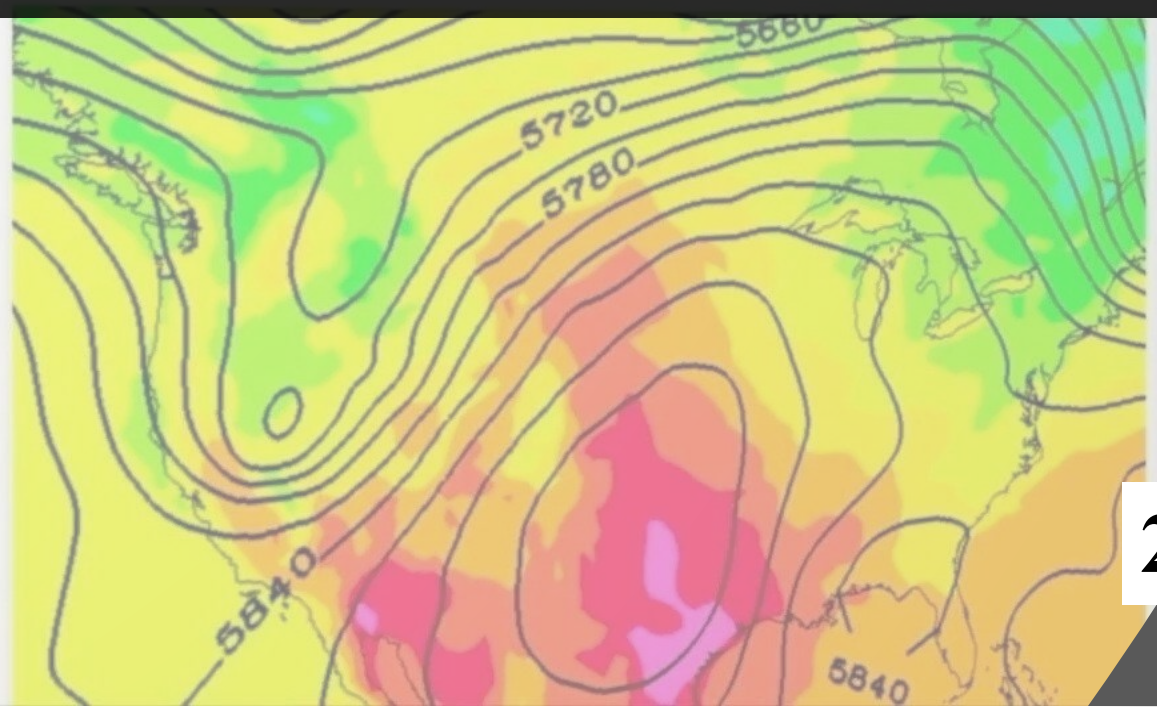
Advancing Heat Resilience

Integrated system for interventions and adaptation for heatwaves.



2023 – 24 -114

Team Members

Supervisor : Mrs. Sanika Wijewardane

Co Supervisor : Mr. Sathira Hettiarachchi

Student Name	Student ID
Ranawaka .T.D (Leader)	IT20142728
D.M.S.M Dissanayaka	IT20145552
T.M.S.B.Thelwadana	IT20645366
B.N.S.Gunadasa	IT20652500

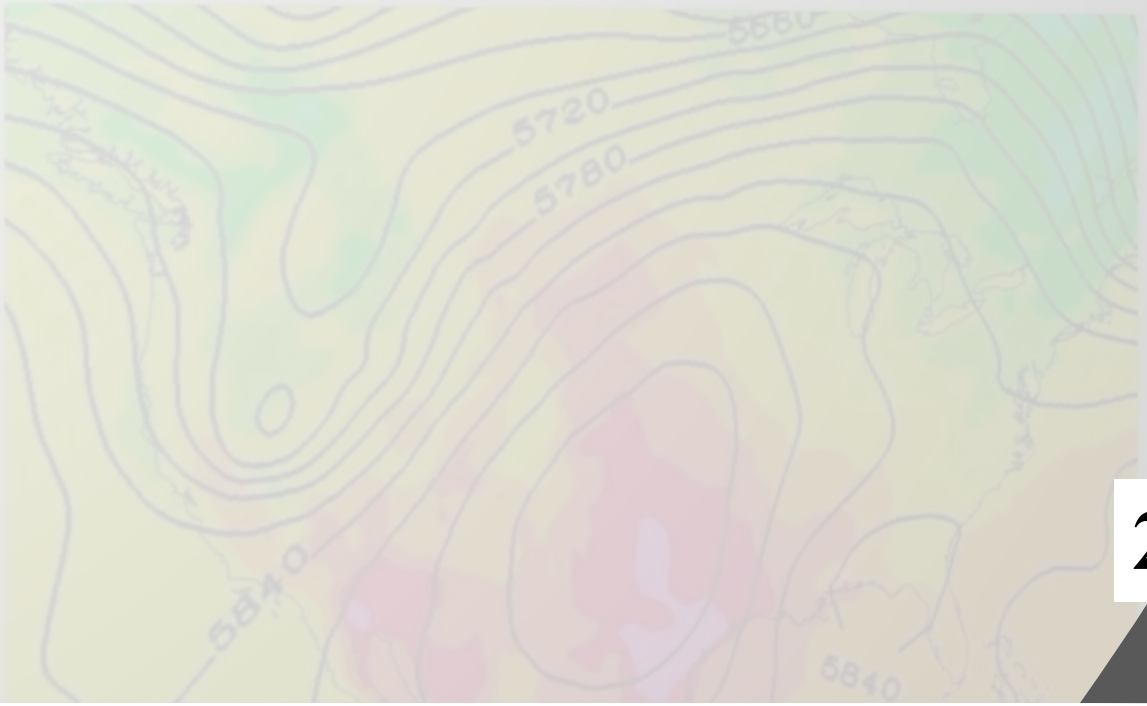
2023 – 24 -114

Introduction

- We Plan to develop a system for prevent from heat wave impacts in Sri Lanka. There are lot of areas which are facing heat wave impacts in Sri Lanka. There different target groups we are target for this system and they will be the main stakeholders of this system. Through our system we planned to cover heatwave detections and occurring frequencies , health impacts and agricultural based impacts on heatwaves. We plan to develop a mobile application based on machine learning to address these impacts on different target groups.

2023 – 24 -114

Overview



2023 – 24 -114

Research Problem

- What is the impact of heatwaves on workers' health and safety, and which worker groups are at higher risk of prevalent illnesses and injuries during heatwaves?

The goal of the project is to better understand how heat waves impact worker health and safety in South Australia by comparing the incidence rates of accidents and illnesses during heatwaves and non-heatwave seasons. The study also aims to pinpoint particular demographic and occupational groups that are more susceptible to illnesses and accidents when exposed to high temperatures. In order to inform policymakers and service providers on the essential adaptation and prevention strategies to safeguard vulnerable employees during heatwave occurrences, the study will answer this key research topic.

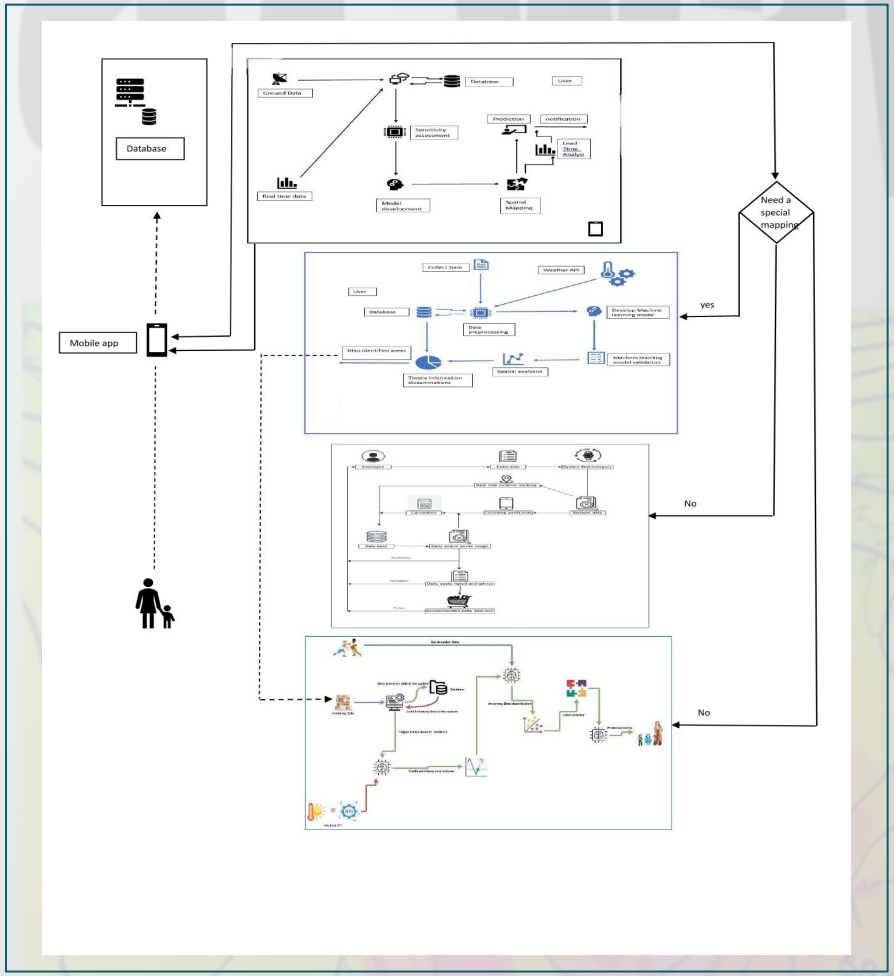
2023 – 24 -114

Specific and Sub Objectives

- Assess the Impact of Heatwaves on Workers.
- Identify Vulnerable Worker Groups.
- Heat wave mapping
- Give agricultural solutions based on machine learning

2023 – 24 -114

System Architecture



2023 – 24 -114

Soil Moisture Monitoring and Crop Recommendation

IT20142728 | Ranawaka . T. D

BSc (Hons) in Information Technology
Specializing in Information Technology

2023 – 24 -114

Introduction

- The interference of heatwaves are become a critical concern in recent years in various sectors including agriculture in Sri Lanka.
- Proposed heat resilience solutions with soil damage detection tools are identified as a important sources when it comes to decision making for agricultural field
- Proposed heat resilience solutions with soil damage detection tools are identified as a important sources when it comes to decision making for agricultural field
- Proposed heat resilience solutions with soil damage detection tools are identified as a important sources when it comes to decision making for agricultural field
- Proposed heat resilience solutions with soil damage detection tools are identified as a important sources when it comes to decision making for agricultural field

Research Problem

- Soil moisture is a significant factor that affects crop development and yield as well as the frequency and severity of heatwaves.

