Personalized Mobile Patient Guidance System for Early Detection and Management of Metabolic Syndrome

TMP-23-226

Status Document II

B M G Peiris

BSc (Hons) In Information Technology Specializing In Information Technology

Department of Information Technology

Sri Lanka Institute of Information Technology

Sri Lanka – **July 2023**

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Declaration, copyright statement and the statement of the supervisor

We declare that this is our own work and this proposal does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or Institute of higher learning and to the best of our knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

Name	Student ID	Signature
Peiris B.M.G	**IT20147396**	

The supervisor/s should certify the proposal report with the following declaration. The above candidates are carrying out research for the undergraduate Dissertation under my supervision.

…… ……24/07/2023…

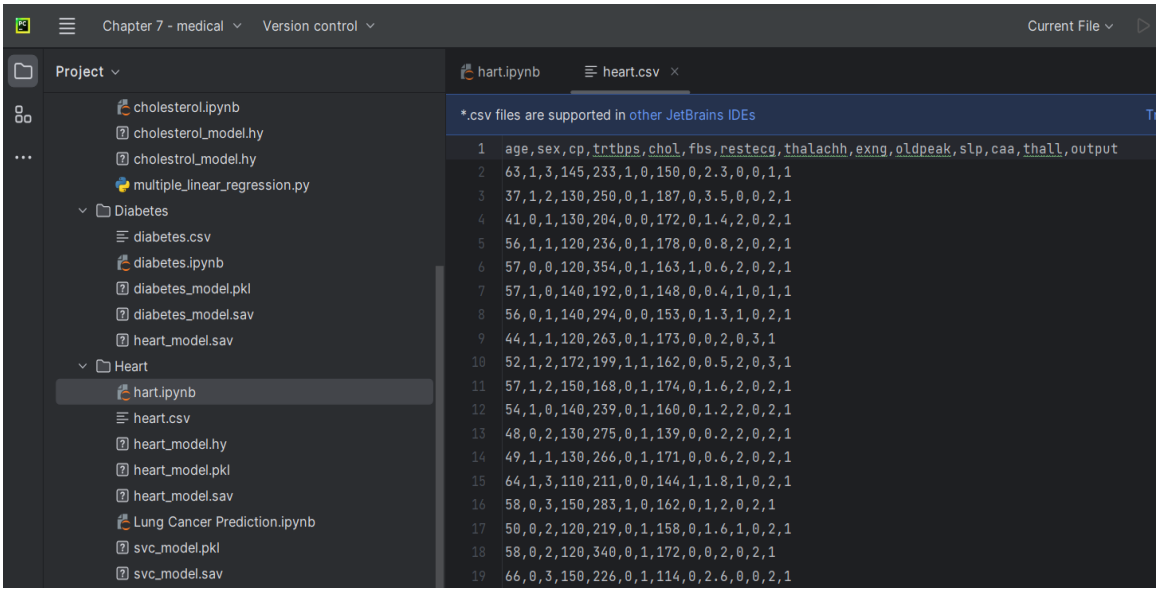
Signature of the supervisor Date

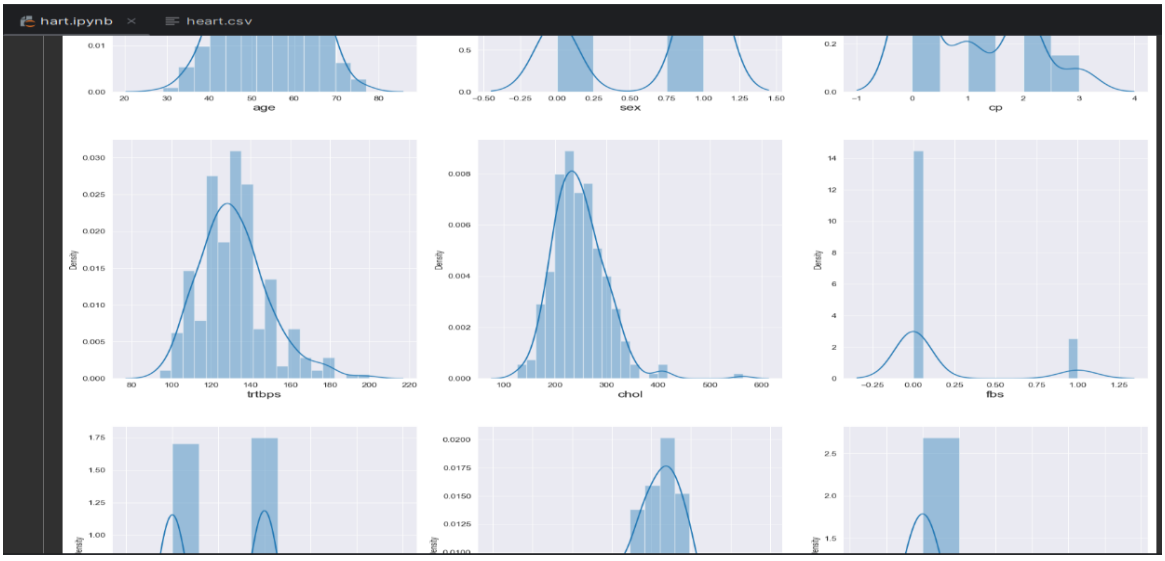
Contents

My Component Progress

Model Trainings

I have developed ***Heart Attack Prediction*** Model based on metabolic syndromes. I trained the data set to predict the Heart Attack. This heart attacks happens as a side effect of cholesterol and high blood pressure, that's why I selected to train this model.





KNN

[319]

```
from sklearn.neighbors import KNeighborsClassifier
k_model = KNeighborsClassifier(n_neighbors=16)
kfitModel = k_model.fit(X_train, Y_train)

# accuracy score on training data

kX_train_prediction = kfitModel.predict(X_train)
training_data_accuray = accuracy_score(kX_train_prediction,Y_train)
print('Accuracy on training data  : ', training_data_accuray)

# accuracy score on testing data
kX_test_prediction = kfitModel.predict(X_test)
kx_lgr_test_data_accuray = accuracy_score(kX_test_prediction,Y_test)
print('Accuracy on test data      : ', kx_lgr_test_data_accuray)
```

```
Accuracy on training data  :  0.8547717842323651
Accuracy on test data      :  0.819672131147541
```

Logistic Regression

[304]

```
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score, confusion_matrix, classification_report

lr = LogisticRegression()
lr.fit(X_train, Y_train)
y_pred = lr.predict(X_test)

lr_train_acc = accuracy_score(Y_train, lr.predict(X_train))
lr_test_acc = accuracy_score(Y_test, y_pred)

print(f"Training Accuracy of Logistic Regression Model is {lr_train_acc}")
print(f"Test Accuracy of Logistic Regression Model is {lr_test_acc}")
```

```
Training Accuracy of Logistic Regression Model is 0.8547717842323651
Test Accuracy of Logistic Regression Model is 0.7868852459016393
```

[305]

```
# confusion matrix
confusion_matrix(Y_test, y_pred)
```

```
array([[19,  9],
       [ 4, 29]], dtype=int64)
```

[306]

```
# classification report
print(classification_report(Y_test, y_pred))
```

```
              precision    recall  f1-score   support
```

DecisionTreeClassifier

[310]
```
from sklearn.tree import DecisionTreeClassifier

dtc = DecisionTreeClassifier()
dtc.fit(X_train, Y_train)

y_pred = dtc.predict(X_test)

dtc_train_acc = accuracy_score(Y_train, dtc.predict(X_train))
dtc_test_acc = accuracy_score(Y_test, y_pred)

print(f"Training Accuracy of Decision Tree Model is {dtc_train_acc}")
print(f"Test Accuracy of Decision Tree Model is {dtc_test_acc}")
```

```
Training Accuracy of Decision Tree Model is 1.0
Test Accuracy of Decision Tree Model is 0.7049180327868853
```

[311]
```
# confusion matrix
confusion_matrix(Y_test, y_pred)
```

```
array([[17, 11],
       [ 7, 26]], dtype=int64)
```

[312]
```
# classification report
print(classification_report(Y_test, y_pred))
```

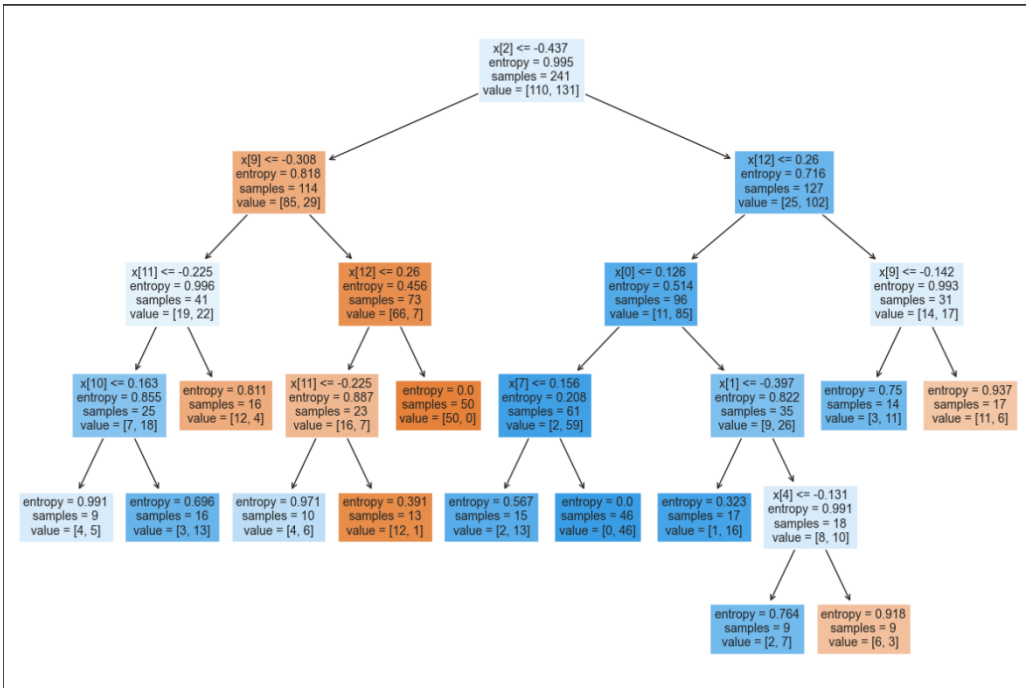
```
              precision    recall  f1-score   support
```

SVC

[307]
```
from sklearn.svm import SVC

svc = SVC()
svc.fit(X_train, Y_train)

y_pred = svc.predict(X_test)

svc_train_acc = accuracy_score(Y_train, svc.predict(X_train))
svc_test_acc = accuracy_score(Y_test, y_pred)

print(f"Training Accuracy of SVC Model is {svc_train_acc}")
print(f"Test Accuracy of SVC Model is {svc_test_acc}")
```

```
Training Accuracy of SVC Model is 0.9087136929460581
Test Accuracy of SVC Model is 0.8360655737704918
```

[308]
```
# confusion matrix
confusion_matrix(Y_test, y_pred)
```



Random Forest Classifier

[318]

```
from sklearn.ensemble import RandomForestClassifier

rand_clf = RandomForestClassifier(criterion = 'gini', max_depth = 3, max_features = 'sqrt', min_samples_leaf = 2, min_samp
rand_clf.fit(X_train, Y_train)

y_pred = rand_clf.predict(X_test)

rand_clf_train_acc = accuracy_score(Y_train, rand_clf.predict(X_train))
rand_clf_test_acc = accuracy_score(Y_test, y_pred)

print(f"Training Accuracy of Random Forest Model is {rand_clf_train_acc}")
print(f"Test Accuracy of Random Forest Model is {rand_clf_test_acc}")
```

```
Training Accuracy of Random Forest Model is 0.8879668049792531
Test Accuracy of Random Forest Model is 0.819672131147541
```

