

A KOOS Calculator for Detecting Osteoarthritis Level

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(A part of collaborative research
with

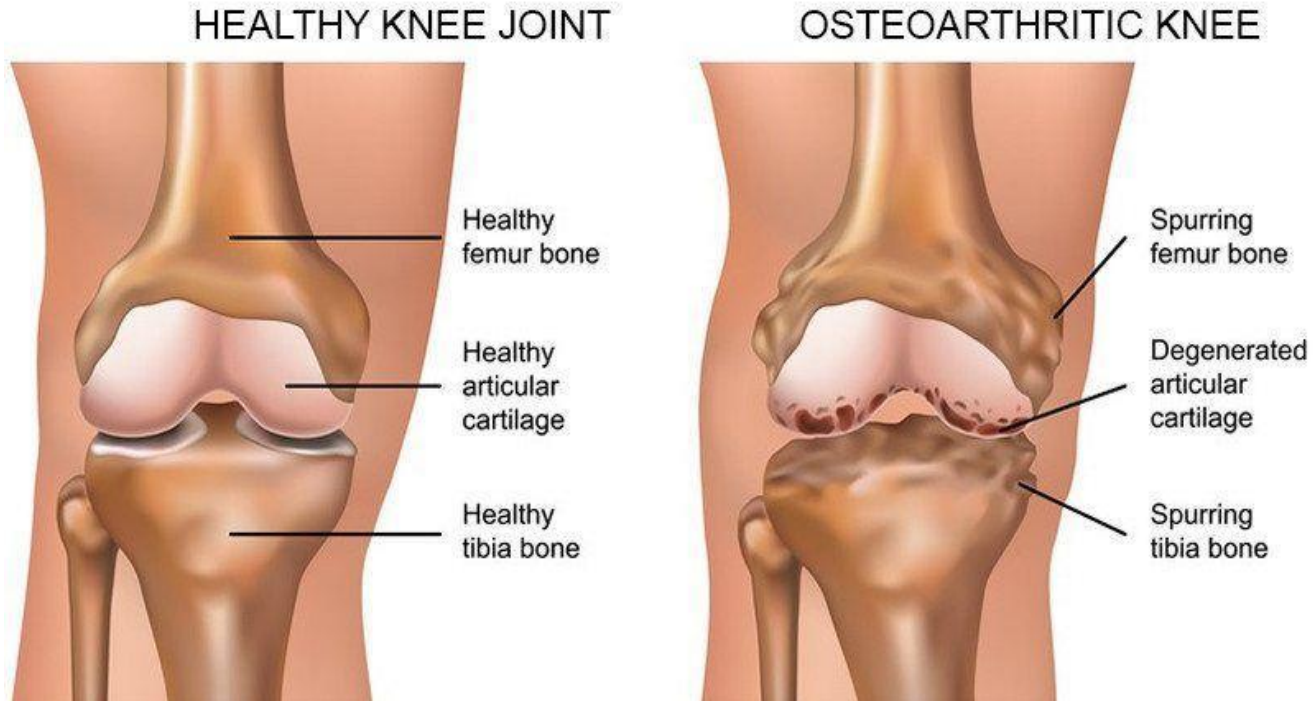
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Outline