How can machine learning models improve their accuracy and dependability of predicting soil moisture under various climatic and soil conditions?

- . Using traditional methods is time consuming and not accurate.Training machine learning models are given more accurate and up to date results. This will be very useful when it comes to large areas. This research will provide the solutions for accurate soil moisture forecasting.

How can machine learning models improve their accuracy of predicting competent crops using soil moisture and soil conditions?

Cultivators can anticipate the soil moisture needs of their crops under various temperature conditions, they may better prepare for heat waves and prevent crop losses.

Specific and Sub Objectives

- **The main objectives of this study are to create a system for monitoring the soil moisture conditions fields in real time of through mobile application. So, the cultivators can easily predict the moisture requirements for their crops and improve their water management efficiency**

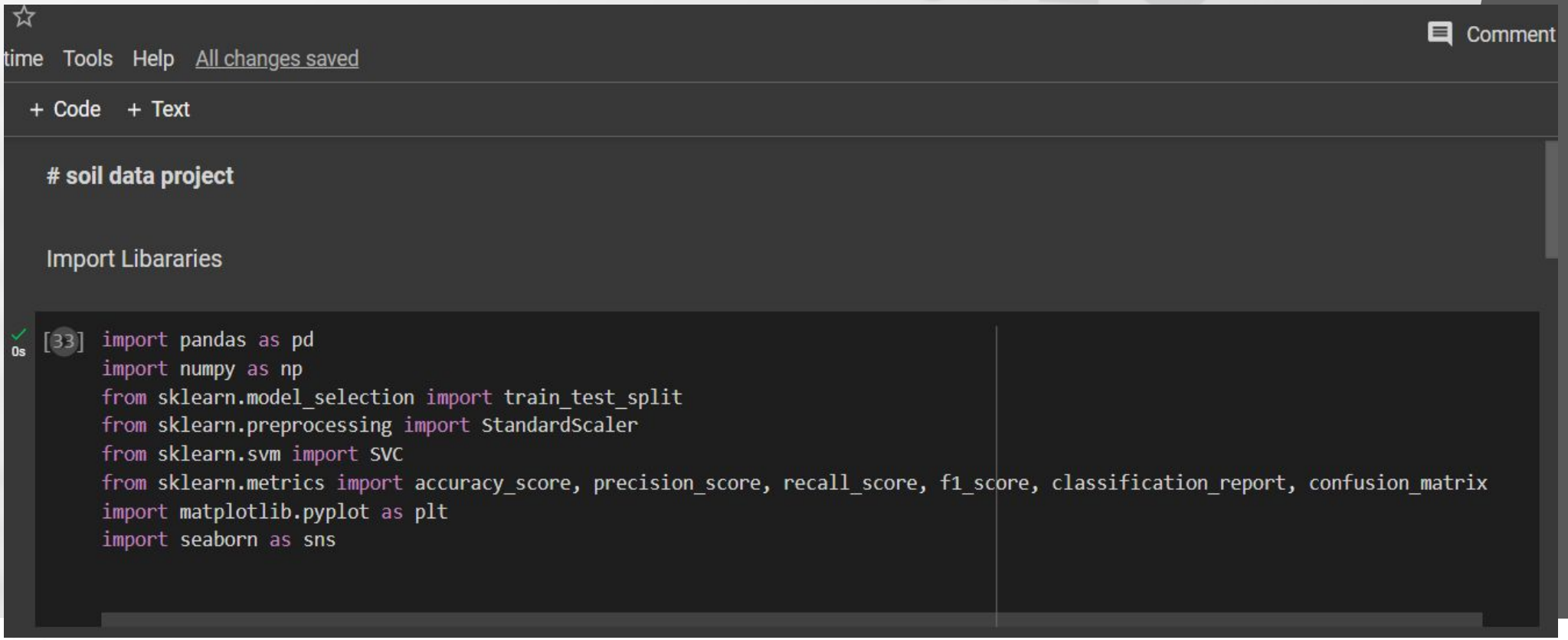
- Make a real time soil monitoring system using ioT devices..

- Build a crop recommendation system using soil moisture and temperature and other conditions.

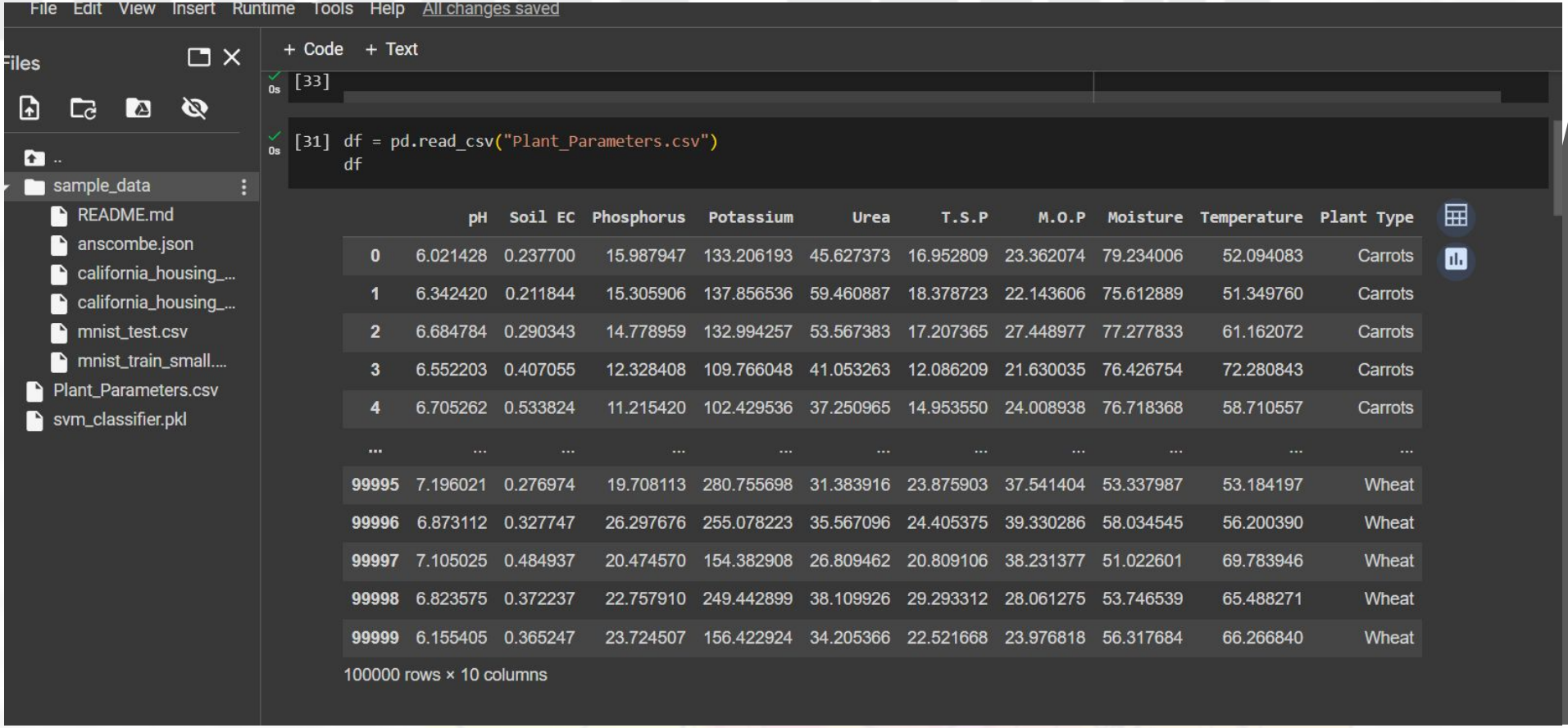
- Soil moisture forecasting system using multiple types of satellite remote sensing data, including optical, thermal, and radar