XGB Classifier

[325]

```
from xgboost import XGBClassifier

xgb = XGBClassifier(booster = 'gblinear', learning_rate = 1, n_estimators = 10)
xgb.fit(X_train, Y_train)

y_pred = xgb.predict(X_test)

xgb_train_acc = accuracy_score(Y_train, xgb.predict(X_train))
xgb_test_acc = accuracy_score(Y_test, y_pred)

print(f"Training Accuracy of XGB Model is {xgb_train_acc}")
print(f"Test Accuracy of XGB Model is {xgb_test_acc}")
```

```
Training Accuracy of XGB Model is 0.8506224066390041
Test Accuracy of XGB Model is 0.7868852459016393
```

[326]

```
models = ['Logistic Regression', 'KNN', 'SVC', 'Decision Tree', 'Random Forest','Gradient Boosting', 'XgBoost']
scores = [lr_test_acc, kx_lgr_test_data_accuray, svc_test_acc, dtc_test_acc, rand_clf_test_acc,gb_test_acc, xgb_test_acc]

models = pd.DataFrame({'Model' : models, 'Score' : scores})
```

GradientBoostingClassifier

[320]
```
#Gradient Boosting Classifier
from sklearn.ensemble import GradientBoostingClassifier

gb = GradientBoostingClassifier()

parameters = {
    'loss': ['deviance', 'exponential'],
    'learning_rate': [0.001, 0.1, 1, 10],
    'n_estimators': [100, 150, 180, 200]
}

grid_search = GridSearchCV(gb, parameters, cv = 5, n_jobs = -1, verbose = 1)
grid_search.fit(X_train, Y_train)
```

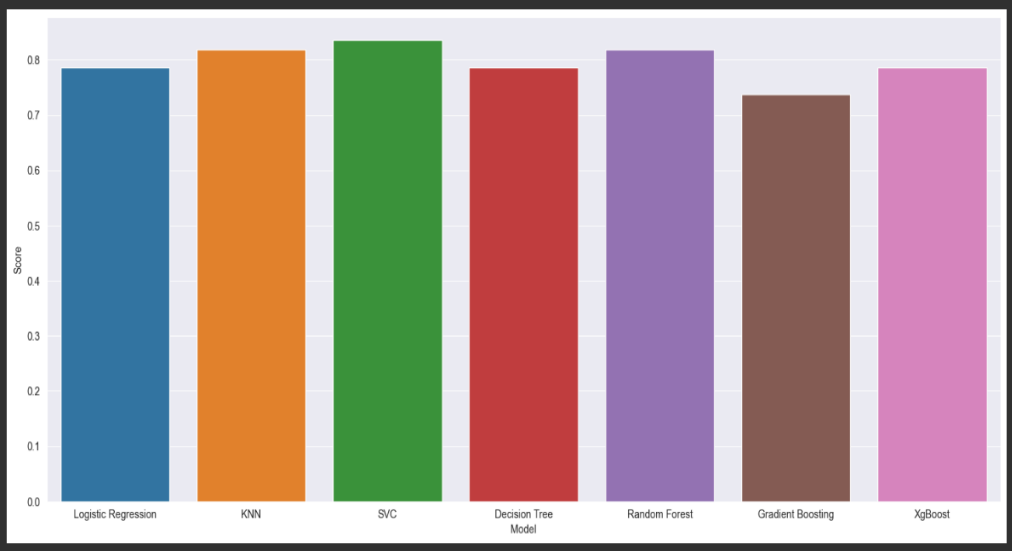
```
Fitting 5 folds for each of 32 candidates, totalling 160 fits
```

GridSearchCV
estimator: GradientBoostingClassifier
GradientBoostingClassifier

[321]
```
# best parameter and best score

print(grid_search.best_params_)
print(grid_search.best_score_)
```

```
{'learning_rate': 1, 'loss': 'exponential', 'n_estimators': 200}
0.8051870748299319
```

[327]
```
plt.figure(figsize = (18, 8))

sns.barplot(x = 'Model', y = 'Score', data = models)
plt.show()
```



SVC gives us the best result so we will save this model for production but it overfited then i select Random Forest .

Check the 2 possible outputs

We add 2 condition to identify the 2 possible outcomes

1. More chance of having heart Attack

2. less chance of having heart Attack

```
[360]
if y_New == 0:
    print("Less chance of heart attack")
else:
    print("More chance of heart attack")

y_New- [1]
More chance of heart attack

[361]
if y_2 == 0:
    print("More chance of heart attack")
else:
    print("Less chance of heart attack")

y_2- [0]
More chance of heart attack
```

our accuracy score is 0.8196721.hy file provides the desired output for the heart attack analysis and prediction dataset for the purpose.

```
76]
if y_New == 0:
    print("Less chance of heart attack")
else:
    print("More chance of heart attack")

Less chance of heart attack
```

```
[369]
import numpy as np
import joblib

[370]
loaded_model = joblib.load('heart_model.hy')

[374]
X_New = np.array([55,1,0,140,217,0,1,111,1,5.6,0,0,3])
X_New = np.reshape(X_New, (1, -1))

[375]
y_New = loaded_model.predict(X_New)

[376]
if y_New == 0:
    print("Less chance of heart attack")
else:
    print("More chance of heart attack")

Less chance of heart attack
```

Developing UI parts

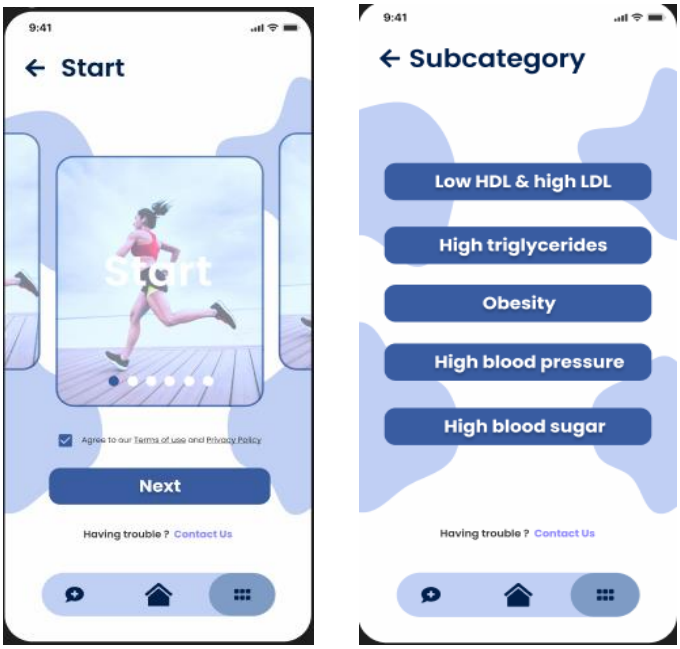


Figure 1 screenshot of first and two interfaces in giving health recommendation component in the metabolic mobile app.

Figure 2 screenshot of third and fourth interfaces in giving health recommendation component in the metabolic mobile app.

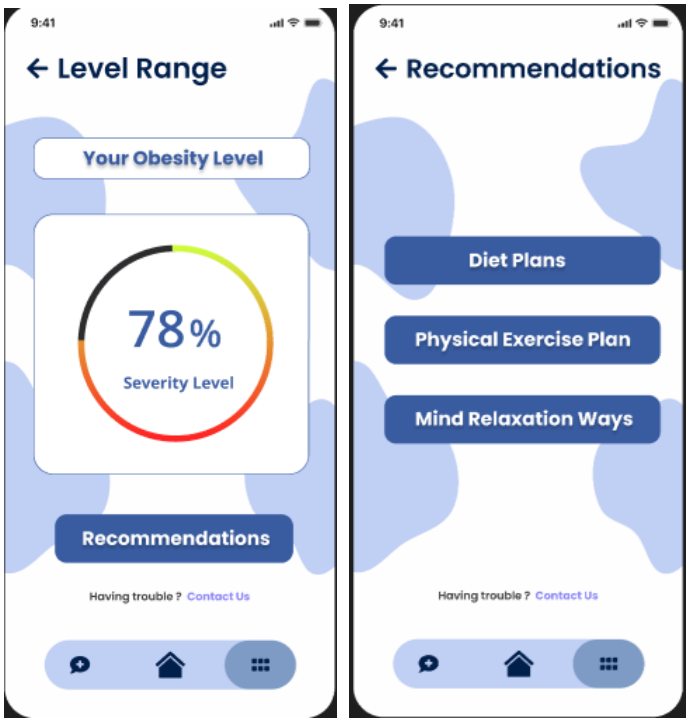


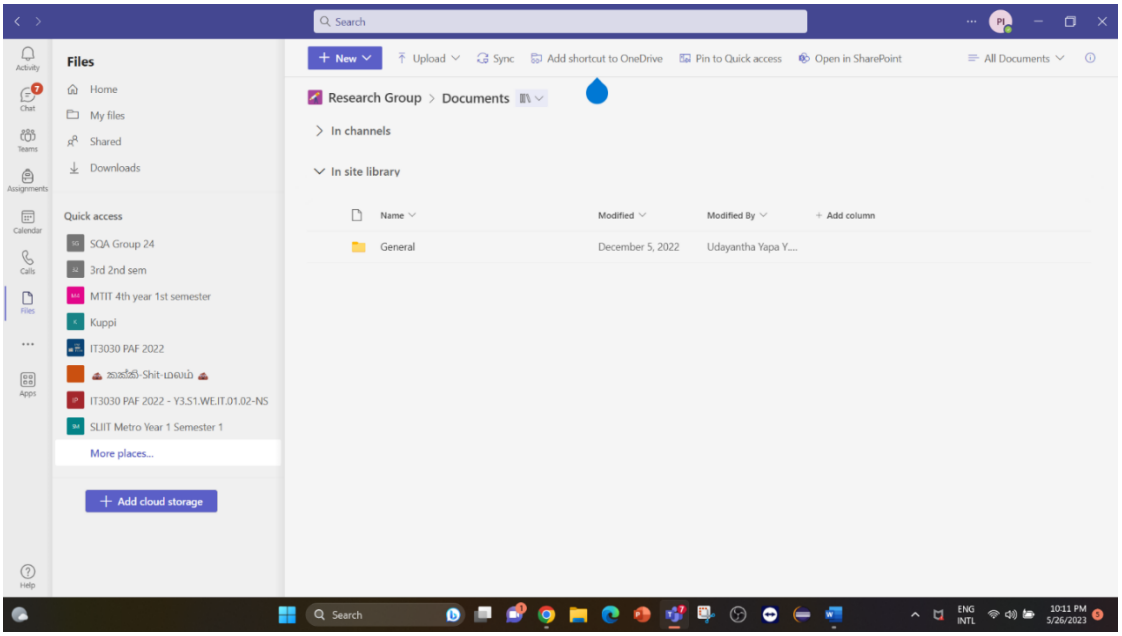
Figure 3 screenshot of fifth and final interfaces in giving health recommendation component in the metabolic mobile app.