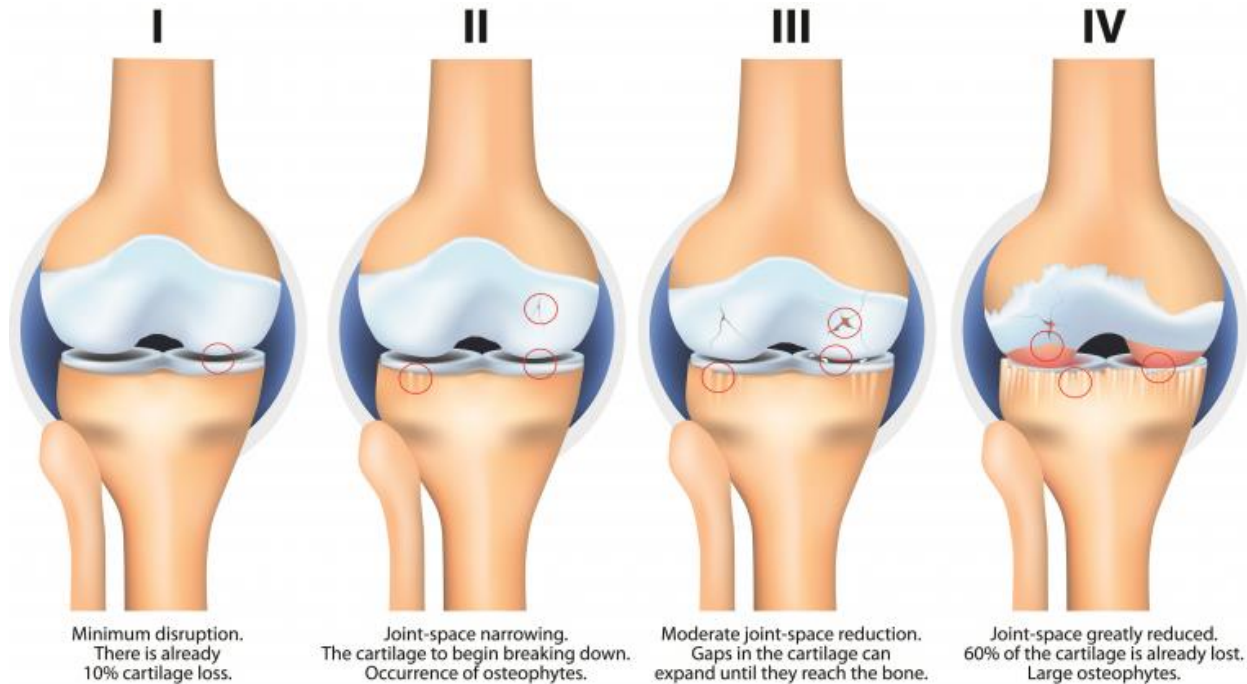


- Introduction
- Background
- Problem Domain
- Method
- Results
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- References

Introduction : Osteoarthritis



Introduction : Stages of Osteoarthritis



Introduction : KOOS



- A *self-reported outcome measure* assessing the patient's opinion about the health, symptoms, and functionality of their knee
- A **42-item** questionnaire, including **5 subscales: symptoms, pain, ADLs, sports/recreation, and quality of life**
- The maximum score a patient can achieve is 100, indicating no knee problems
- The minimum score is zero, indicating severe knee problems

Introduction : KOOS Calculation



1. PAIN $100 - \frac{\text{Mean Score (P1-P9)} \times 100}{4} = \text{KOOS Pain}$
2. SYMPTOMS $100 - \frac{\text{Mean Score (S1-S7)} \times 100}{4} = \text{KOOS Symptoms}$
3. ADL $100 - \frac{\text{Mean Score (A1-A17)} \times 100}{4} = \text{KOOS ADL}$
4. SPORT/REC $100 - \frac{\text{Mean Score (SP1-SP5)} \times 100}{4} = \text{KOOS Sport/Rec}$
5. QOL $100 - \frac{\text{Mean Score (Q1-Q4)} \times 100}{4} = \text{KOOS QOL}$

Introduction : KOOS Calculation



Final KOOS is the average of the KOOS of the five subscales

$$\text{KOOS} = \frac{\text{KOOS Pain} + \text{KOOS Symptoms} + \text{KOOS ADL} + \text{KOOS Sports} + \text{KOOS QOL}}{5}$$

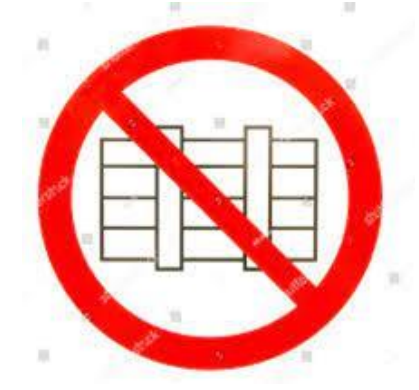
Background : Current Practice of OA Evaluation