Completion of the Project

Screen Shots



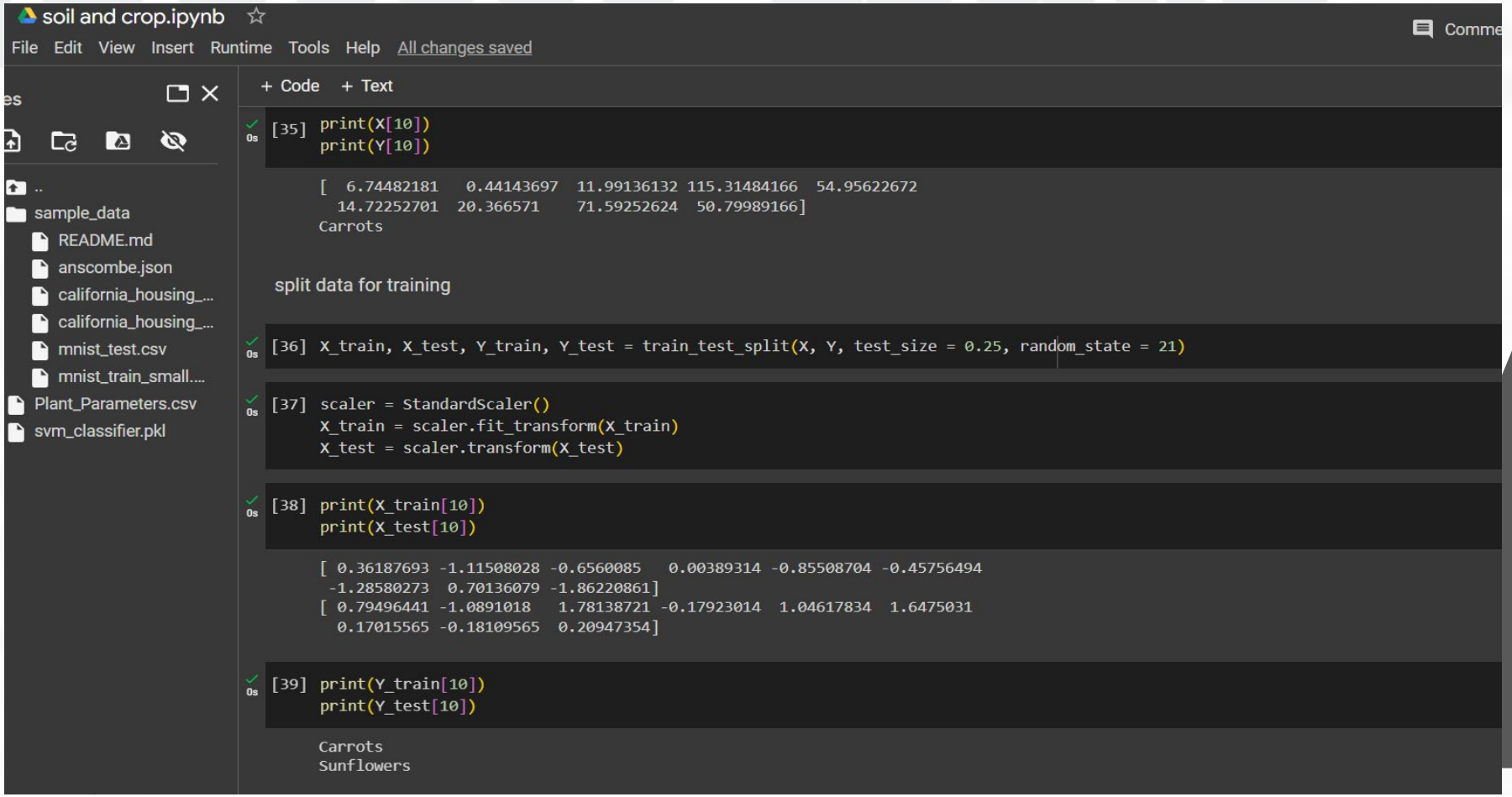
Completion of the Project



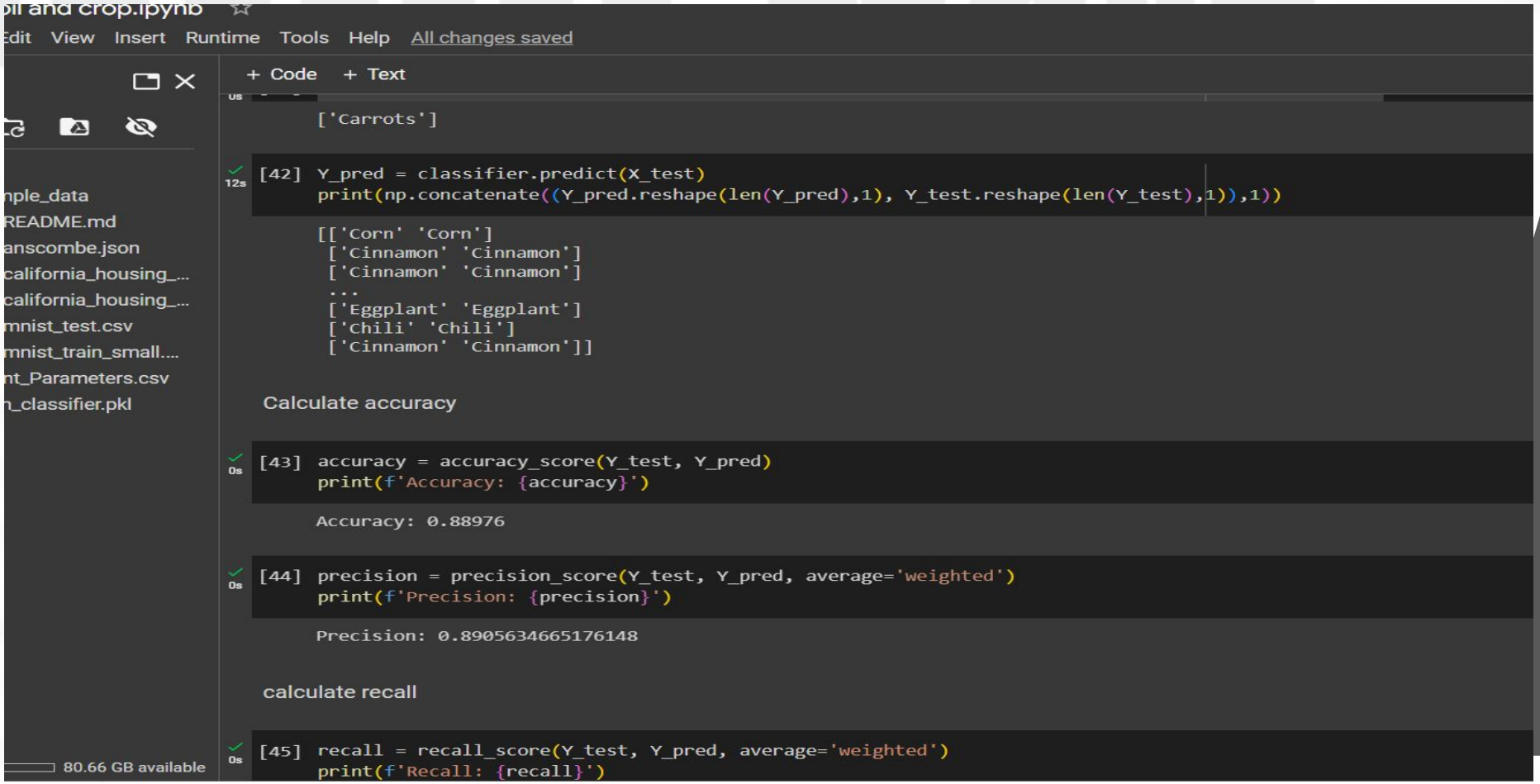
	pH	Soil EC	Phosphorus	Potassium	Urea	T.S.P	M.O.P	Moisture	Temperature	Plant Type
0	6.021428	0.237700	15.987947	133.206193	45.627373	16.952809	23.362074	79.234006	52.094083	Carrots
1	6.342420	0.211844	15.305906	137.856536	59.460887	18.378723	22.143606	75.612889	51.349760	Carrots
2	6.684784	0.290343	14.778959	132.994257	53.567383	17.207365	27.448977	77.277833	61.162072	Carrots
3	6.552203	0.407055	12.328408	109.766048	41.053263	12.086209	21.630035	76.426754	72.280843	Carrots
4	6.705262	0.533824	11.215420	102.429536	37.250965	14.953550	24.008938	76.718368	58.710557	Carrots
...	...	...	...	...	...	...	...	...	...	...
99995	7.196021	0.276974	19.708113	280.755698	31.383916	23.875903	37.541404	53.337987	53.184197	Wheat
99996	6.873112	0.327747	26.297676	255.078223	35.567096	24.405375	39.330286	58.034545	56.200390	Wheat
99997	7.105025	0.484937	20.474570	154.382908	26.809462	20.809106	38.231377	51.022601	69.783946	Wheat
99998	6.823575	0.372237	22.757910	249.442899	38.109926	29.293312	28.061275	53.746539	65.488271	Wheat
99999	6.155405	0.365247	23.724507	156.422924	34.205366	22.521668	23.976818	56.317684	66.266840	Wheat

100000 rows × 10 columns

Completion of the Project



Completion of the Project



oil and crop.ipynb

Edit View Insert Runtime Tools Help All changes saved

+ Code + Text

```
['Carrots']
```

```
[42] Y_pred = classifier.predict(X_test)
     print(np.concatenate((Y_pred.reshape(len(Y_pred),1), Y_test.reshape(len(Y_test),1)),1))
```

```
[['Corn' 'Corn']
 ['Cinnamon' 'Cinnamon']
 ['Cinnamon' 'Cinnamon']
 ...
 ['Eggplant' 'Eggplant']
 ['Chili' 'Chili']
 ['Cinnamon' 'Cinnamon']]
```