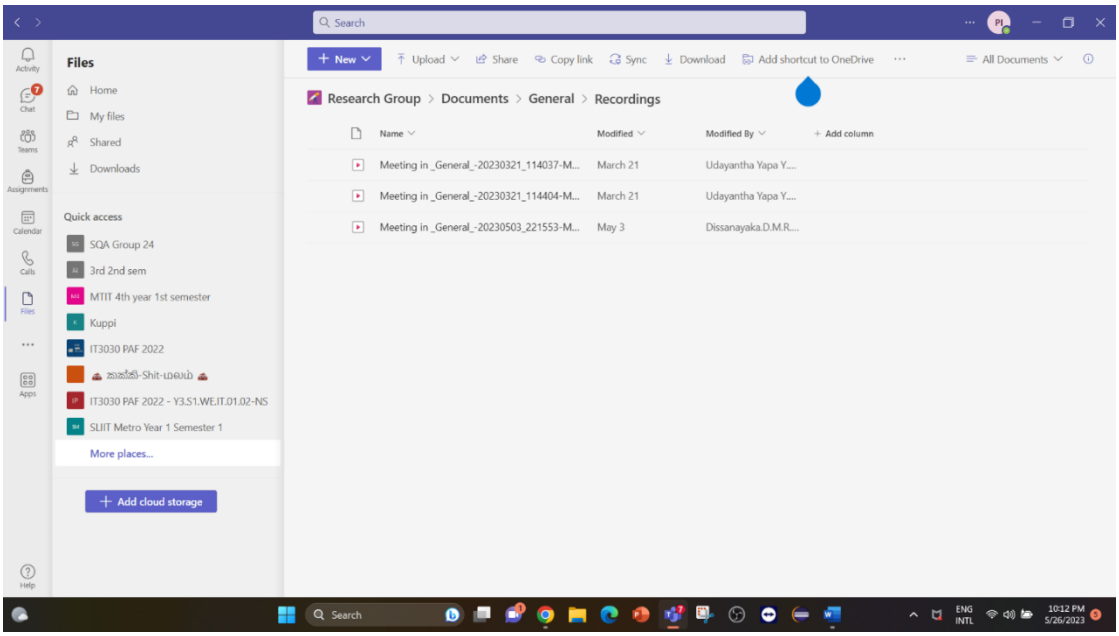
After the start mobile interface, If the patient select or system select the subcategory is obesity or any other one disease among those five diseases then system will show the Age Range metabolic mobile interface to the patient. Patient will select or system will choose the age range is 35-50 years the system shows the obesity level range of that patient. Then system will show is this obesity level is low obesity level or medium obesity level or high obesity level to the patient. At the finally, system will provide suitable health recommendation and suggestions including food plans and exercise plans to the patient.

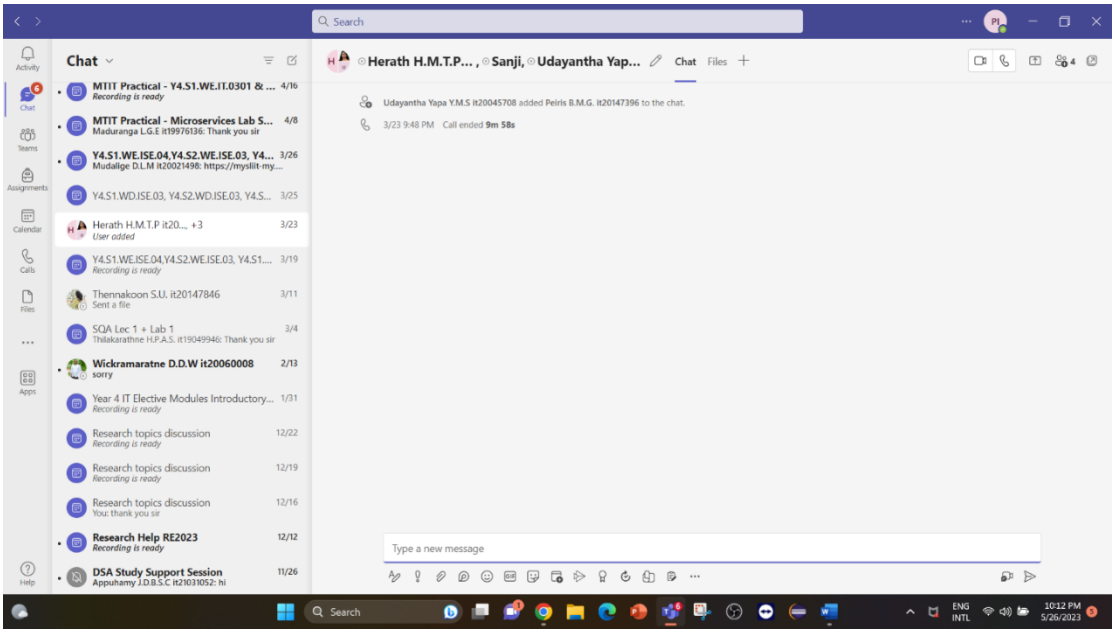
- EX: - 78% = High obesity risk Weight

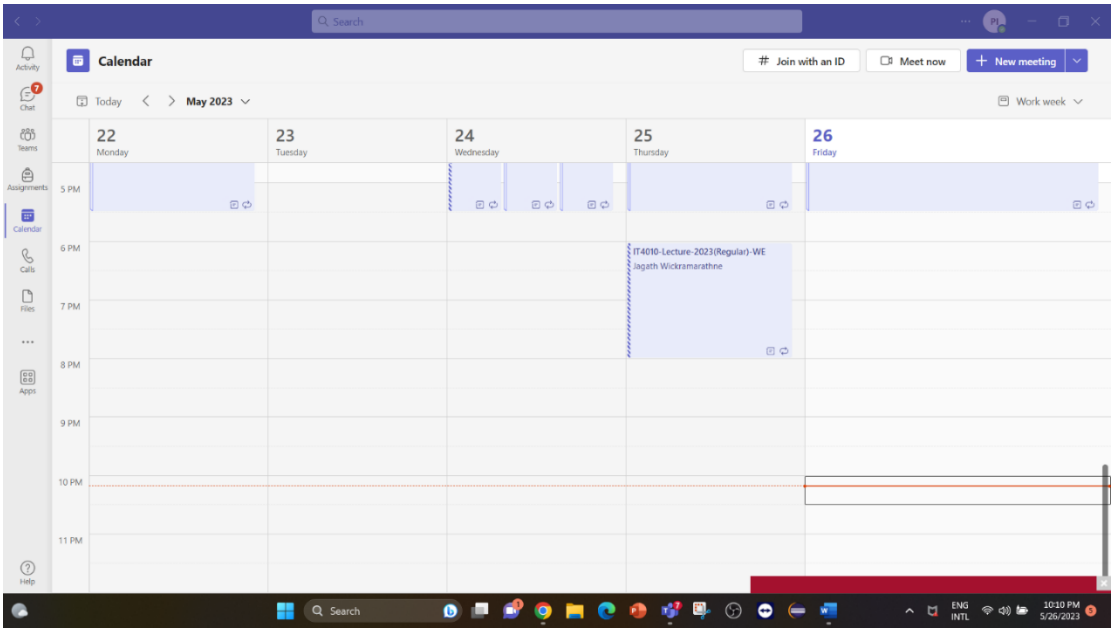
That is the overall flow of my component. Figure 1- Figure 3 is the final screenshot of all interfaces in giving health recommendation component in the metabolic mobile application. I had used different technologies including Machine-learning, Deep-Learning, Artificial Intelligence, tacking technologies, Goalsetting tools to provide the consistence and correct health recommendations to the patient and I used light color range including blue and white to the interfaces because of this is the medical mobile application that's why I choose light color range. Mainly, our system will generate health recommendations and suggestions by scanning report and tracking patient's details, Patients can enter their details. Provide these two facilities. My system will give health recommendations and suggestions based on the risk Weight of the prediction and give food plans and exercise plans based on the diseases.

