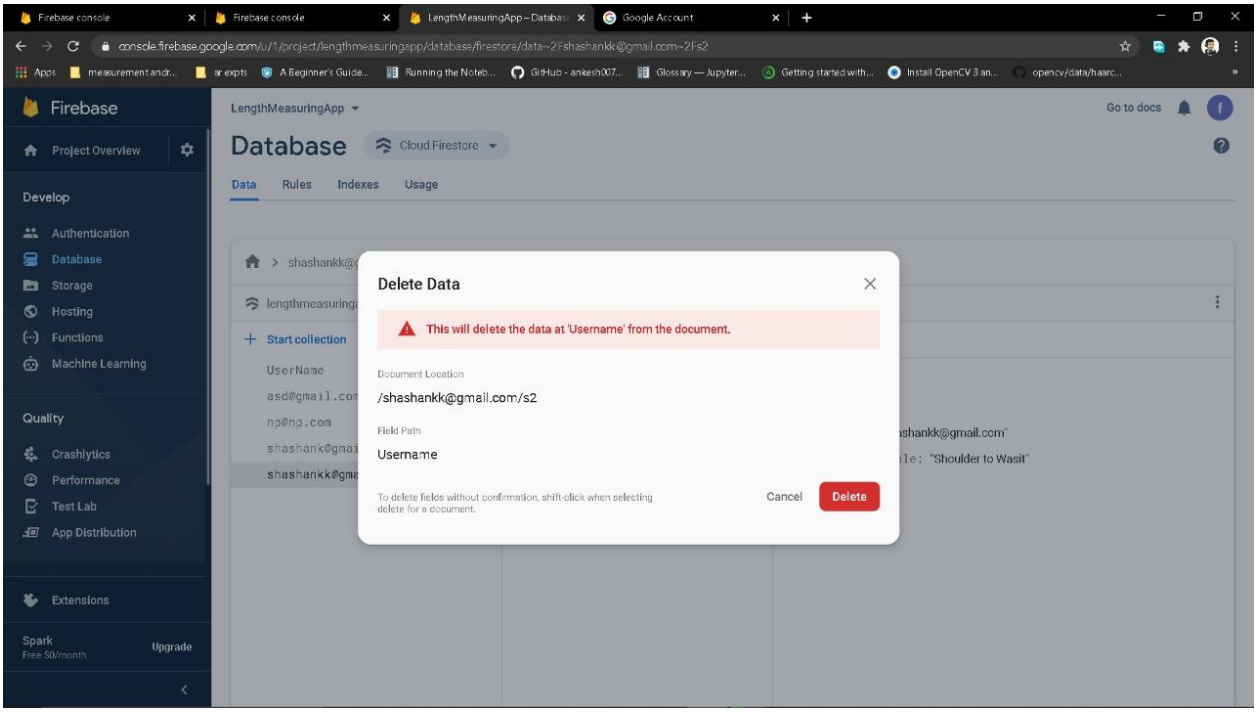

Fig C.14 Popup for deleting data

Appendix D:

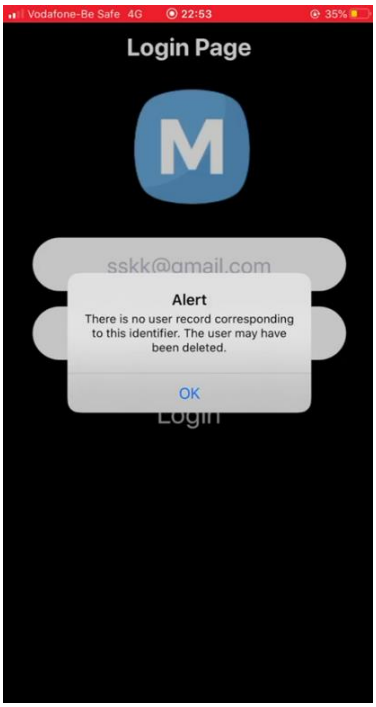

Fig D.1 Login Contraint

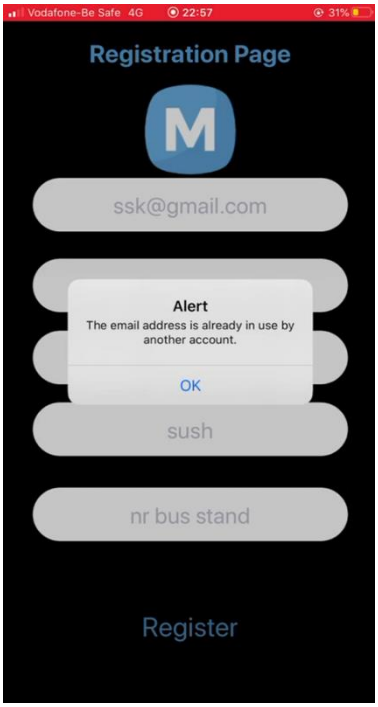

Fig D.2 Registration contraint

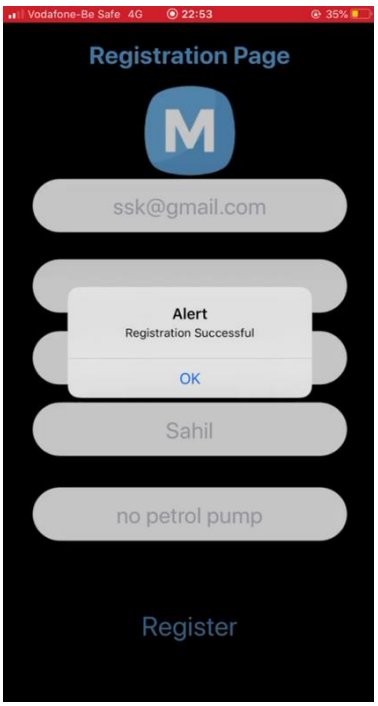

Fig D.3 Registration success

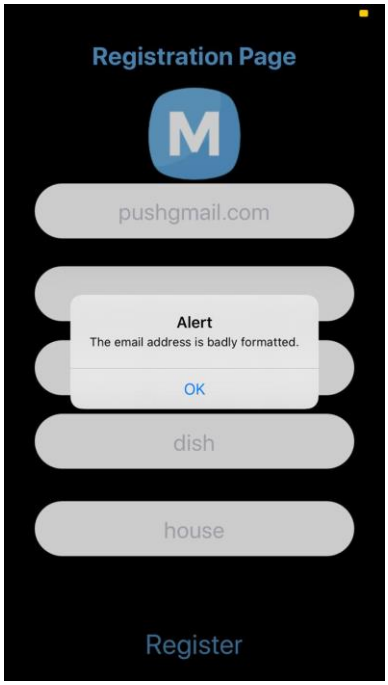

Fig D.4 Email format

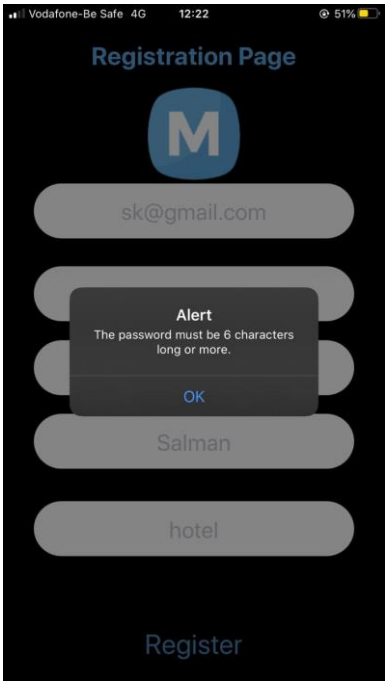

Fig D.5 Password Constraint

ABBREVIATIONS

TERM	DESCRIPTION
CUDA	Compute Unified Device Architecture
OpenCV	Open Source Computer Vision
SDK	Software Development Kit
GPU	Graphics Processing Unit
AR Core	Augmented Reality Core
API	Application Interface
SLAM	Simultaneous Localisation and Mapping
MD5	Message Digest Algorithm 5
AES	Advanced Encryption Standard
IDE	Integrated Development Environment

Table A.1 Abbreviations

USER MANUAL

How to Register?

Once you open the app, tap on REGISTRATION button (Refer fig.1) if you don't have an account. Registration page appears as show in Fig 2.Fill your details in the fields and click register.

How to Login?

Once you open the application, tap on LOGIN button (Refer fig.1) if you have an account. Login page appears as shown in Fig 3. Enter your email and password and click login.