Calculate accuracy

```
[43] accuracy = accuracy_score(Y_test, Y_pred)
     print(f'Accuracy: {accuracy}')
```

```
Accuracy: 0.88976
```

```
[44] precision = precision_score(Y_test, Y_pred, average='weighted')
     print(f'Precision: {precision}')
```

```
Precision: 0.8905634665176148
```

calculate recall

```
[45] recall = recall_score(Y_test, Y_pred, average='weighted')
     print(f'Recall: {recall}')
```

nple_data
README.md
anscombe.json
california_housing_...
california_housing_...
mnist_test.csv
mnist_train_small....
nt_Parameters.csv
n_classifier.pkl

80.66 GB available

Completion of the Project

il and crop.ipynb ☆

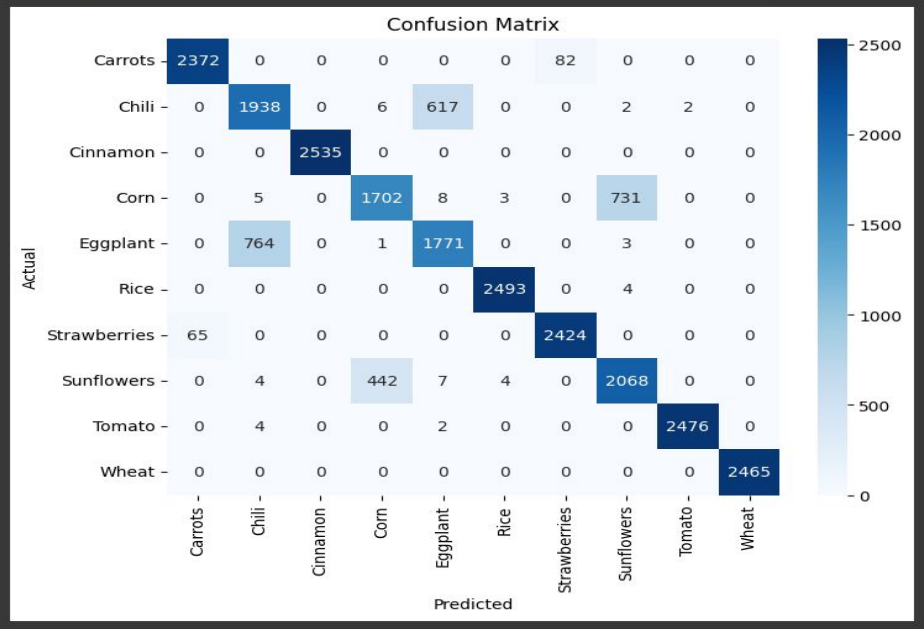
dit View Insert Runtime Tools Help All changes saved

+ Code + Text

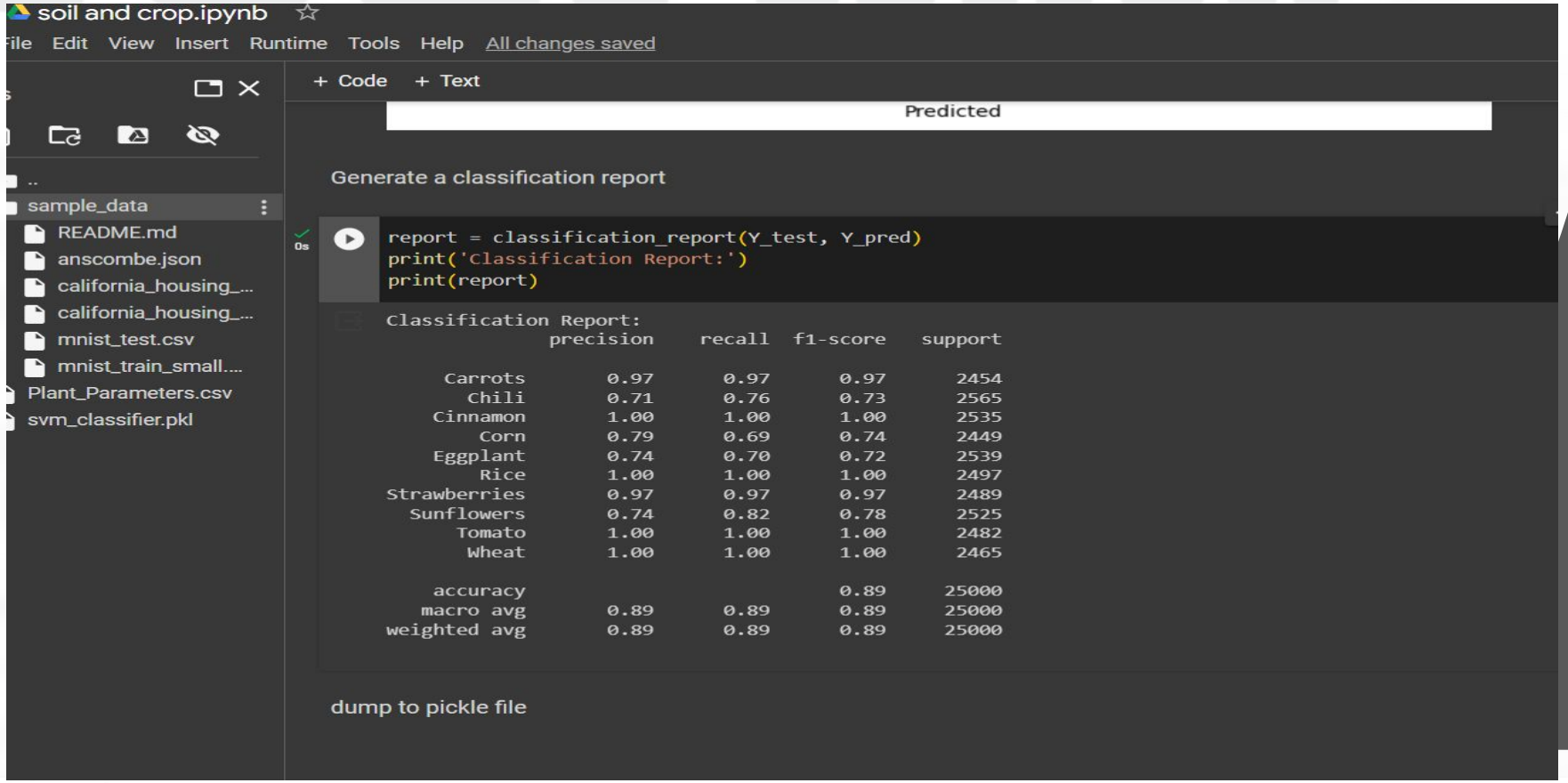
```
labels = ['Carrots','Chili','Cinnamon','Corn','Eggplant','Rice','Strawberries','Sunflowers','Tomato','Wheat']

# Create a heatmap of the confusion matrix
plt.figure(figsize=(8, 6))
sns.heatmap(confusion, annot=True, fmt='d', cmap='Blues', xticklabels=labels, yticklabels=labels)
plt.xlabel('Predicted')
plt.ylabel('Actual')
plt.title('Confusion Matrix')
plt.show()
```

ple_data
README.md
nscombe.json
alifornia_housing_...
alifornia_housing_...
nnist_test.csv
nnist_train_small....
t_Parameters.csv
_classifier.pkl

80.66 GB available

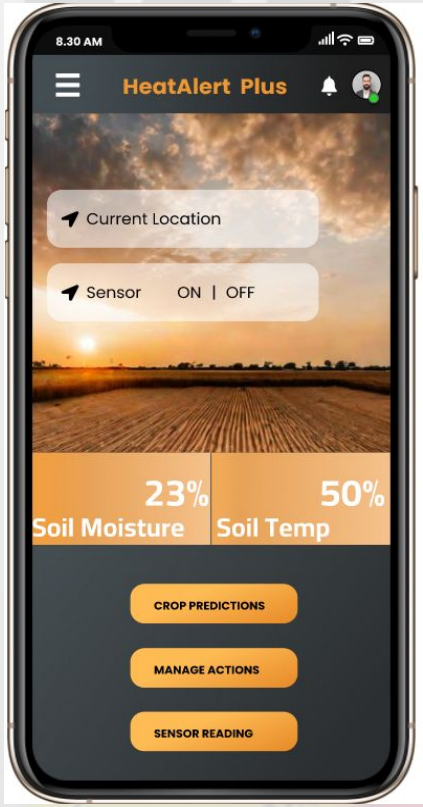


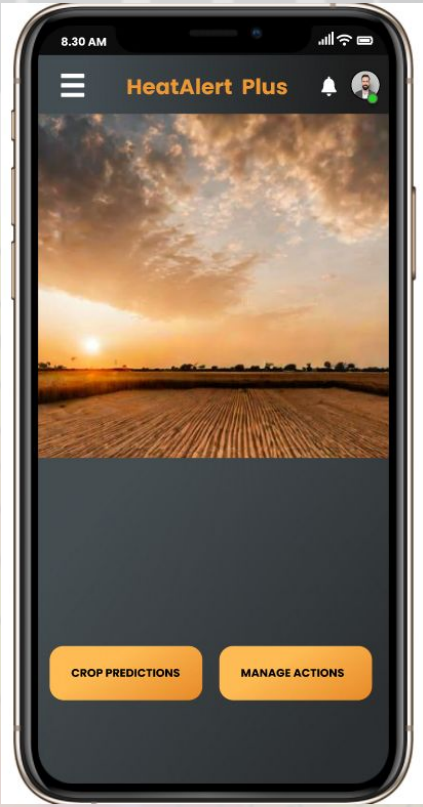
Completion of the Project



Prototype


8.30 AM
HeatAlert Plus
OVERVIEW
Daily Point Usage
67%
Time
11:26 am
SUN 23RD OCT
Temperature
26 ℃
Current Location
Kandy, Sri Lanka
Weekly Report
2023 HeatAlert Plus