Manually clinical and
sociodemographic data
collection



Third Party software for
KOOS calculation



No well-organized database
for storing data

Background : Our Goals

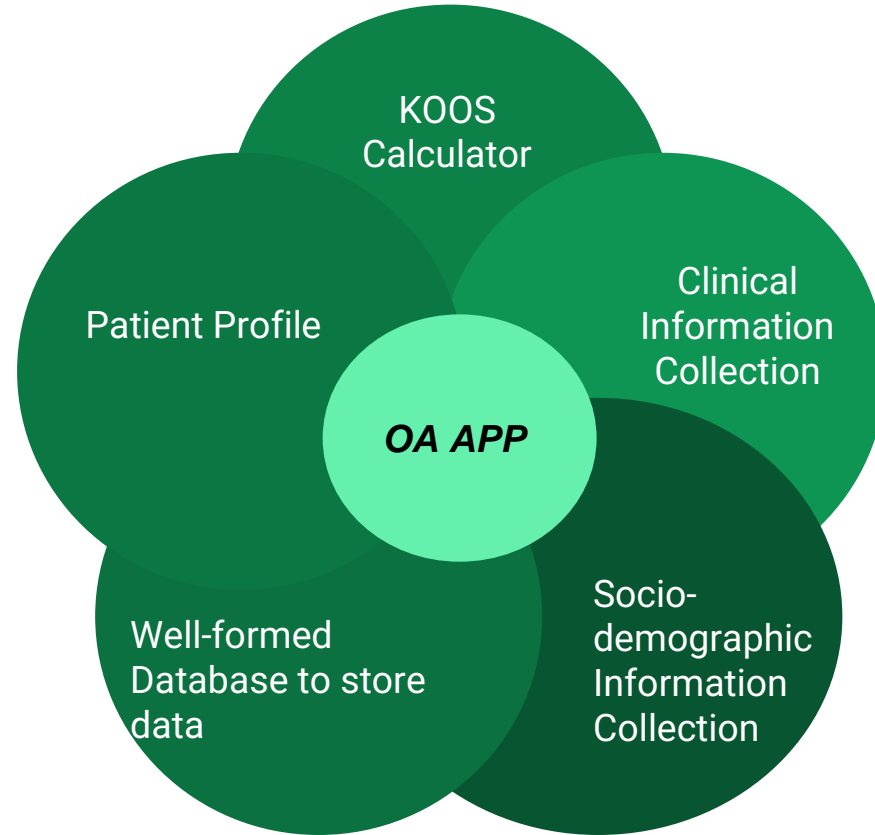


Ease of both patients and doctors



Efficiency

Problem Domain



Problem Domain : User Profile



- Mobile Number
- PID (At present based on Malaysian Health Record System, can be customized for any country)

Problem Domain : KOOS Calculator



- Pain
- Symptoms
- ADLs
- Sports and recreation function
- Quality of life

Problem Domain : Clinical Information Collection



- Height
- Weight
- Waist circumference
- Which knee is affected?
- What are the symptoms of the affected knee?
- Do you have pain in other joints?
- Menstrual history (for female)
- Smoking
- Alcohol intake
- Sports activity
- Recent injury to knee

Problem Domain : Socio-demographic Information Collection



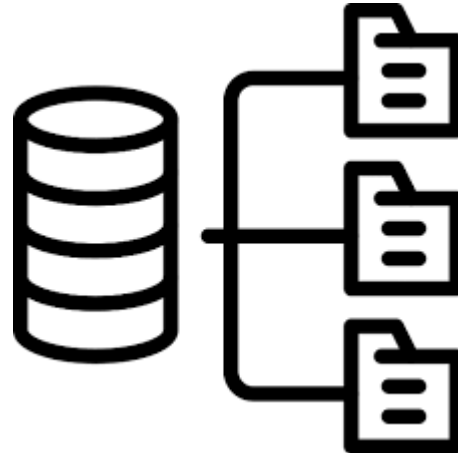
- Occupation
- Activity associated with work
- House type
- Floor number
- Frequent use of staircase
- House toilet type
- Prayer position