Screenshots of MS Teams

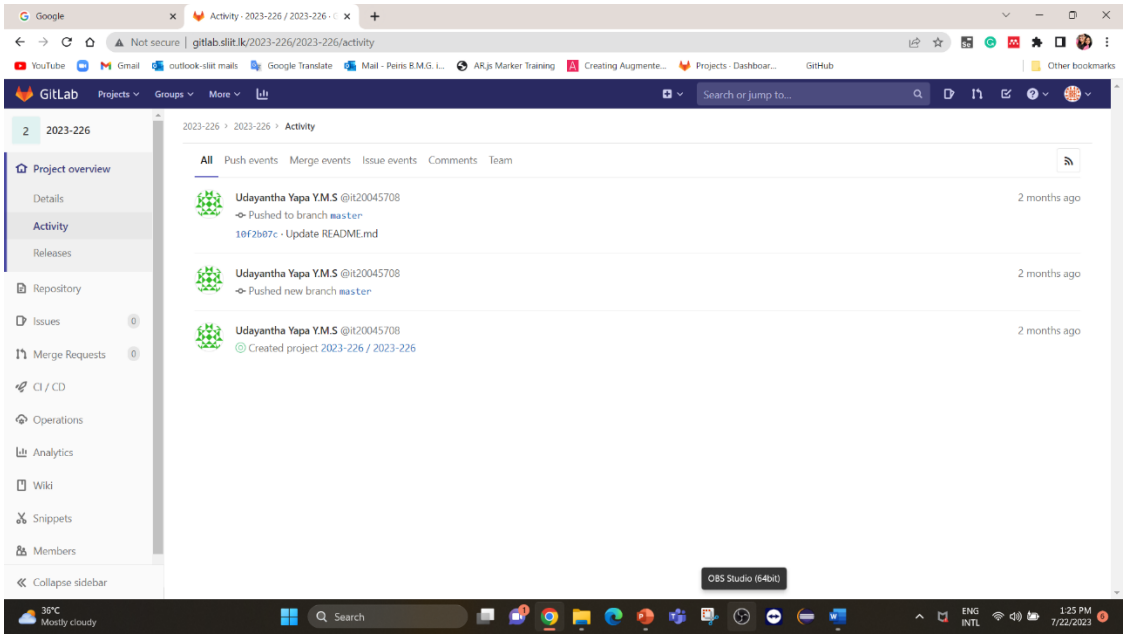


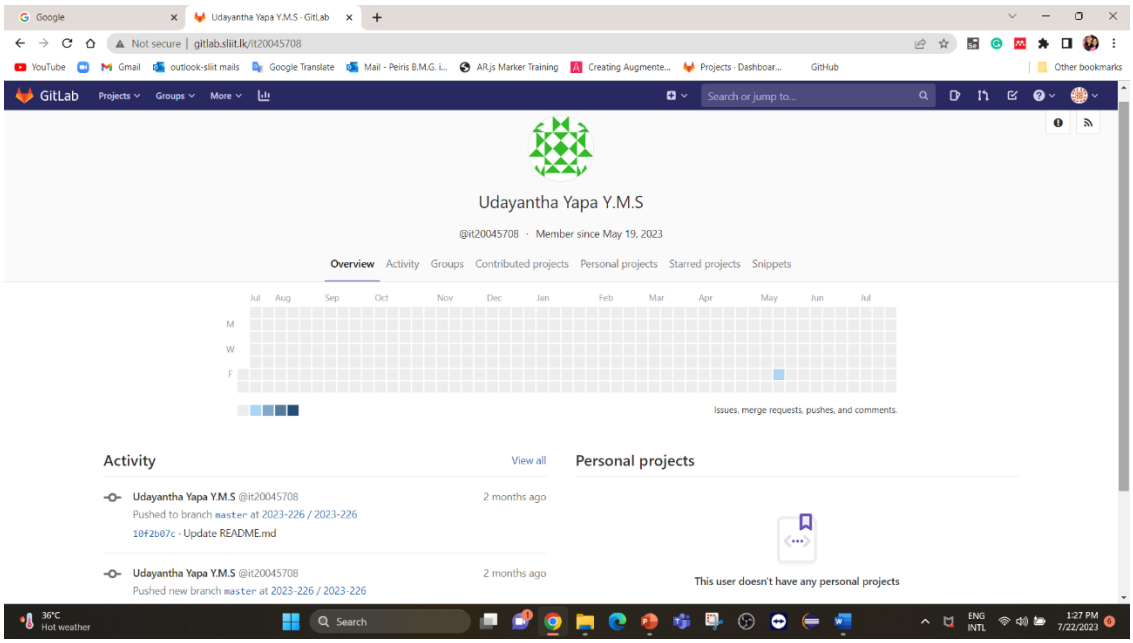


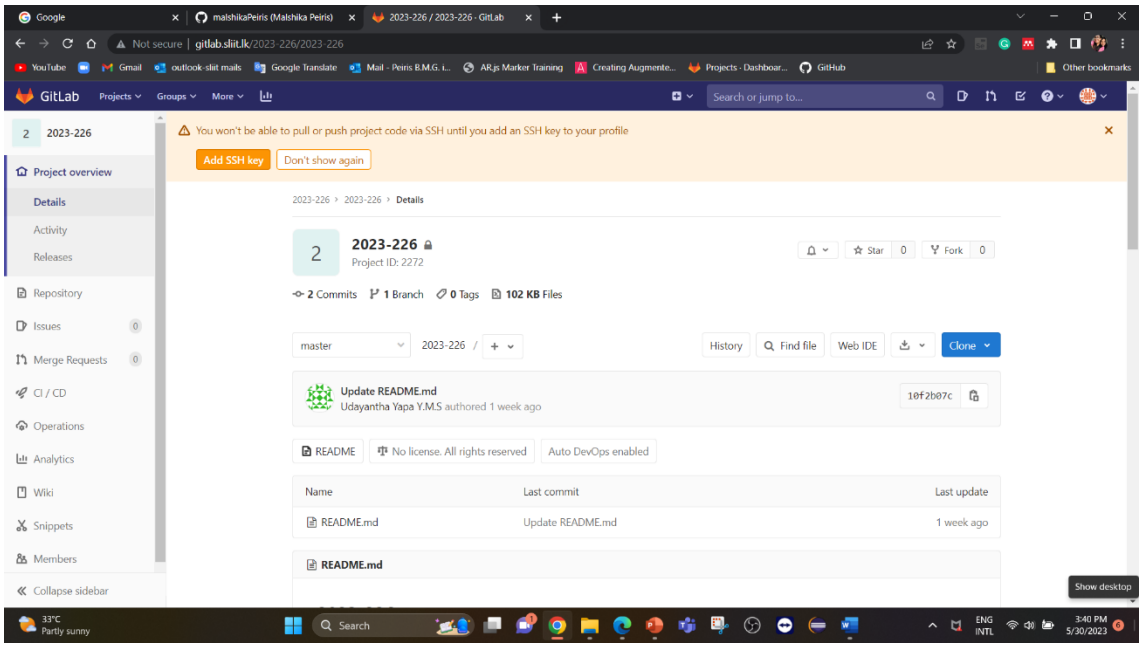

Search
Chat
Herath H.M.T.P... , Sanji, Udayantha Yap...
Chat
Files
Udayantha Yapa Y.M.S it20045708 added Peiris B.M.G. it20147396 to the chat.
3/23 9:48 PM Call ended 9m 58s
Type a new message
MTIT Practical - Y4.S1.WE.IT.0301 & ...
MTIT Practical - Microservices Lab S...
Y4.S1.WE.ISE.04,Y4.S2.WE.ISE.03, Y4...
Y4.S1.WD.ISE.03, Y4.S2.WD.ISE.03, Y4.S...
Herath H.M.T.P it20..., +3
Y4.S1.WE.ISE.04,Y4.S2.WE.ISE.03, Y4.S1....
Thennakoon S.U. it20147846
SQA Lec 1 + Lab 1
Wickramaratne D.D.W it20060008
Year 4 IT Elective Modules Introductory...
Research topics discussion
Research topics discussion
Research topics discussion
Research Help RE2023
DSA Study Support Session

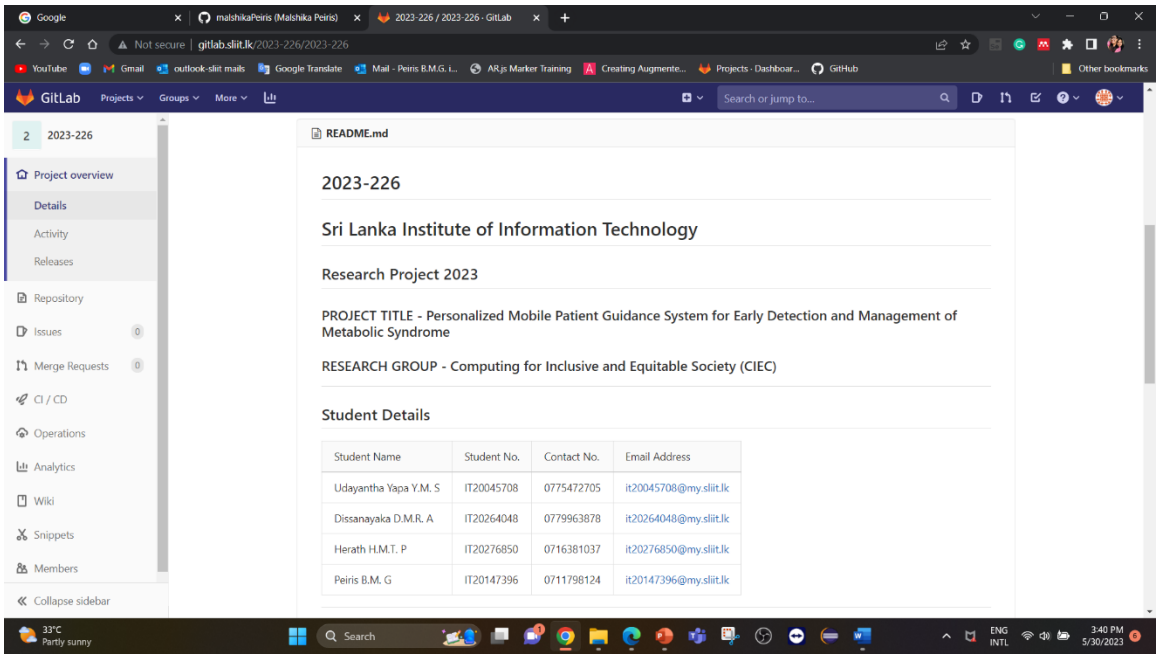

Search
Calendar
Join with an ID
Meet now
New meeting
Today
May 2023
Work week
22 Monday
23 Tuesday
24 Wednesday
25 Thursday
26 Friday
5 PM
6 PM
7 PM
8 PM
9 PM
10 PM
11 PM
IT4010-Lecture-2023(Regular)-WE
Jagath Wickramarathne

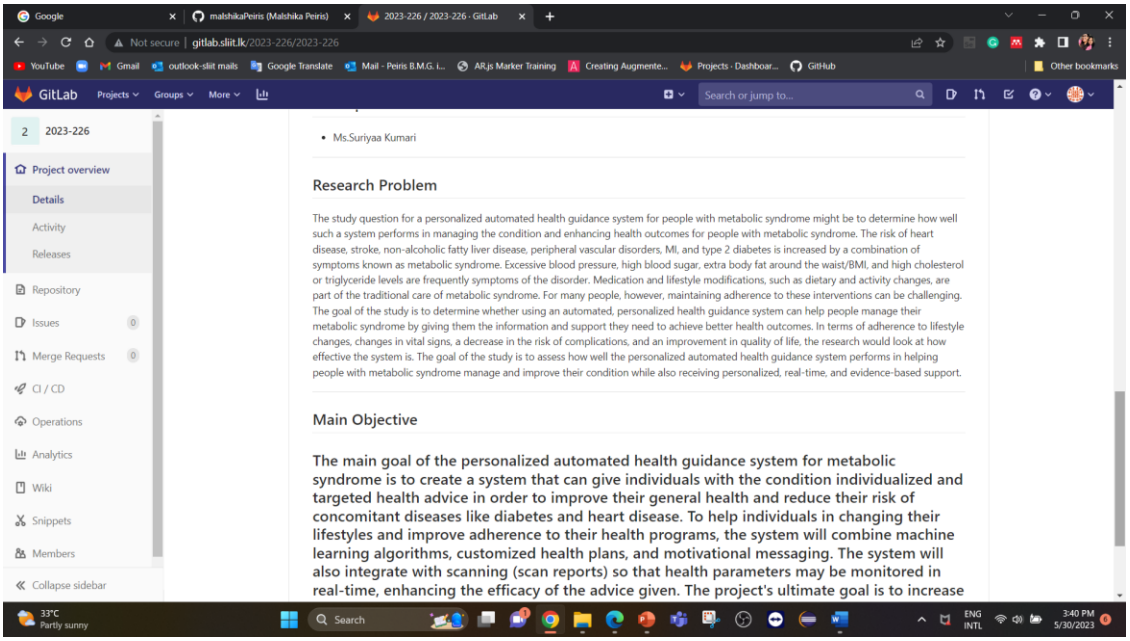
Git Lab


Google
Activity · 2023-226 / 2023-226
Not secure | gitlab.sliit.lk/2023-226/2023-226/activity
GitLab
Projects
Groups
More
Search or jump to...
2023-226
Project overview
Details
Activity
Releases
Repository
Issues
Merge Requests
CI / CD
Operations
Analytics
Wiki
Snippets
Members
Collapse sidebar
2023-226 › 2023-226 › Activity
All
Push events
Merge events
Issue events
Comments
Team
Udayantha Yapa Y.M.S @it20045708
Pushed to branch master
10f2b07c · Update README.md
2 months ago
Udayantha Yapa Y.M.S @it20045708
Pushed new branch master
2 months ago
Udayantha Yapa Y.M.S @it20045708
Created project 2023-226 / 2023-226
2 months ago
OBS Studio (64bit)
36°C
Mostly cloudy
Search
ENG
INTL
1:25 PM
7/22/2023

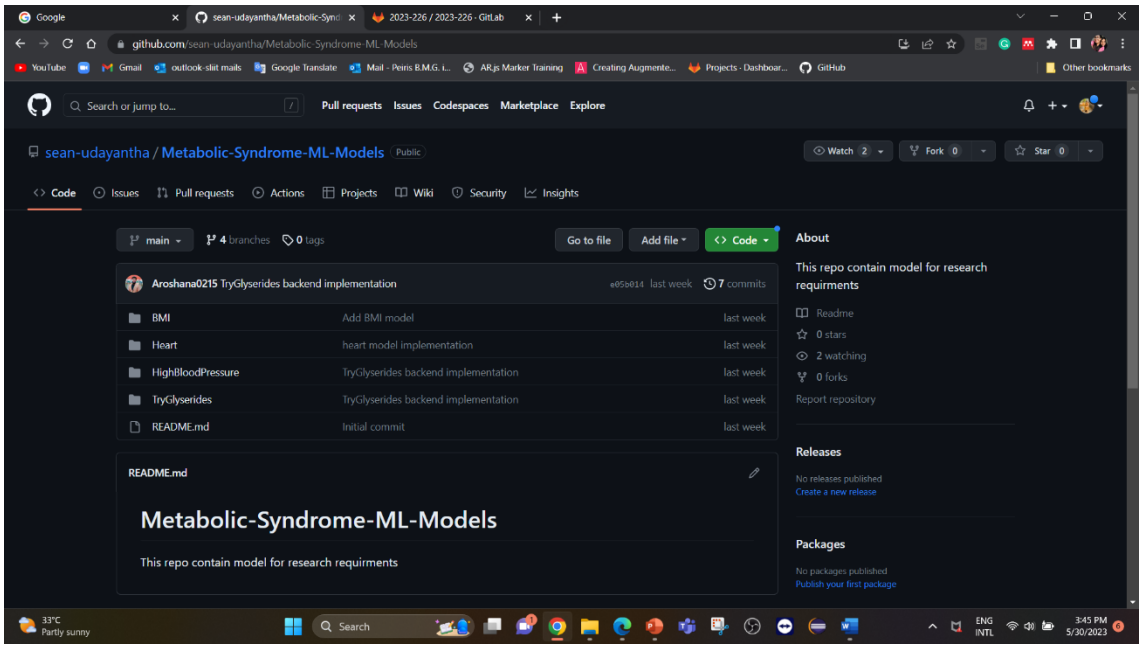

Google
Udayantha Yapa Y.M.S · GitLab
Not secure | gitlab.sliit.lk/it20045708
GitLab
Projects
Groups
More
Search or jump to...
Udayantha Yapa Y.M.S
@it20045708 · Member since May 19, 2023
Overview
Activity
Groups
Contributed projects
Personal projects
Starred projects
Snippets
Issues, merge requests, pushes, and comments.
Activity
View all
Udayantha Yapa Y.M.S @it20045708
Pushed to branch master at 2023-226 / 2023-226
10f2b07c · Update README.md
2 months ago
Udayantha Yapa Y.M.S @it20045708
Pushed new branch master at 2023-226 / 2023-226
2 months ago
Personal projects
This user doesn't have any personal projects
36°C
Hot weather
Search
ENG
INTL
1:27 PM
7/22/2023