8.30 AM
HeatAlert Plus
Current Location
Sensor ON | OFF
23%
Soil Moisture
50%
Soil Temp
CROP PREDICTIONS
MANAGE ACTIONS
SENSOR READING


8.30 AM
HeatAlert Plus
CROP PREDICTIONS
MANAGE ACTIONS

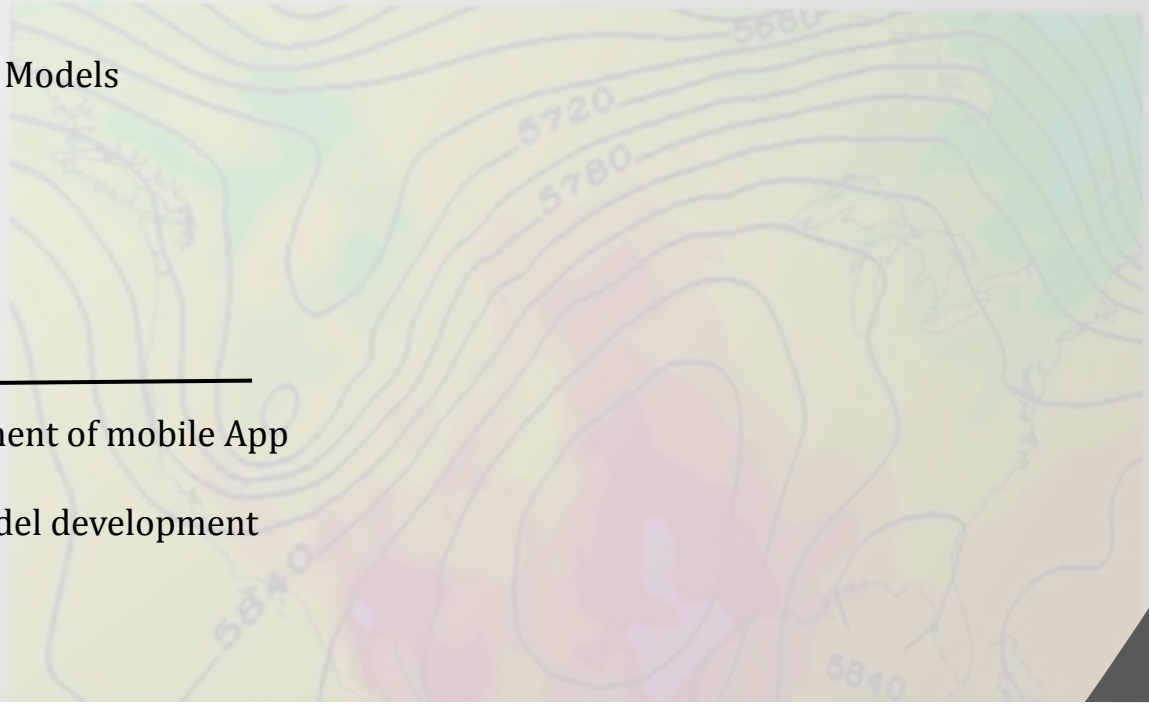
Progress at the Moment

Completed

- Collecting Dataset
- Data Preparation
- Identification of ML Models
- User interfaces
- ioT sensor build

To Do

- Front End development of mobile App
- Soil Forecasting Model development



References

[1] A Machine Learning-Based Approach for Surface Soil Moisture Estimations with Google Earth Engine

https://www.mdpi.com/2072-4292/13/11/2099

[2] A Machine Learning Data Fusion Model for Soil Moisture Retrieval

[3] From data to interpretable models: machine learning for soil moisture forecasting

https://link.springer.com/article/10.1007/s41060-022-00347-8

[4] Circulation and Soil Moisture Contributions to Heatwaves in the United States

https://journals.ametsoc.org/abstract/journals/clim/35/24/JCLI-D-21-0156.1.xml

[5] The Influence of Soil Moisture on the Historic 2021 Pacific Northwest Heatwave

https://journals.ametsoc.org/abstract/journals/mwre/151/5/MWR-D-22-0253.1.xml

[6] Impacts of Extreme Heat Stress and Increased Soil Temperature on Plant Growth and Development

https://cropwatch.unl.edu/2016/impacts-extreme-heat-stress-and-increased-soil-temperature-plant-growth-and-development

Topic

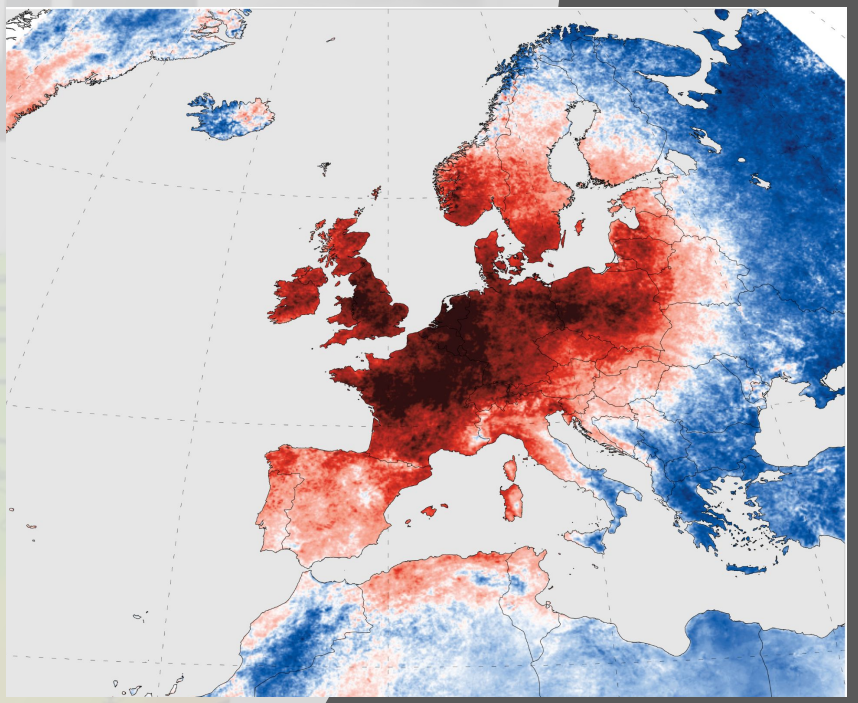
IT20145552 | Dissanayaka. DMSM

BSc (Hons) in Information Technology
Specializing in Information Technology

2023 – 24 -114

Introduction

The escalating frequency and severity of heatwaves on a global scale have become a prominent concern due to their profound implications for human health, infrastructure, and ecosystems. As the world experiences the growing impacts of climate change, the incidence of heatwaves is projected to increase, exacerbating the risks posed to vulnerable populations and underscoring the urgency of effective adaptive measures