Problem Domain : Well-formed database

- User authentication
- Storing other information



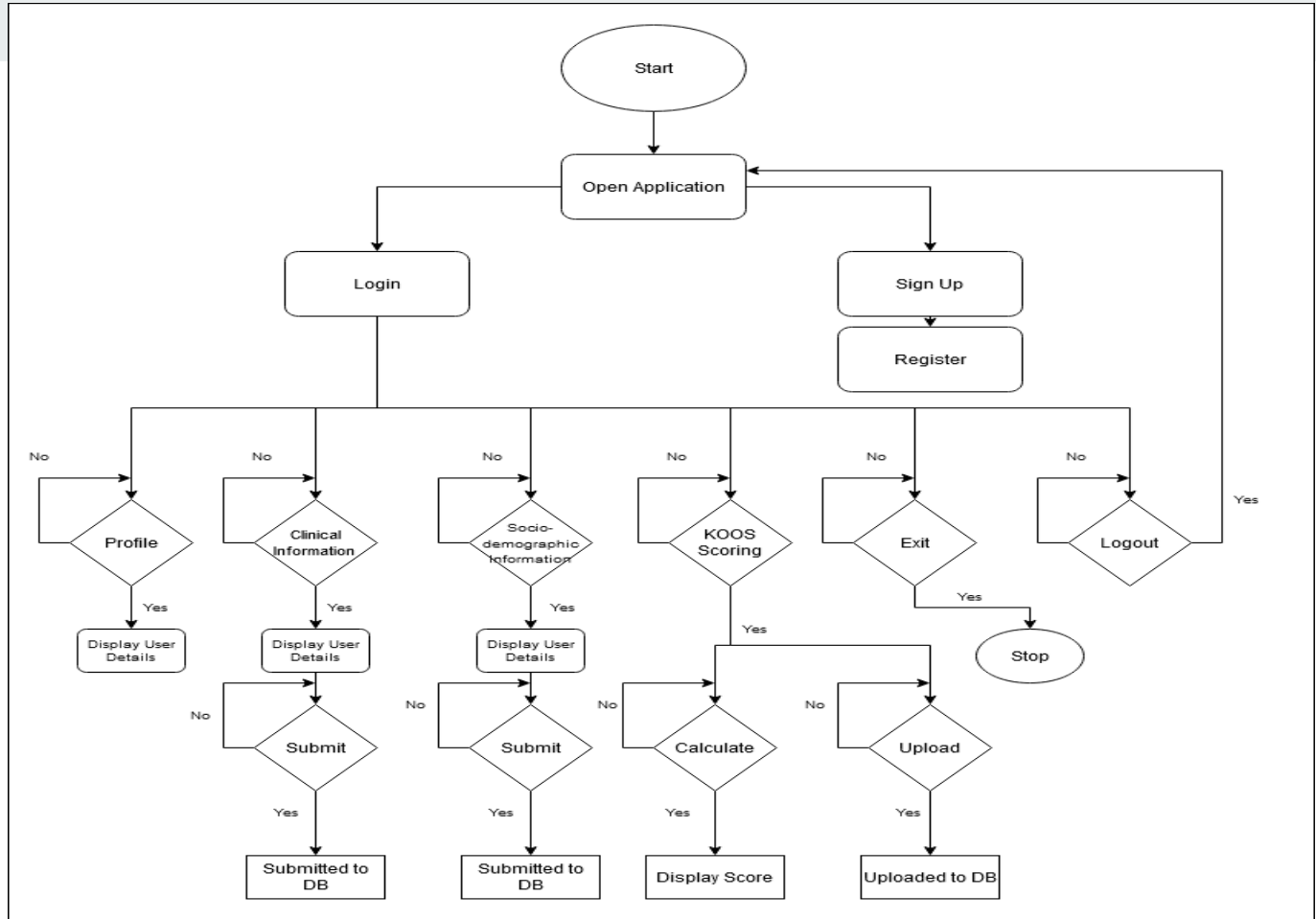
USER AUTHENTICATION



Method : OA APP



Flow Chart



Method : Database Management



For user profile authentication



For storing other information



Results



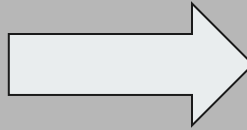
Test Environment

- App tested in android devices
- Data is displayed in a web page
- No pilot study is performed