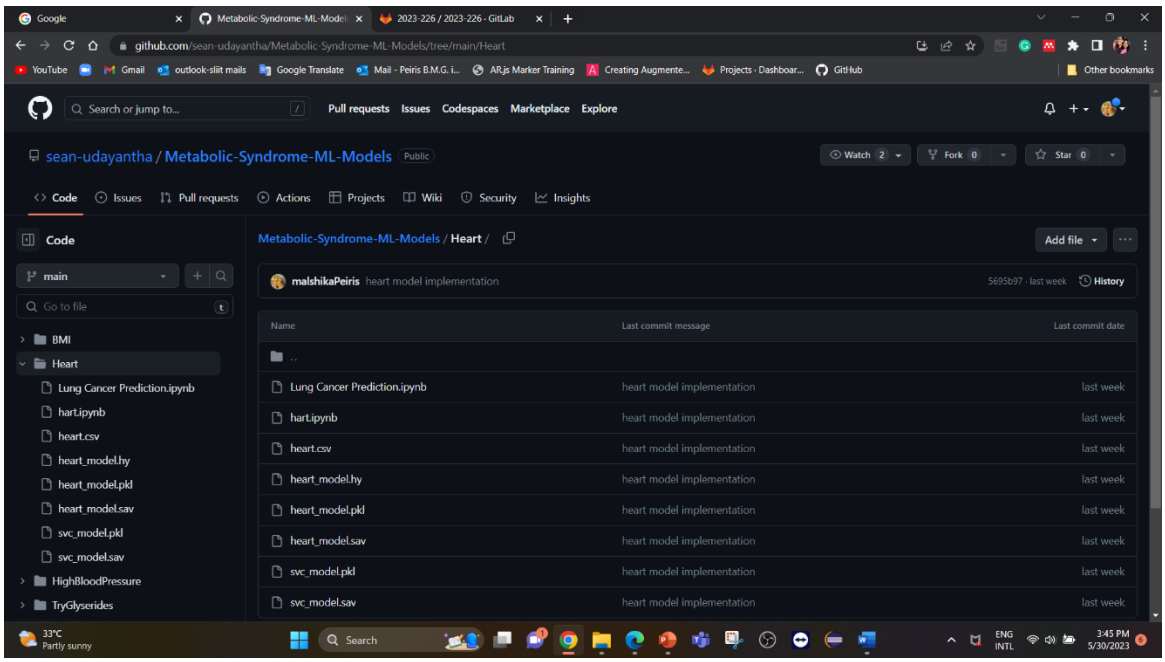

GitLab
2023-226
You won't be able to pull or push project code via SSH until you add an SSH key to your profile
Add SSH key
Don't show again
2023-226
Project ID: 2272
2 Commits
1 Branch
0 Tags
102 KB Files
master
History
Find file
Web IDE
Clone
Update README.md
Udayantha Yapa Y.M.S authored 1 week ago
README
No license. All rights reserved
Auto DevOps enabled
README.md
Update README.md
1 week ago


README.md
2023-226
Sri Lanka Institute of Information Technology
Research Project 2023
PROJECT TITLE - Personalized Mobile Patient Guidance System for Early Detection and Management of Metabolic Syndrome
RESEARCH GROUP - Computing for Inclusive and Equitable Society (CIEC)
Student Details
Udayantha Yapa Y.M. S IT20045708 0775472705 it20045708@my.sliit.lk
Dissanayaka D.M.R. A IT20264048 0779963878 it20264048@my.sliit.lk
Herath H.M.T. P IT20276850 0716381037 it20276850@my.sliit.lk
Peiris B.M. G IT20147396 0711798124 it20147396@my.sliit.lk


Google
malshikaPeiris (Malshika Peiris)
2023-226 / 2023-226 · GitLab
Not secure | gitlab.sliit.lk/2023-226/2023-226
YouTube
Gmail
outlook-sliit mails
Google Translate
Mail - Peiris B.M.G. i...
ARjs Marker Training
Creating Augmente...
Projects · Dashboar...
GitHub
Other bookmarks
GitLab
Projects
Groups
More
Search or jump to...
2
2023-226
Project overview
Details
Activity
Releases
Repository
Issues
Merge Requests
CI / CD
Operations
Analytics
Wiki
Snippets
Members
Collapse sidebar
Ms.Suriyaa Kumari
Research Problem
The study question for a personalized automated health guidance system for people with metabolic syndrome might be to determine how well such a system performs in managing the condition and enhancing health outcomes for people with metabolic syndrome. The risk of heart disease, stroke, non-alcoholic fatty liver disease, peripheral vascular disorders, MI, and type 2 diabetes is increased by a combination of symptoms known as metabolic syndrome. Excessive blood pressure, high blood sugar, extra body fat around the waist/BMI, and high cholesterol or triglyceride levels are frequently symptoms of the disorder. Medication and lifestyle modifications, such as dietary and activity changes, are part of the traditional care of metabolic syndrome. For many people, however, maintaining adherence to these interventions can be challenging. The goal of the study is to determine whether using an automated, personalized health guidance system can help people manage their metabolic syndrome by giving them the information and support they need to achieve better health outcomes. In terms of adherence to lifestyle changes, changes in vital signs, a decrease in the risk of complications, and an improvement in quality of life, the research would look at how effective the system is. The goal of the study is to assess how well the personalized automated health guidance system performs in helping people with metabolic syndrome manage and improve their condition while also receiving personalized, real-time, and evidence-based support.
Main Objective
The main goal of the personalized automated health guidance system for metabolic syndrome is to create a system that can give individuals with the condition individualized and targeted health advice in order to improve their general health and reduce their risk of concomitant diseases like diabetes and heart disease. To help individuals in changing their lifestyles and improve adherence to their health programs, the system will combine machine learning algorithms, customized health plans, and motivational messaging. The system will also integrate with scanning (scan reports) so that health parameters may be monitored in real-time, enhancing the efficacy of the advice given. The project's ultimate goal is to increase
33°C
Partly sunny
Search
ENG
INTL
3:40 PM
5/30/2023

Git Hub


github.com/sean-udayantha/Metabolic-Syndrome-ML-Models
Search or jump to...
Pull requests
Issues
Codespaces
Marketplace
Explore
sean-udayantha / Metabolic-Syndrome-ML-Models
Public
Watch 2
Fork 0
Star 0
Code
Issues
Pull requests
Actions
Projects
Wiki
Security
Insights
main
4 branches
0 tags
Go to file
Add file
Code
Aroshana0215 TryGlyserides backend implementation
7 commits
BMI
Add BMI model
last week
Heart
heart model implementation
last week
HighBloodPressure
TryGlyserides backend implementation
last week
TryGlyserides
TryGlyserides backend implementation
last week
README.md
Initial commit
last week
About
This repo contain model for research requirments
Readme
0 stars
2 watching
0 forks
Report repository
Releases
No releases published
Create a new release
Packages
No packages published
Publish your first package
README.md
Metabolic-Syndrome-ML-Models
This repo contain model for research requirments