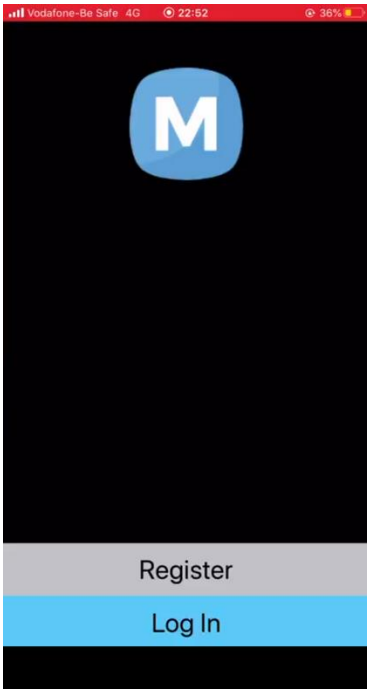

Fig 1. Main page

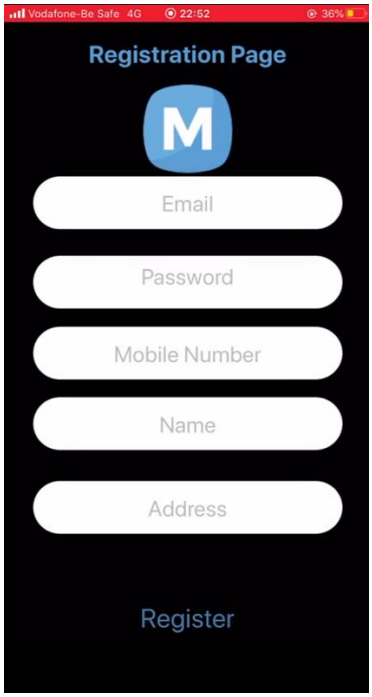

Fig.2 Registration Page

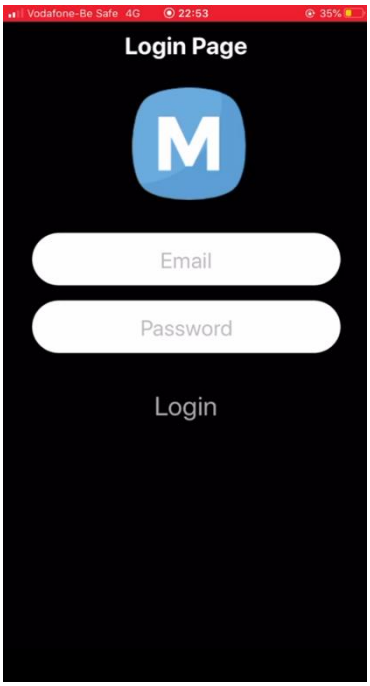

Fig.3 Login Page

How to get Measurements?

Once you're logged into your account, HOME page appears as shown in Fig 4. Choose the required part you want to measure and click on the camera icon so camera opens up with a pointer as in Fig 5. Move & tap the pointer on one end, then move it to other end and tap. Measurement will appear on the screen. Click UPLOAD to store the measurements in the database. (Refer Fig.6)

How to write feedback and view measurements?

Once user takes all his/her measurements, then click VIEW ALL to view all the measurements. User can give their feedback about the application in FEEDBACK section in the home page. (Refer Fig 7).

How to Logout?

On the Home page, click on the logout button at top right corner (Refer Fig.4) which will help user to logout from the application.

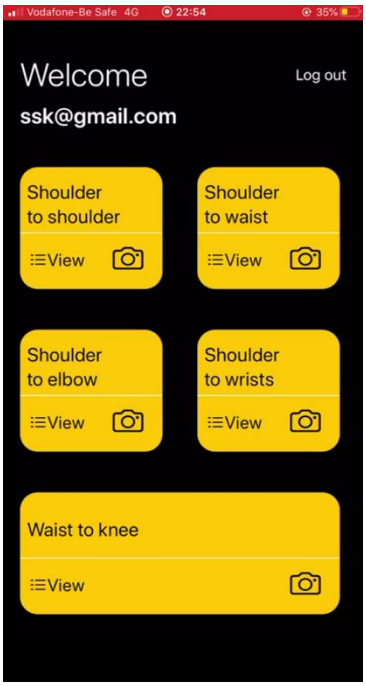

Fig.4 Home page

Fig.5 Camera Pointer

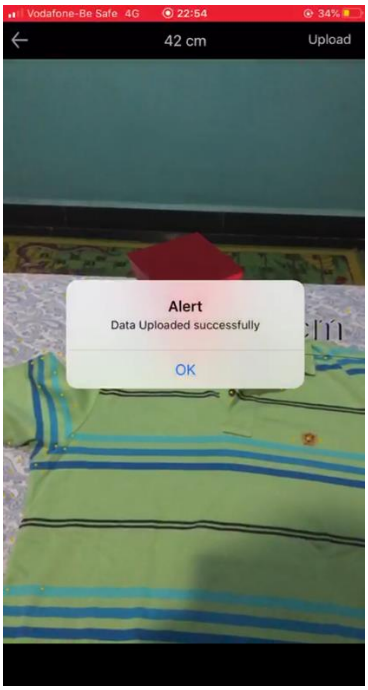

Fig.6 Data uploaded

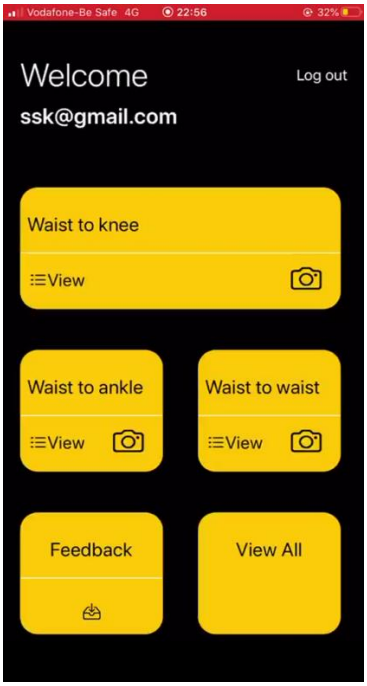

Fig.7 View & Feedback