Results

Osteoarthritis
Status

Get Started

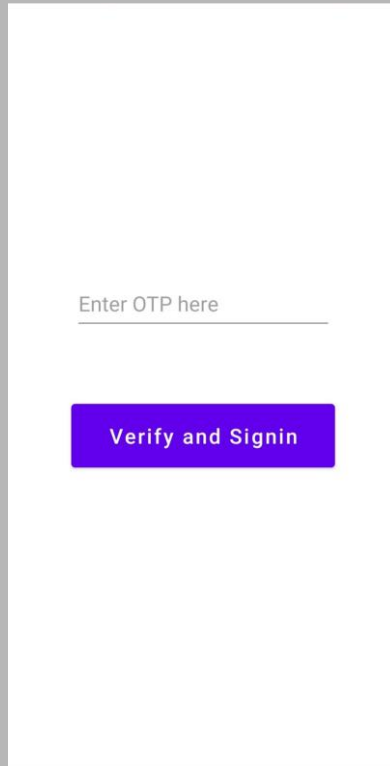


 MY +60 ▾

Get started with an OTP

Exit

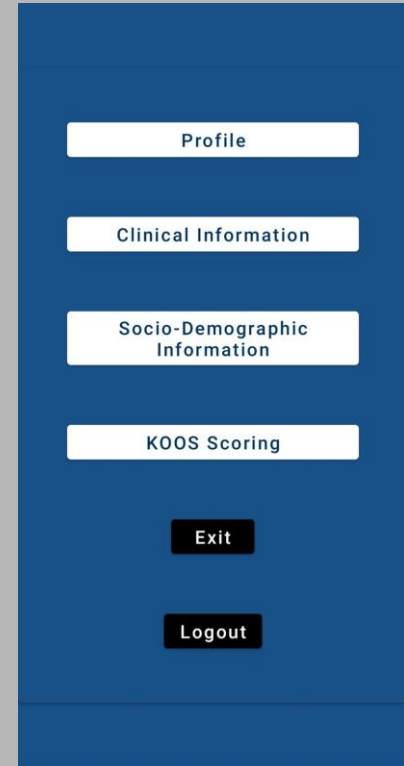
Results



Enter OTP here

Verify and Signin

This is a white rectangular box representing a mobile app screen. It contains a text input field with the placeholder text "Enter OTP here" and a purple button with the text "Verify and Signin".



Profile

Clinical Information

Socio-Demographic Information

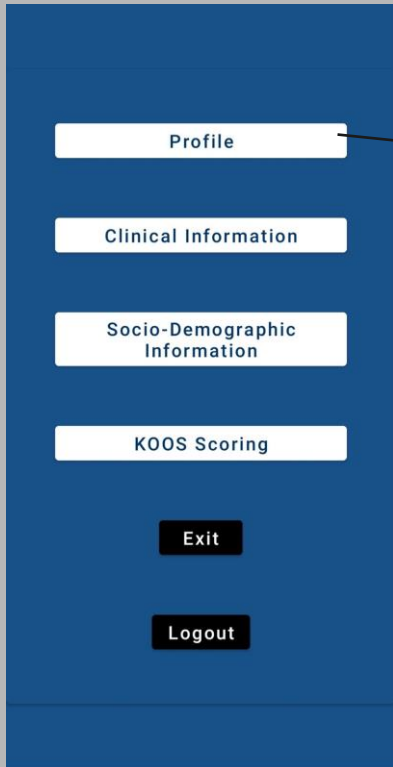
KOOS Scoring

Exit

Logout

This is a dark blue rectangular box representing a mobile app screen. It contains five white buttons stacked vertically: "Profile", "Clinical Information", "Socio-Demographic Information", "KOOS Scoring", and "Exit". At the bottom, there are two black buttons with white text: "Exit" and "Logout".