github.com/sean-udayantha/Metabolic-Syndrome-ML-Models/tree/main/Heart
Search or jump to...
Pull requests
Issues
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Marketplace
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sean-udayantha / Metabolic-Syndrome-ML-Models
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Actions
Projects
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Security
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svc_model.sav
HighBloodPressure
TryGlyserides
Metabolic-Syndrome-ML-Models / Heart /
Add file
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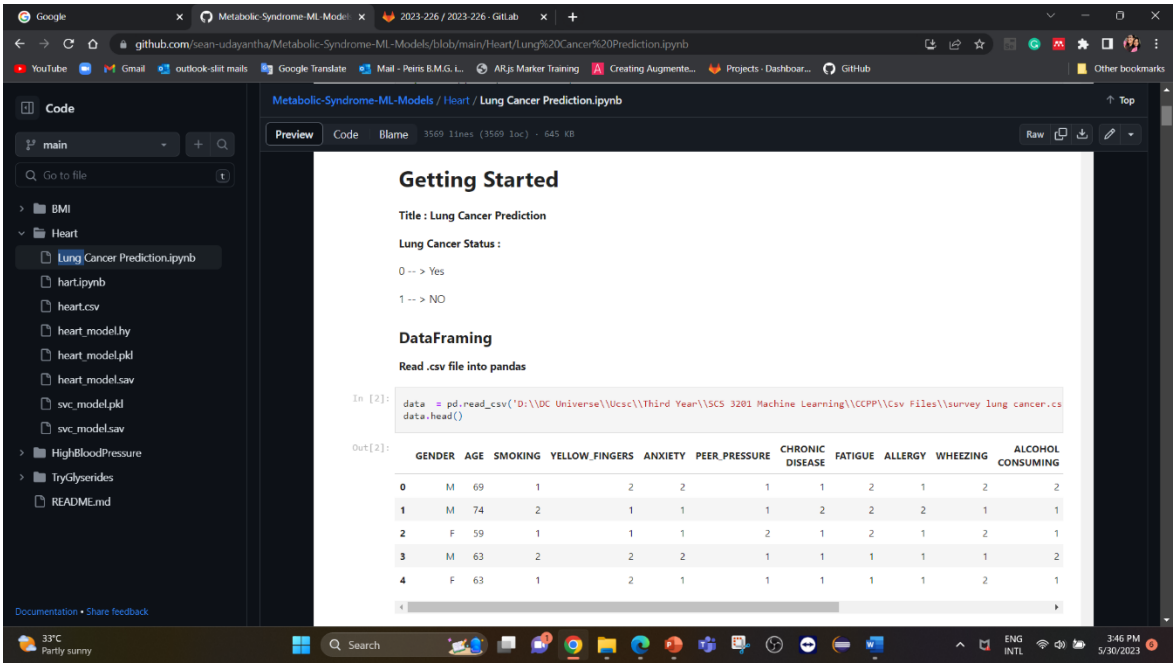
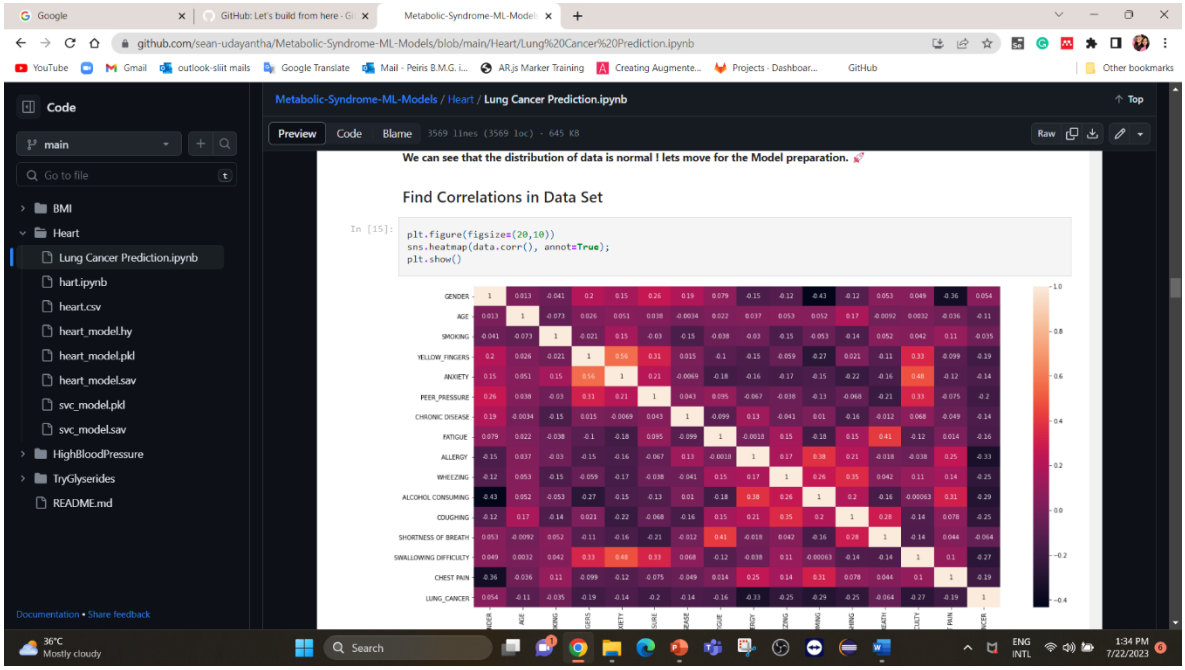
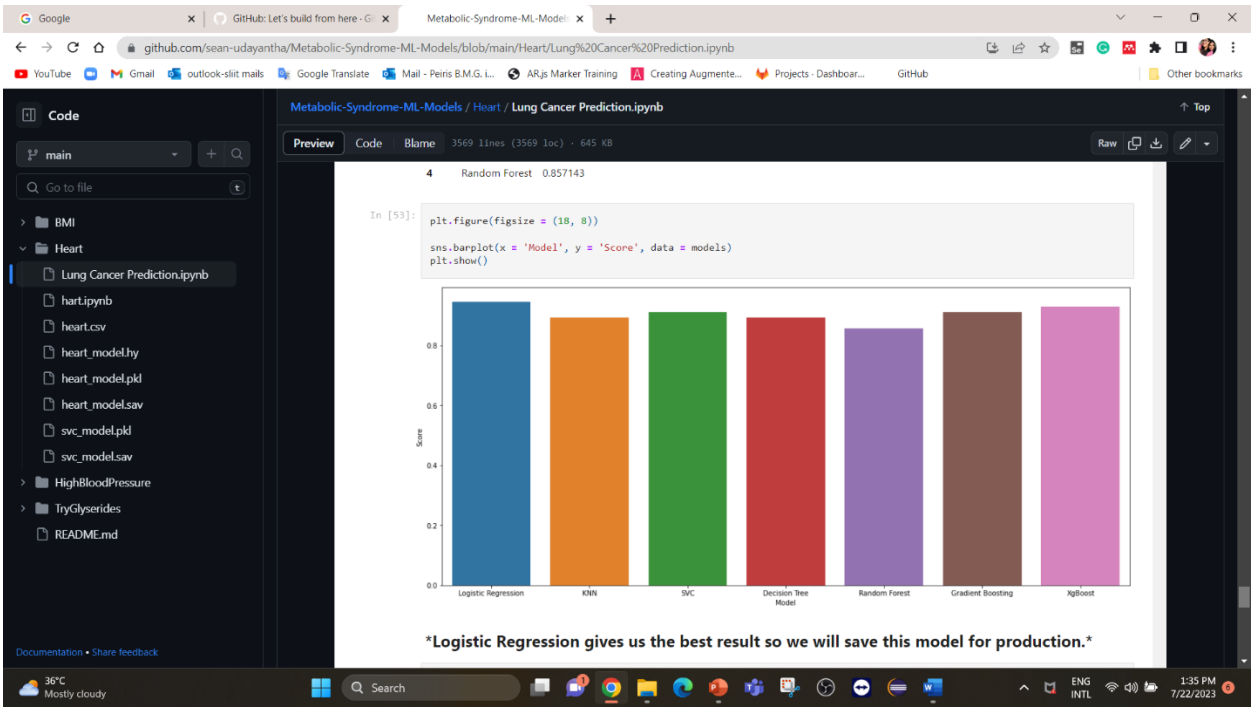
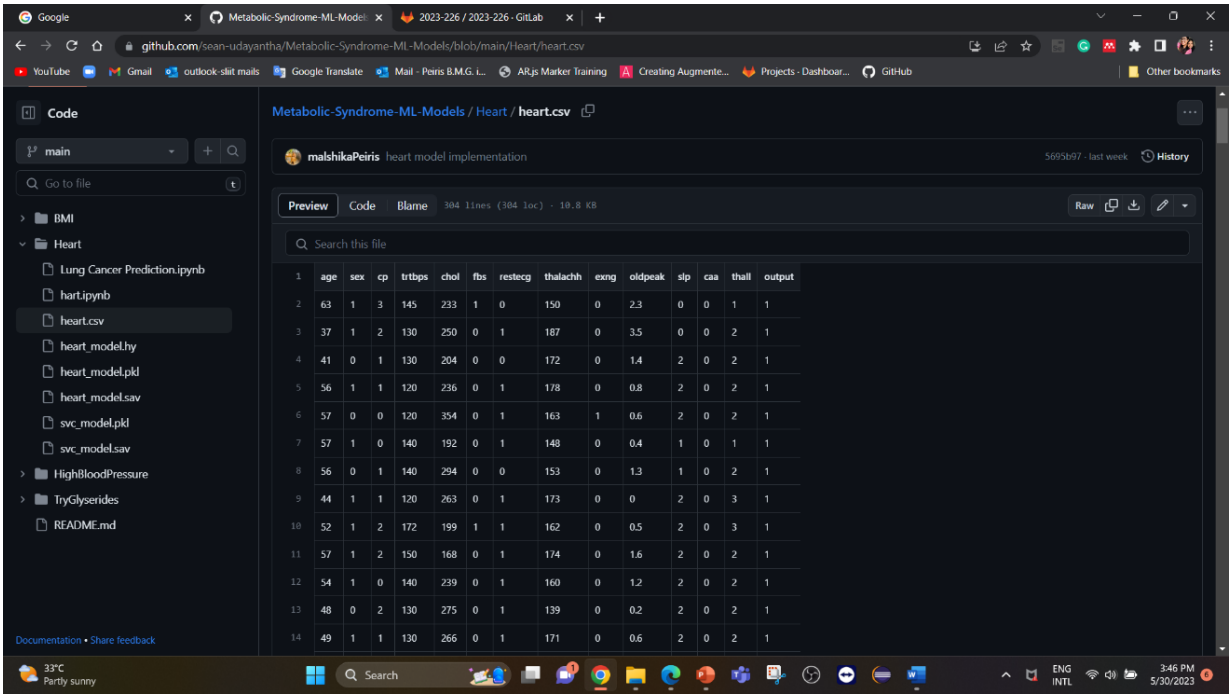
History
Name
Last commit message
Last commit date
Lung Cancer Prediction.ipynb
heart model implementation
last week
hart.ipynb
heart model implementation
last week
heart.csv
heart model implementation
last week
heart_model.hy
heart model implementation
last week
heart_model.pkl
heart model implementation
last week
heart_model.sav
heart model implementation
last week
svc_model.pkl
heart model implementation
last week
svc_model.sav
heart model implementation
last week


Metabolic-Syndrome-ML-Models / Heart / Lung Cancer Prediction.ipynb
Preview
Code
Blame
Raw
Getting Started
Title : Lung Cancer Prediction
Lung Cancer Status :
0 -- > Yes
1 -- > NO
DataFraming
Read .csv file into pandas
In [2]:
data = pd.read_csv('D:\\DC Universe\\Ucsc\\Third Year\\SCS 3201 Machine Learning\\CCPP\\Csv Files\\survey lung cancer.cs
data.head()
Out[2]:
GENDER AGE SMOKING YELLOW_FINGERS ANXIETY PEER_PRESSURE CHRONIC DISEASE FATIGUE ALLERGY WHEEZING ALCOHOL CONSUMING
0 M 69 1 2 2 1 1 2 1 2 2
1 M 74 2 1 1 1 2 2 2 1 1
2 F 59 1 1 1 2 1 2 1 2 1
3 M 63 2 2 2 1 1 1 1 1 2
4 F 63 1 2 1 1 1 1 1 2 1


Metabolic-Syndrome-ML-Models / Heart / Lung Cancer Prediction.ipynb
Preview
Code
Blame
Raw
We can see that the distribution of data is normal ! lets move for the Model preparation.
Find Correlations in Data Set
In [15]:
plt.figure(figsize=(20,10))
sns.heatmap(data.corr(), annot=True);
plt.show()


Metabolic-Syndrome-ML-Models / Heart / Lung Cancer Prediction.ipynb
4 Random Forest 0.857143
In [53]:
plt.figure(figsize = (18, 8))
sns.barplot(x = 'Model', y = 'Score', data = models)
plt.show()
Logistic Regression
KNN
SVC
Decision Tree
Random Forest
Gradient Boosting
XgBoost
Logistic Regression gives us the best result so we will save this model for production.