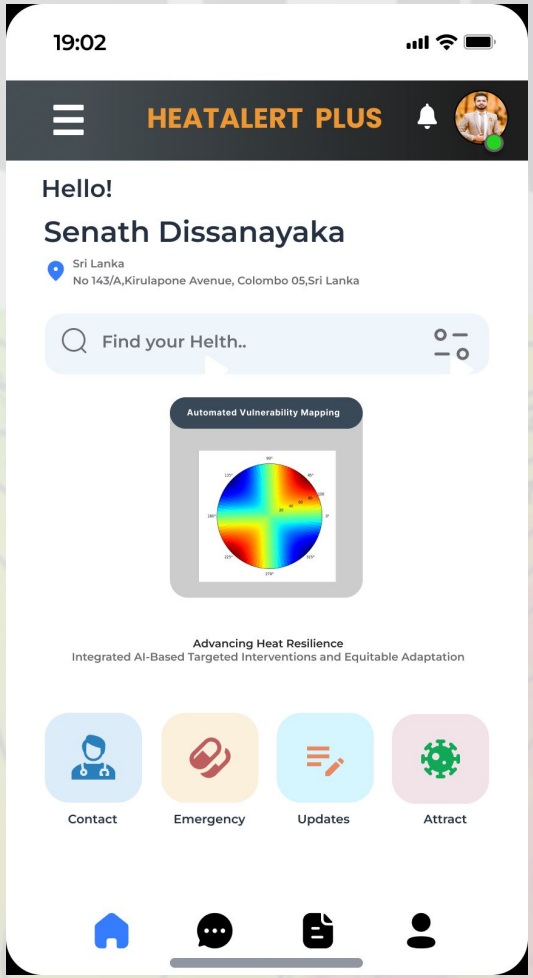


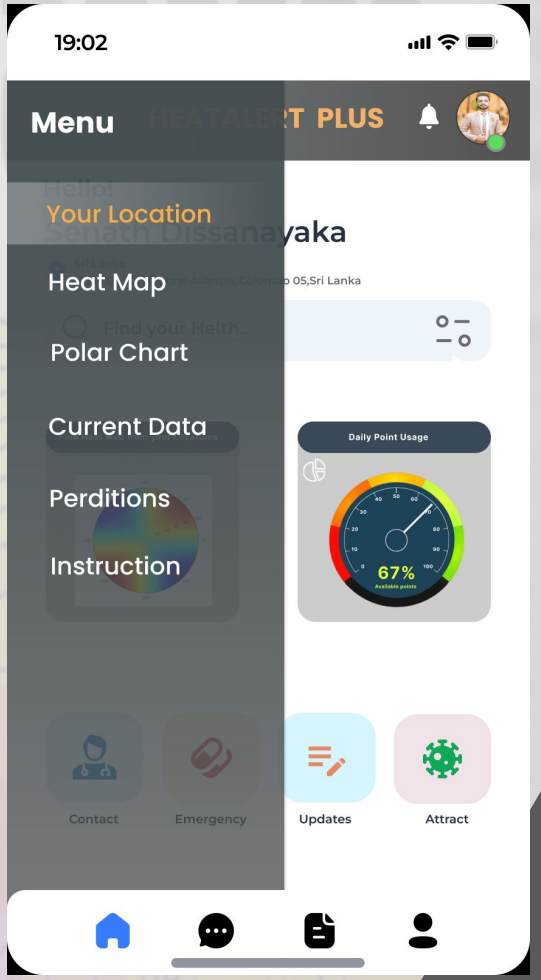
Research Problem

The challenge at the heart of this research subtopic is to develop an automated vulnerability mapping system that effectively identifies and maps areas and populations most susceptible to heat-related risks. While existing research acknowledges the importance of vulnerability assessment, current approaches often rely on manual processes that are time-consuming and resource-intensive. This research seeks to address the limitations of traditional methods by harnessing the power of advanced technologies, such as machine learning and data analytics, to automate the process of vulnerability mapping.