Results



Profile

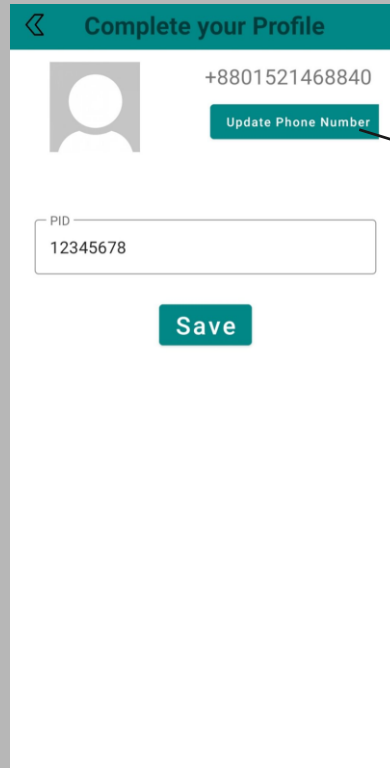
Clinical Information

Socio-Demographic Information

KOOS Scoring

Exit

Logout



Complete your Profile

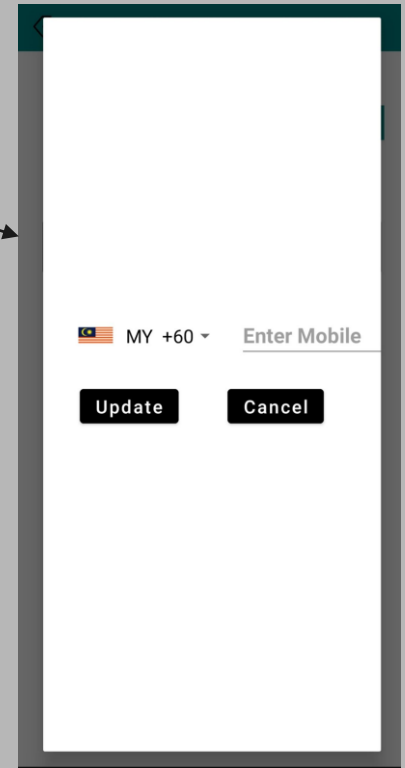
+8801521468840

Update Phone Number

PID

12345678

Save

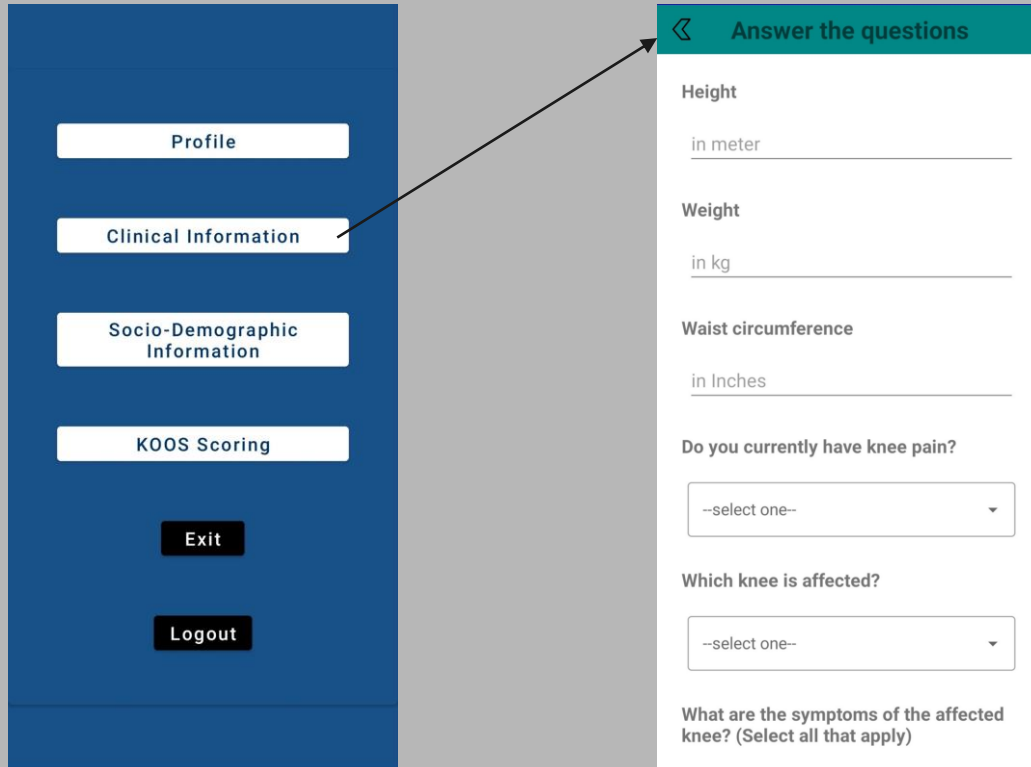


Enter Mobile

MY +60

Update Cancel

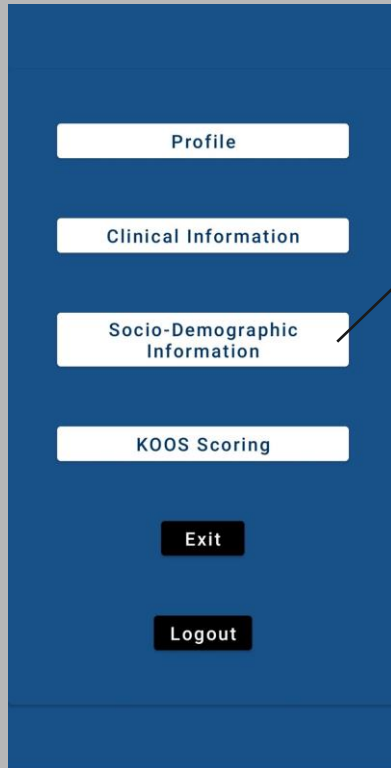
Results



The image displays a user interface for a medical assessment. On the left is a dark blue vertical menu with five white buttons: 'Profile', 'Clinical Information', 'Socio-Demographic Information', 'KOOS Scoring', and 'Exit'. Below these is a black 'Logout' button. An arrow points from the 'Clinical Information' button to