Metabolic-Syndrome-ML-Models / Heart / heart.csv
malshikaPeiris heart model implementation
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63 1 3 145 233 1 0 150 0 2.3 0 0 1 1
37 1 2 130 250 0 1 187 0 3.5 0 0 2 1
41 0 1 130 204 0 0 172 0 1.4 2 0 2 1
56 1 1 120 236 0 1 178 0 0.8 2 0 2 1
57 0 0 120 354 0 1 163 1 0.6 2 0 2 1
57 1 0 140 192 0 1 148 0 0.4 1 0 1 1
56 0 1 140 294 0 0 153 0 1.3 1 0 2 1
44 1 1 120 263 0 1 173 0 0 2 0 3 1
52 1 2 172 199 1 1 162 0 0.5 2 0 3 1
57 1 2 150 168 0 1 174 0 1.6 2 0 2 1
54 1 0 140 239 0 1 160 0 1.2 2 0 2 1
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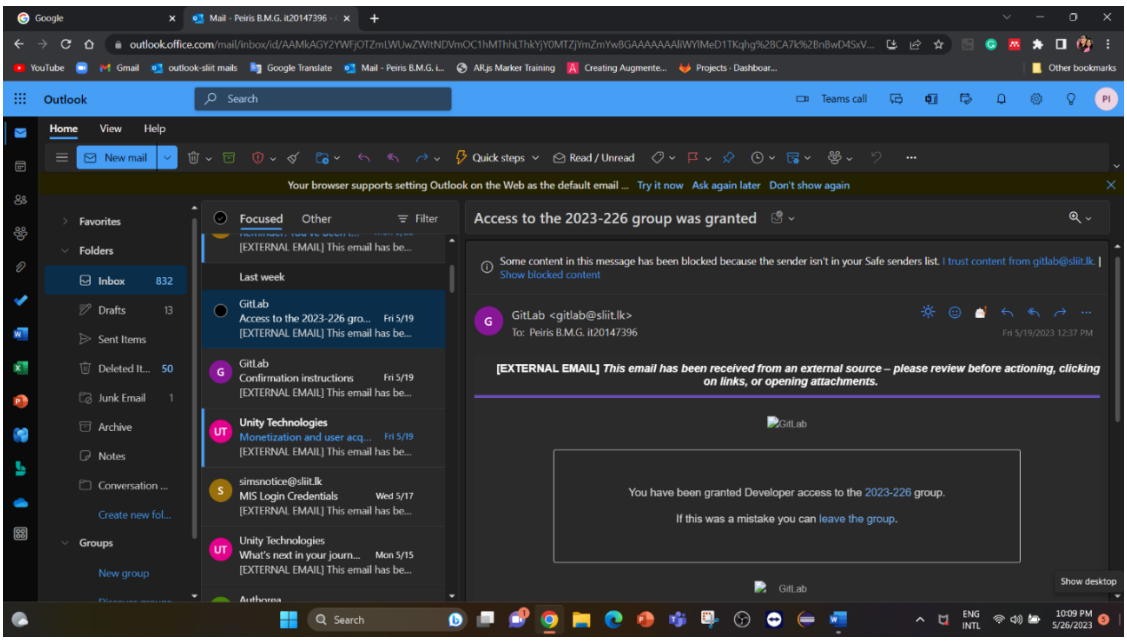
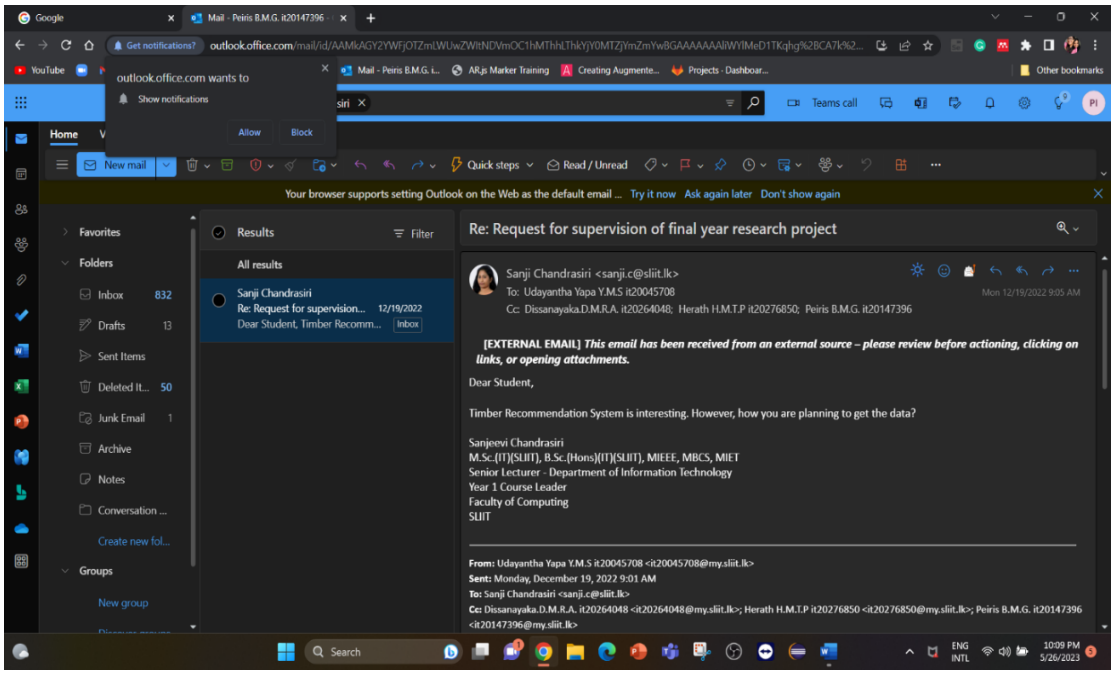
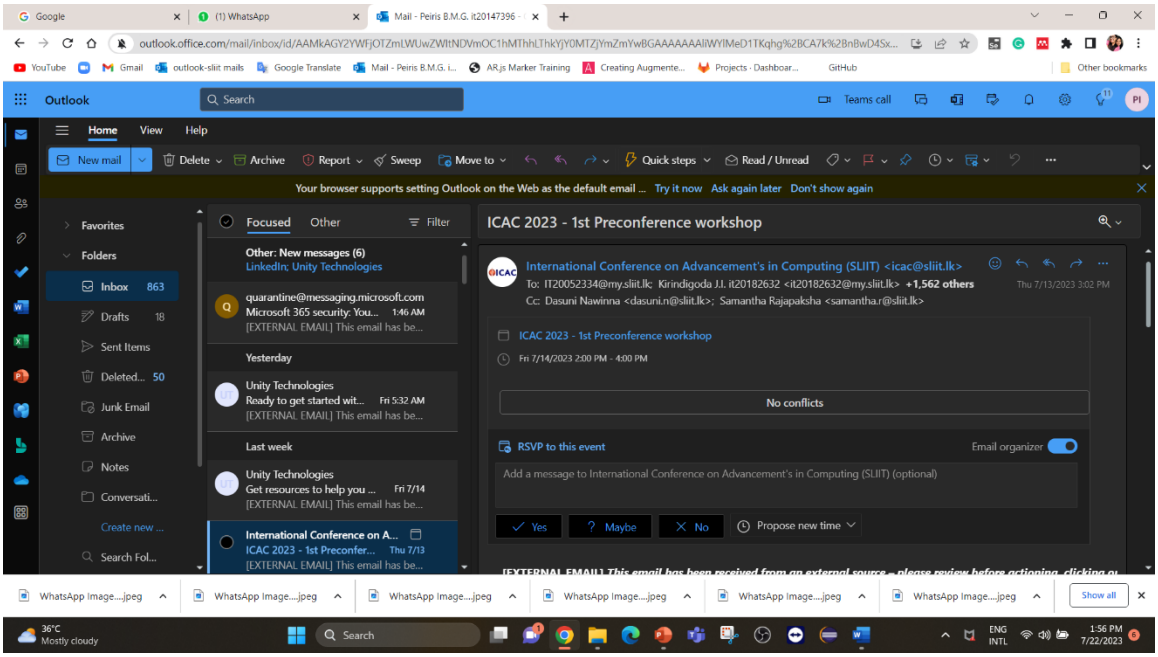
49 1 1 130 266 0 1 171 0 0.6 2 0 2 1

Outlook Mails



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International Conference on Advancement's in Computing (SLIIT) <icac@sliit.lk>
To: IT20052334@my.sliit.lk; Kirindigoda J.I. it20182632 <it20182632@my.sliit.lk> +1,562 others
Cc: Dasuni Nawinna <dasuni.n@sliit.lk>; Samantha Rajapaksha <samantha.r@sliit.lk>
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RSVP to this event
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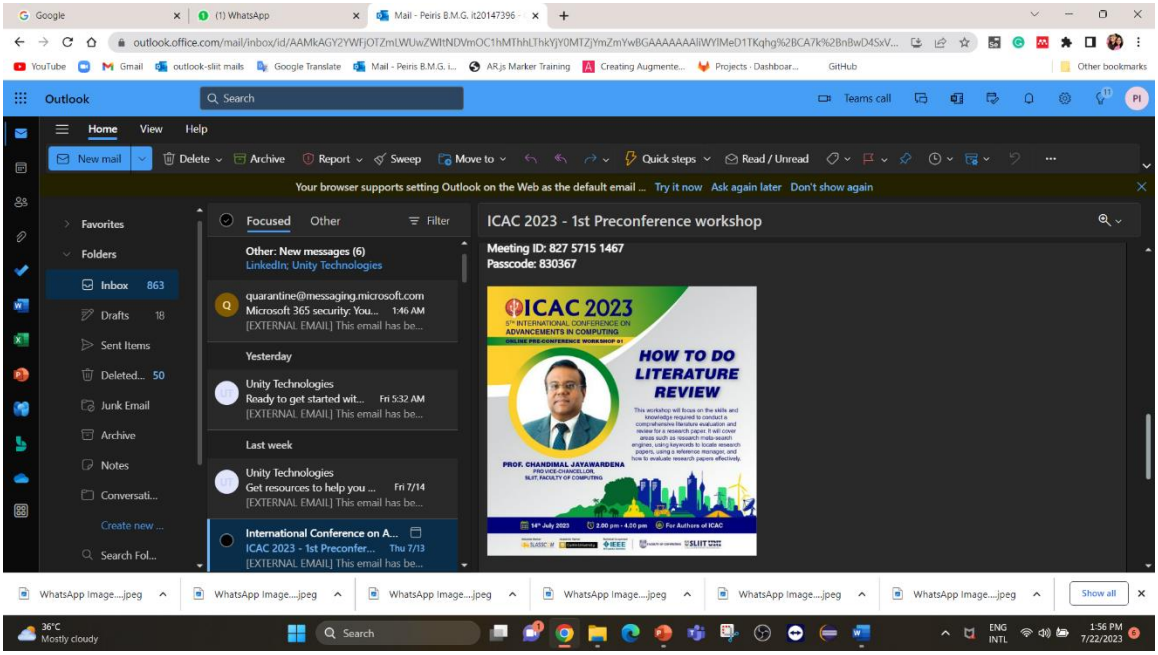
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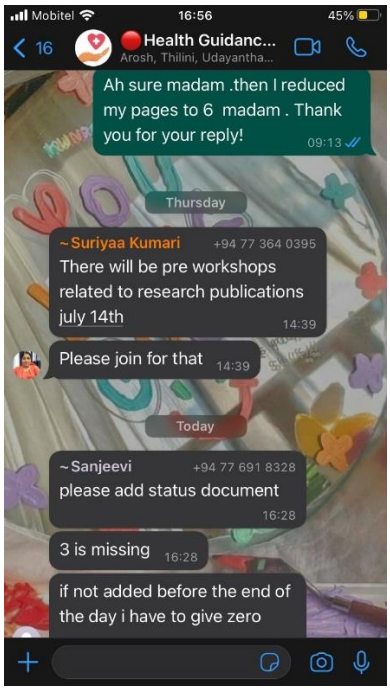
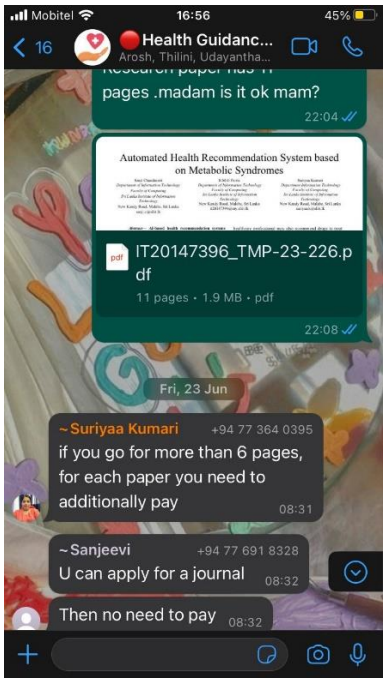
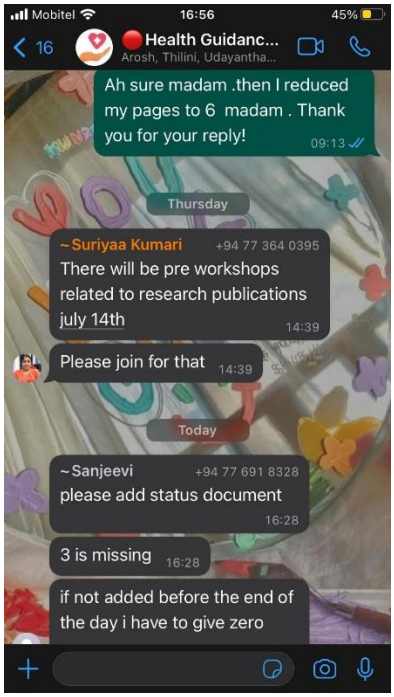
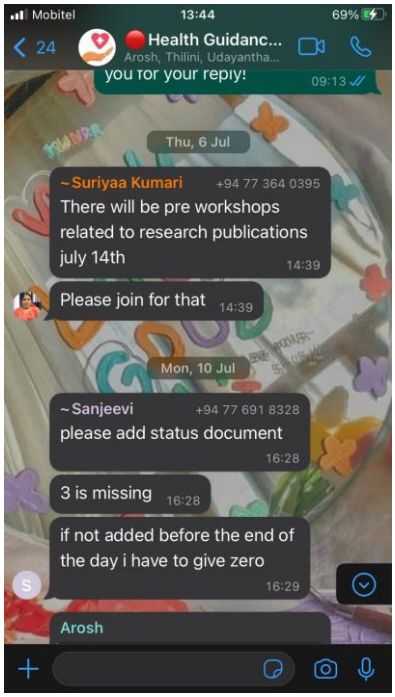
Communication via WhatsApp