Interface

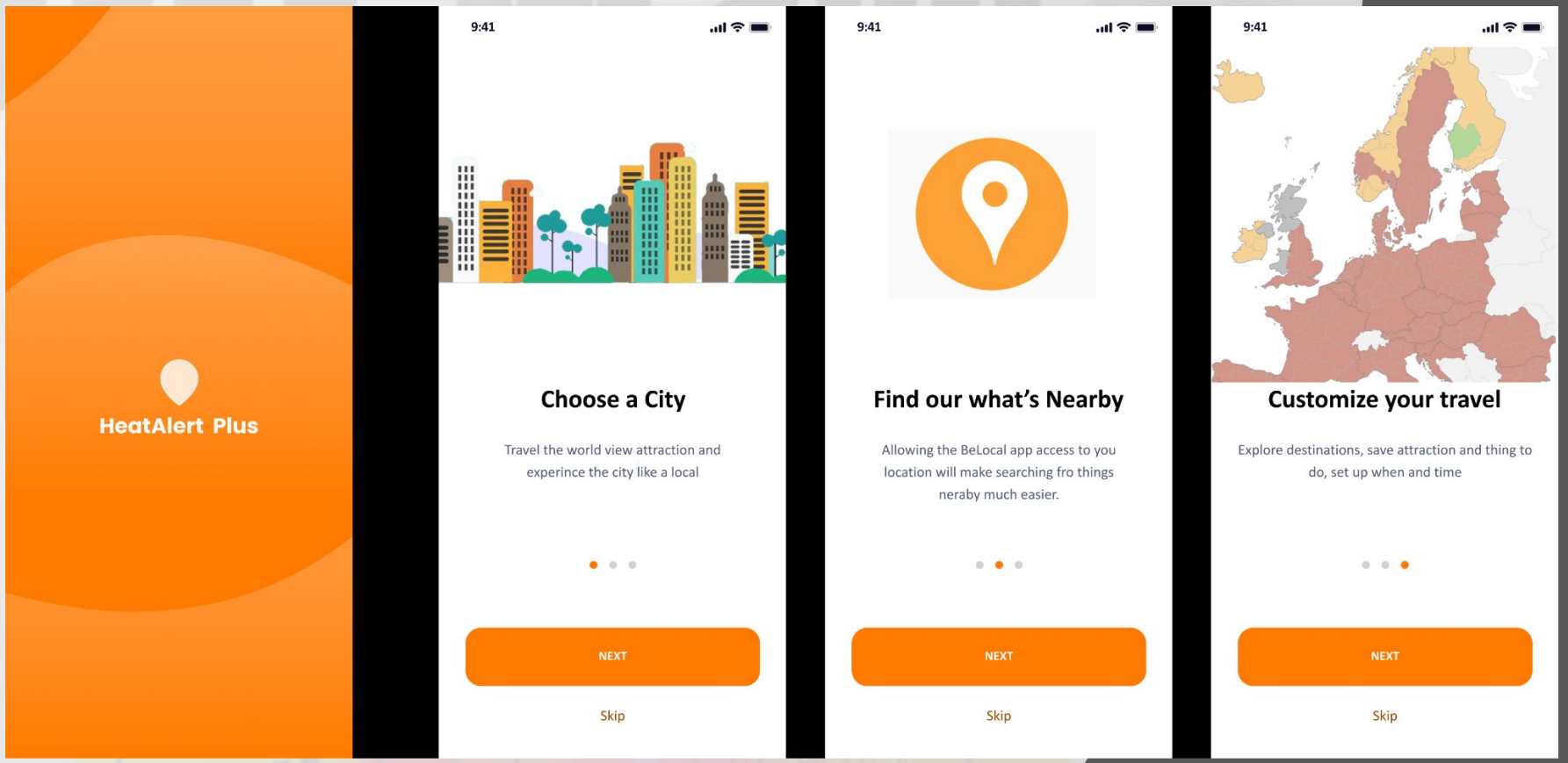
Home





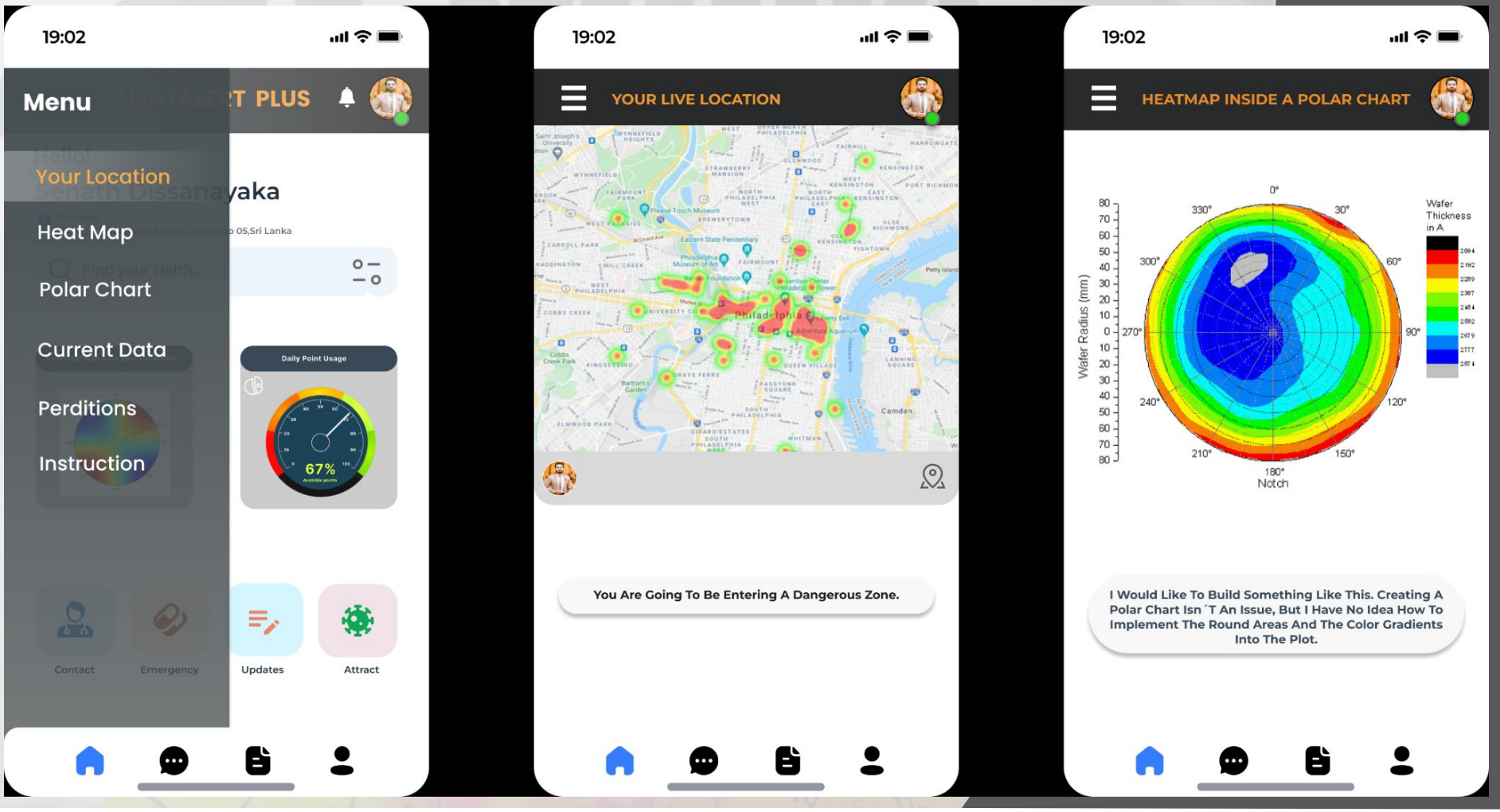
Interface

Create Location and Set Up Locations



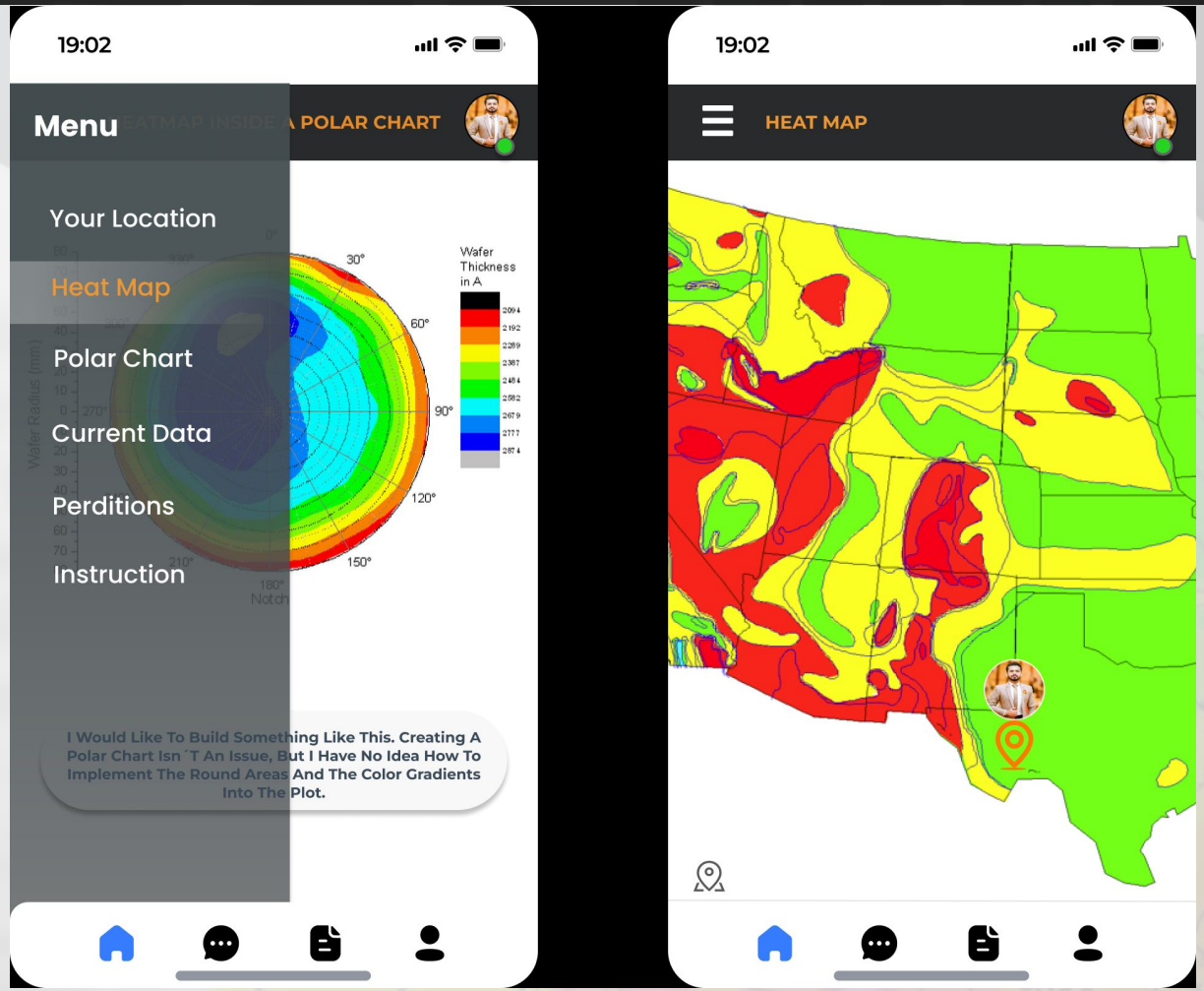
Interface

Current Location Details
Polar Chart



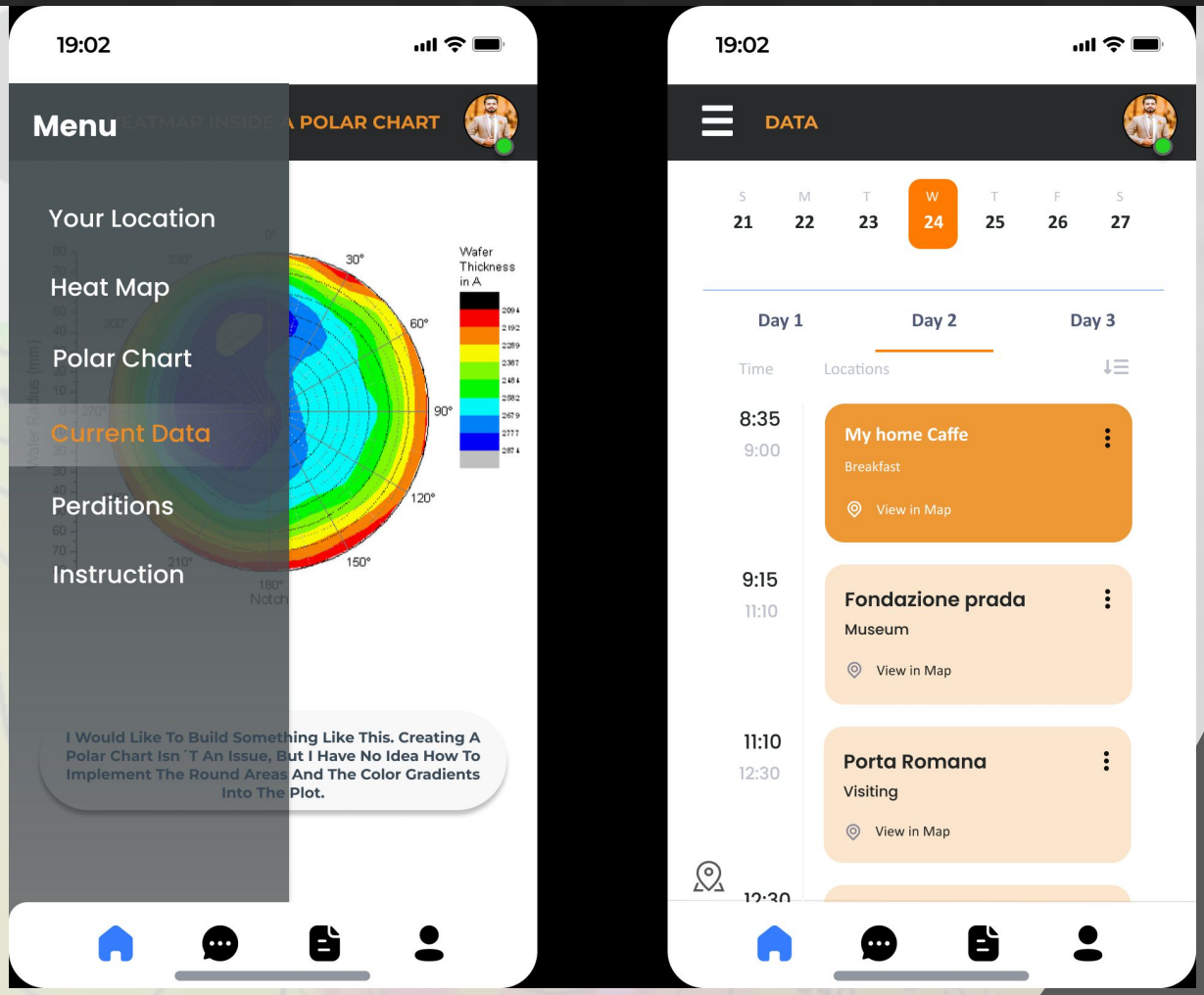
Interface

Heat Map



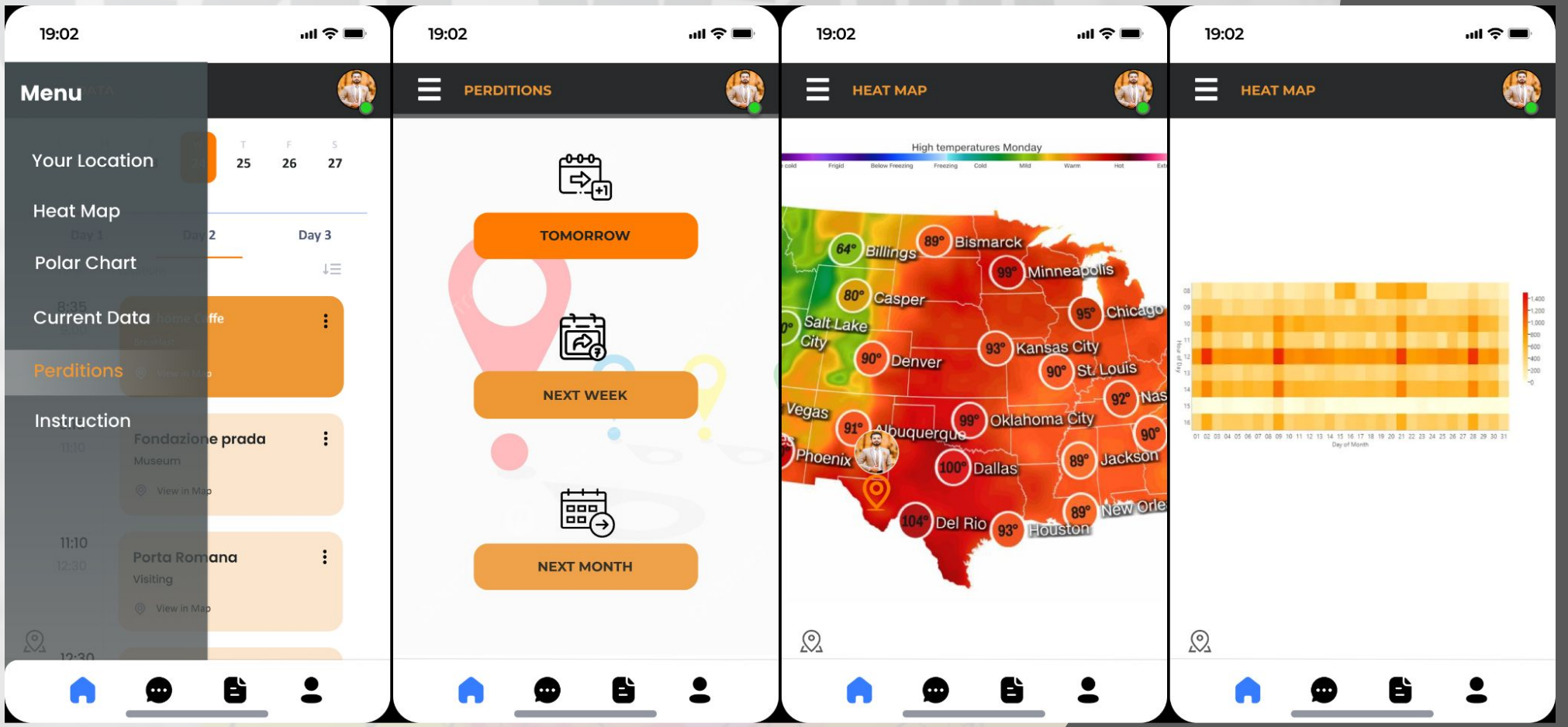
Interface

Traveling Data and /
Location Data Records



Interface

Traveling Data and / Location Data Records



Progress at the Moment

HEATWAVE RISK ASSESSMENT & REAL-TIME MOMENT MANAGEMENT

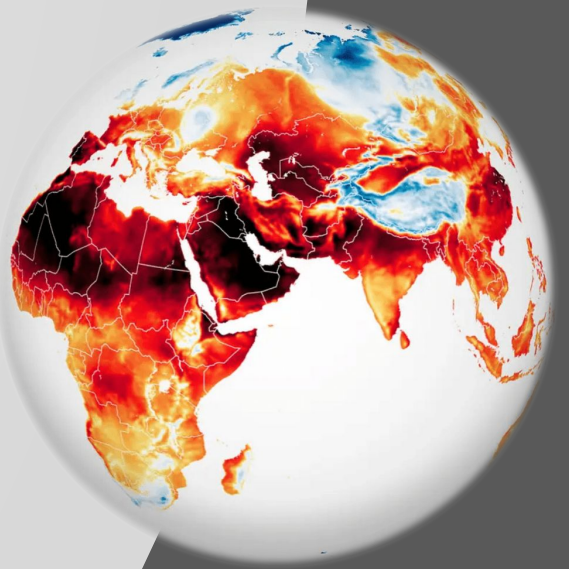
IT20645366 | Thelwadana. T. M. S. B

BSc (Hons) in Information Technology
Specializing in Information Technology

2023 – 24 -114

Introduction

- Heatwaves are becoming increasingly common and pose a significant threat to public health, infrastructure, and the environment.
- Many people do not know how to minimize the heat wave effect in different industries or in the behavior of outdoor activities where the heat wave is high.
- They should develop a method to reduce the heat waves received by the body during work and activities.
- Today, we'll present a complete system created to evaluate heatwave risks, offer real-time guidance, and guarantee safety in extreme heat conditions.



Research Problem

- Develop a **point system** based on meteorological data and accurately identify places and people most vulnerable to heat-related hazards.
- The project intends to address issues with data quality, model accuracy, and Scalability as well as making the point system delivery process clear, understandable, and actionable for stakeholders and policy make.
- “Creating resilient communities capable of proactively adapting to hazards from growing heat waves, ensuring the safety of vulnerable groups and fostering equitable adaptation techniques.”