a form on the right. The form has a teal header with a back arrow and the text 'Answer the questions'. The form contains the following fields:

- Height**
- Weight**
- Waist circumference**
- Do you currently have knee pain?**
- Which knee is affected?**
- What are the symptoms of the affected knee? (Select all that apply)**

Results



Profile

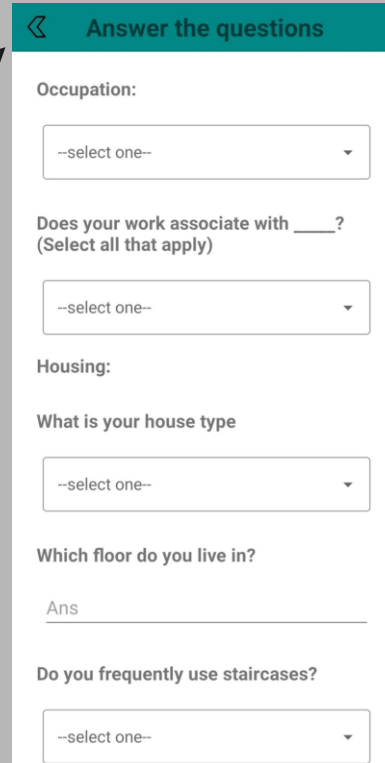
Clinical Information

Socio-Demographic Information

KOOS Scoring

Exit

Logout



Answer the questions

Occupation:

--select one--

Does your work associate with ____?
(Select all that apply)

--select one--

Housing:

What is your house type

--select one--

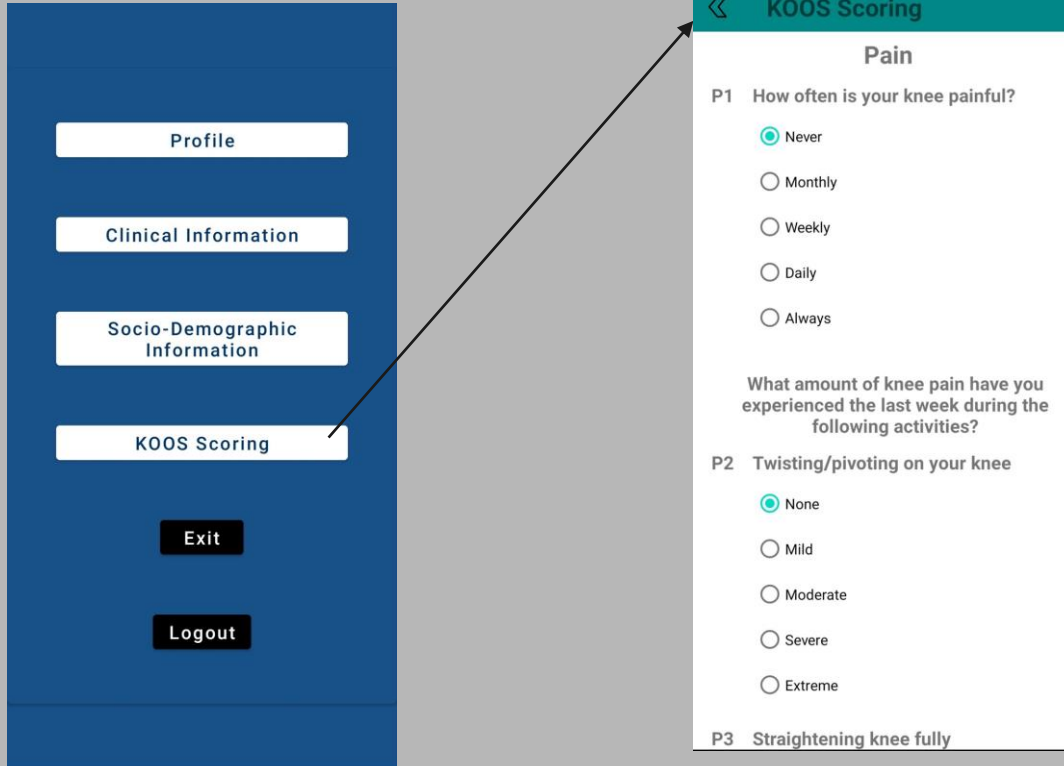
Which floor do you live in?