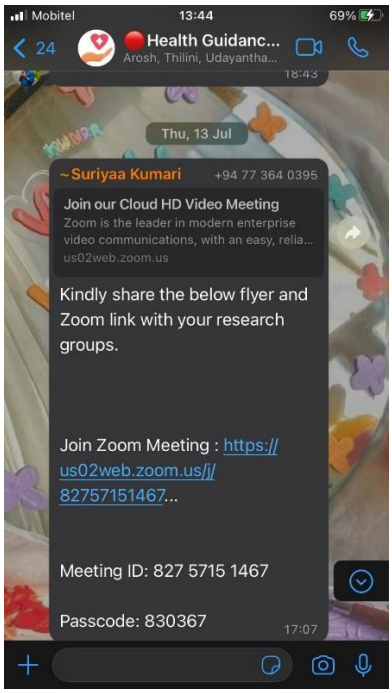
Group with the Supervisor and co-supervisor



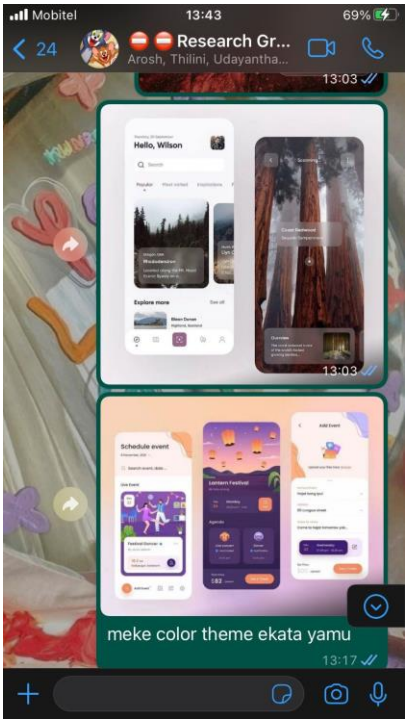


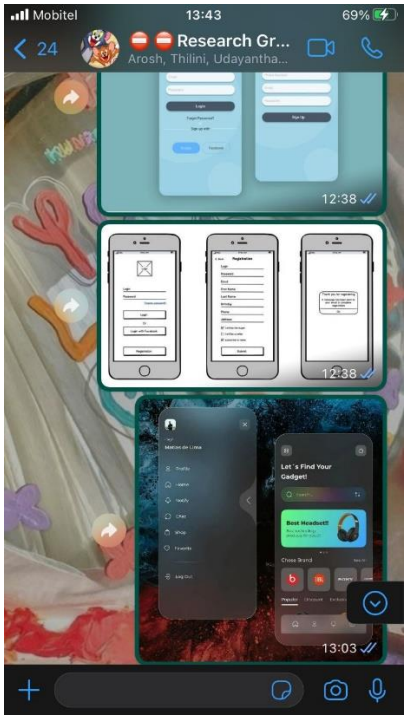


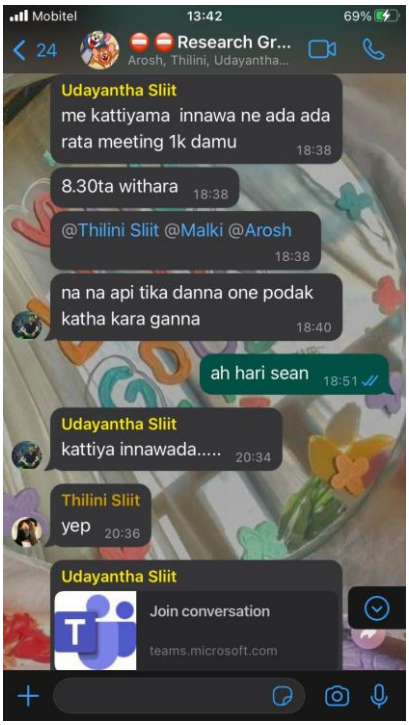


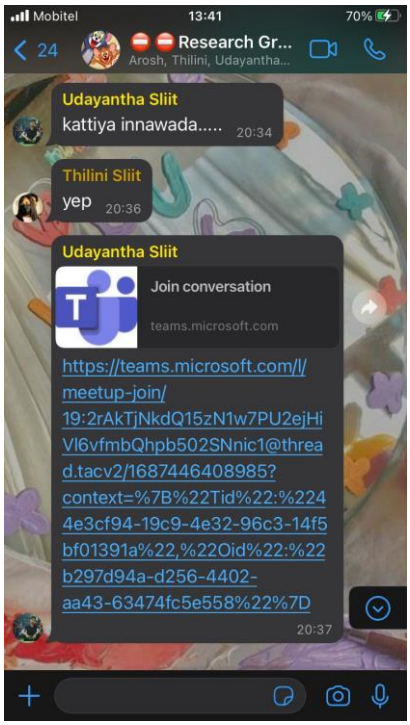


Group with the team members

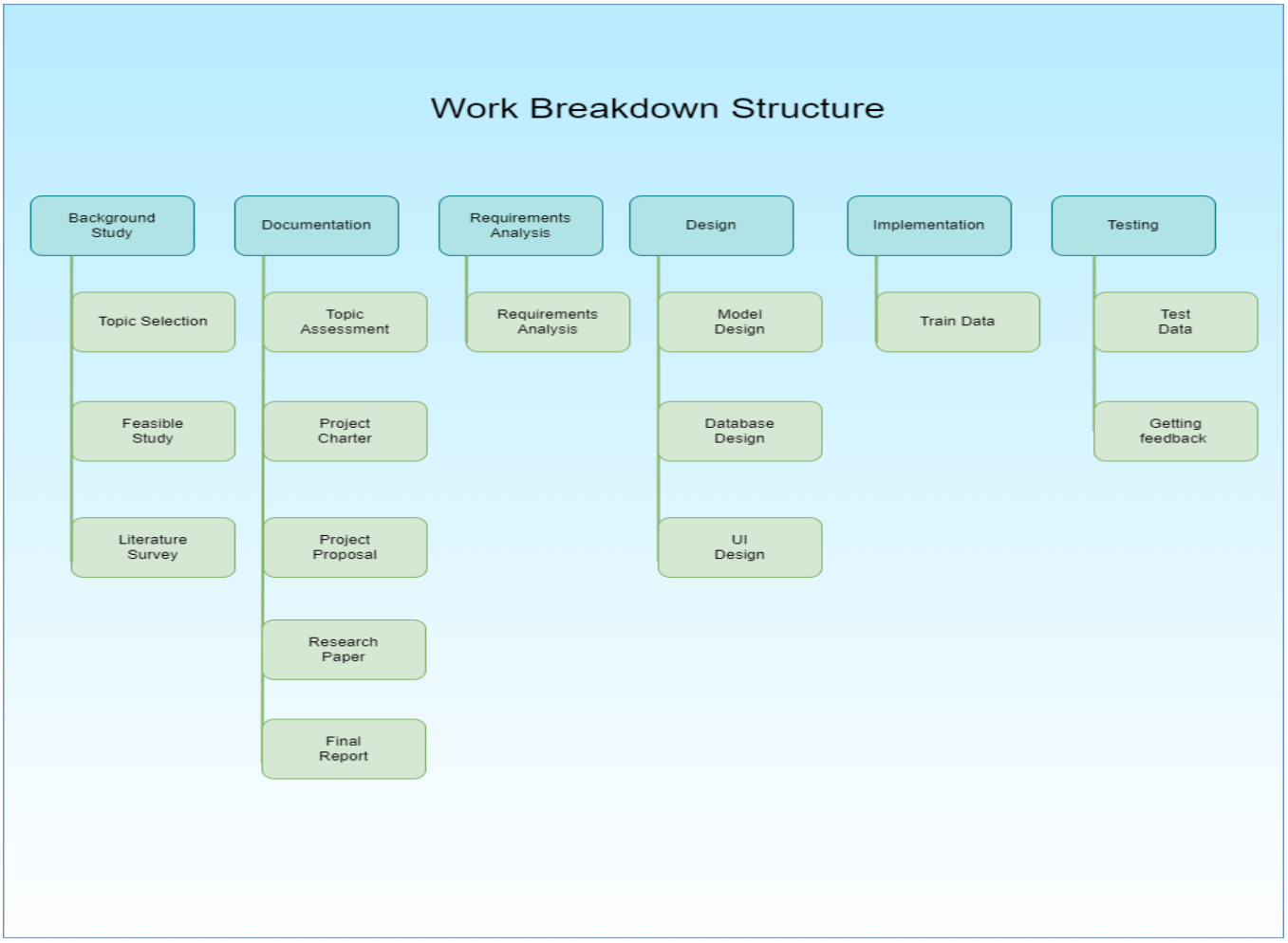




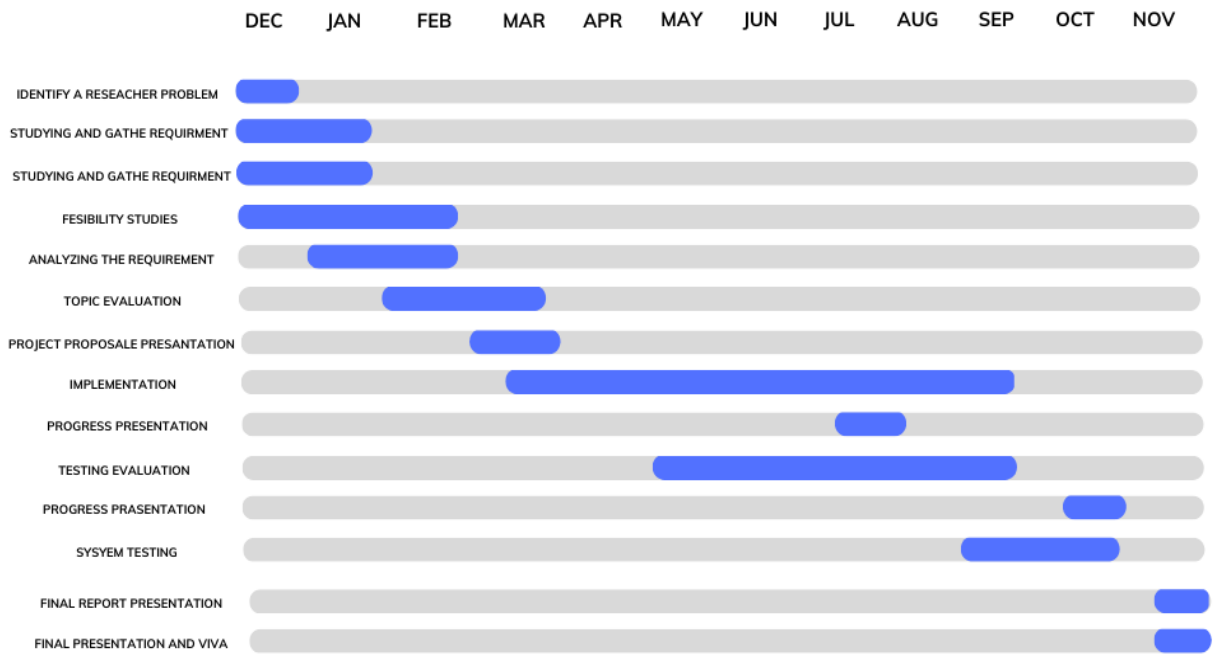




Work BreakDown Chart



Gantt Chart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IDENTIFY A RESEACHER PROBLEM
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STUDYING AND GATHE REQUIRMENT
FESIBILITY STUDIES
ANALYZING THE REQUIREMENT
TOPIC EVALUATION
PROJECT PROPOSALE PRESANTATION
IMPLEMENTATION
PROGRESS PRESENTATION
TESTING EVALUATION
PROGRESS PRASENTATION
SYSYEM TESTING
FINAL REPORT PRESENTATION
FINAL PRESENTATION AND VIVA