Ans

Do you frequently use staircases?

--select one--

Results



The diagram illustrates the navigation flow from a main menu to a specific scoring screen. On the left, a dark blue vertical menu contains four white buttons: 'Profile', 'Clinical Information', 'Socio-Demographic Information', and 'KOOS Scoring'. Below these are two black buttons: 'Exit' and 'Logout'. An arrow points from the 'KOOS Scoring' button to a larger screen on the right. This screen has a teal header with a back arrow and the text 'KOOS Scoring'. The main content area is white and titled 'Pain'. It contains two questions, P1 and P2, each with five radio button options. P1 asks 'How often is your knee painful?' with options: Never (selected), Monthly, Weekly, Daily, and Always. P2 asks 'Twisting/pivoting on your knee' with options: None (selected), Mild, Moderate, Severe, and Extreme. A third question, P3 'Straightening knee fully', is partially visible at the bottom.

KOOS Scoring

Pain

P1 How often is your knee painful?

- ☒ Never
- ☐ Monthly
- ☐ Weekly
- ☐ Daily
- ☐ Always


What amount of knee pain have you experienced the last week during the following activities?

P2 Twisting/pivoting on your knee

- ☒ None
- ☐ Mild
- ☐ Moderate
- ☐ Severe
- ☐ Extreme

P3 Straightening knee fully

Results

 **KOOS Scoring**

Q3 How troubled are you with lack of confidence in your knee?

☐ Not at all

☐ Mildly

☐ Moderately

☒ Severely

☐ Totally

Q4 In general, how much difficulty do you have with your knee?

☐ None

☐ Mild


☒ Moderate

☐ Severe

☐ Extreme

Calculate

Upload Score

 **KOOS Scoring**

Q3 How troubled are you with lack of confidence in your knee?

☐ Not at all

☐ Mildly

☐ Moderately

☒ Severely

☐ Totally

Q4 In general, how much difficulty do you have with your knee?

☐ None

☐ Mild

☒ Moderate

☐ Severe

☐ Extreme

Calculate

KOOS Score is :88

Score

Results : Doctor's Side View of Collected Data

Osteoarthritis Status

User Profile Table

SL	UID	PID	Phone Number
1	DvDwEMN6yxfmGZWSym9M65dpTyv2	23456789	+8801521468841
2	PW3YO8ZmpKRUY67EcqarPClxMw2	78899633	+8801726937948
3	UyiZFYIFW73tfAjjw0O61ZF033	12345678	+8801521468840

Table : User Profiles

User KOOS

SL	Date	UID	KOOS
1	01-05-2022 09:00:34	PW3YO8ZmpKRUY67EcqarPClxMw2	83

Site Link : <https://murshedatasnim.github.io/OA-App-Doctors-Side/>

Conclusion



Beneficial



Easy to use



User friendly

Future Work



- The database will be deployed in AWS
- The App will be available in Google Play Store
- The data collected from this application will be used to train a machine learning model to predict future OA level of a patient

References



- <https://orthoinfo.aaos.org/en/diseases--conditions/arthritis-of-the-knee/>
- <https://developer.android.com/docs>
- <https://www.mayoclinic.org/diseases-conditions/osteoarthritis/symptoms-causes/syc-20351925>
- <http://www.koos.nu/KOOSscoring2012.pdf>
- <https://www.apta.org/patient-care/evidence-based-practice-resources/test-measures/knee-injury-and-osteoarthritis-outcome-score-koos>
- https://firebase.google.com/docs?gclid=CjwKCAjw9-KTBhBcEiwAr19igxdzkOss8fAQFgY0g1x9r_aSb3GJh0hmz1-j6OVn6h67mbCuU5JlihoCt5kQAvD_BwE&gclsrc=aw.ds
- <https://teachmesurgery.com/orthopaedic/principles/osteoarthritis/>

Thank you