How to do daily activities in an environment with more heat waves?

Specific and Sub Objectives

Specific Objective

To develop a framework for assessing heat wave risk and a real-time moment management system that combines the safety score system

- Predicting and evaluating the severity of heat waves
- Managing real-time data
- Allocating shelters for efficient response measures
- Safeguarding vital infrastructure during heat waves

Specific and Sub Objectives

Sub Objectives

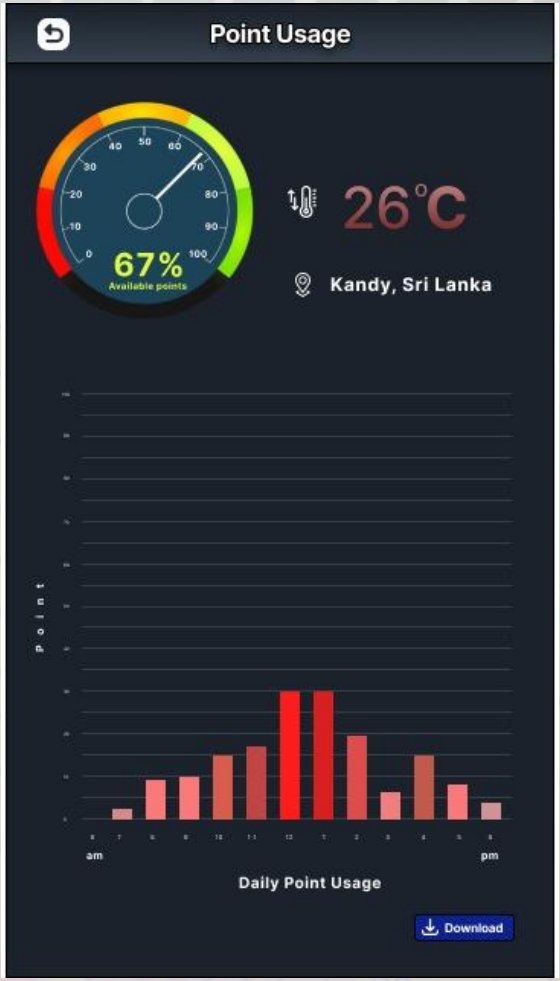
Data Integration and Analysis	• Historical records and weather data
Model Refinement and Validation	• Utilize statistical methods and machine learning algorithms.
Early Warning System Implementation	• Create an early warning system using the information from the prediction model
Dynamic Safety Point Allocation	• Implement an adaptive system for allocating safety points
Public Awareness and Engagement	• Create intuitive user interfaces providing information about safety points.
Collaborative Stakeholder Platform	• Create a cooperative online platform
Scenario Planning and Simulation	• To foresee upcoming heatwave difficulties, use historical data and forecast climatic.
Continuous Monitoring and Improvement	• Create a feedback loop to continually track the system's performance.

User Interface

Point System UI

User Interface

User can check point usage in here and user can download daily report.



User Interface

User can view notification and warning on here.

User Interface

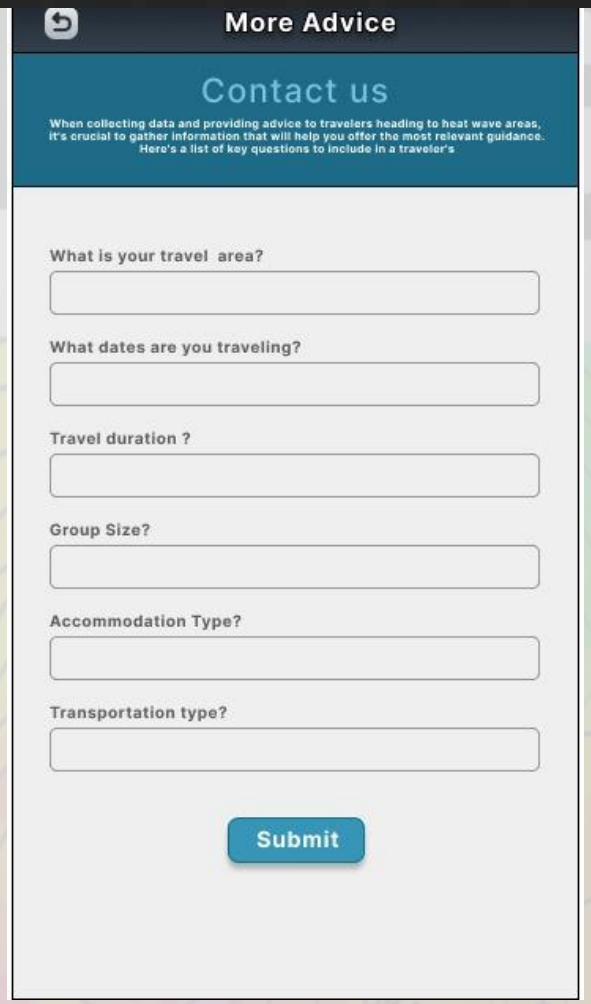
There are two red and green buttons on the navigation bar. The green button indicates that the user is safe and the red button indicates that the user is not safe.

User Interface

Advice for travelers is shown here. You can use each advice when you want to use it. if you want to more advice click see more button.

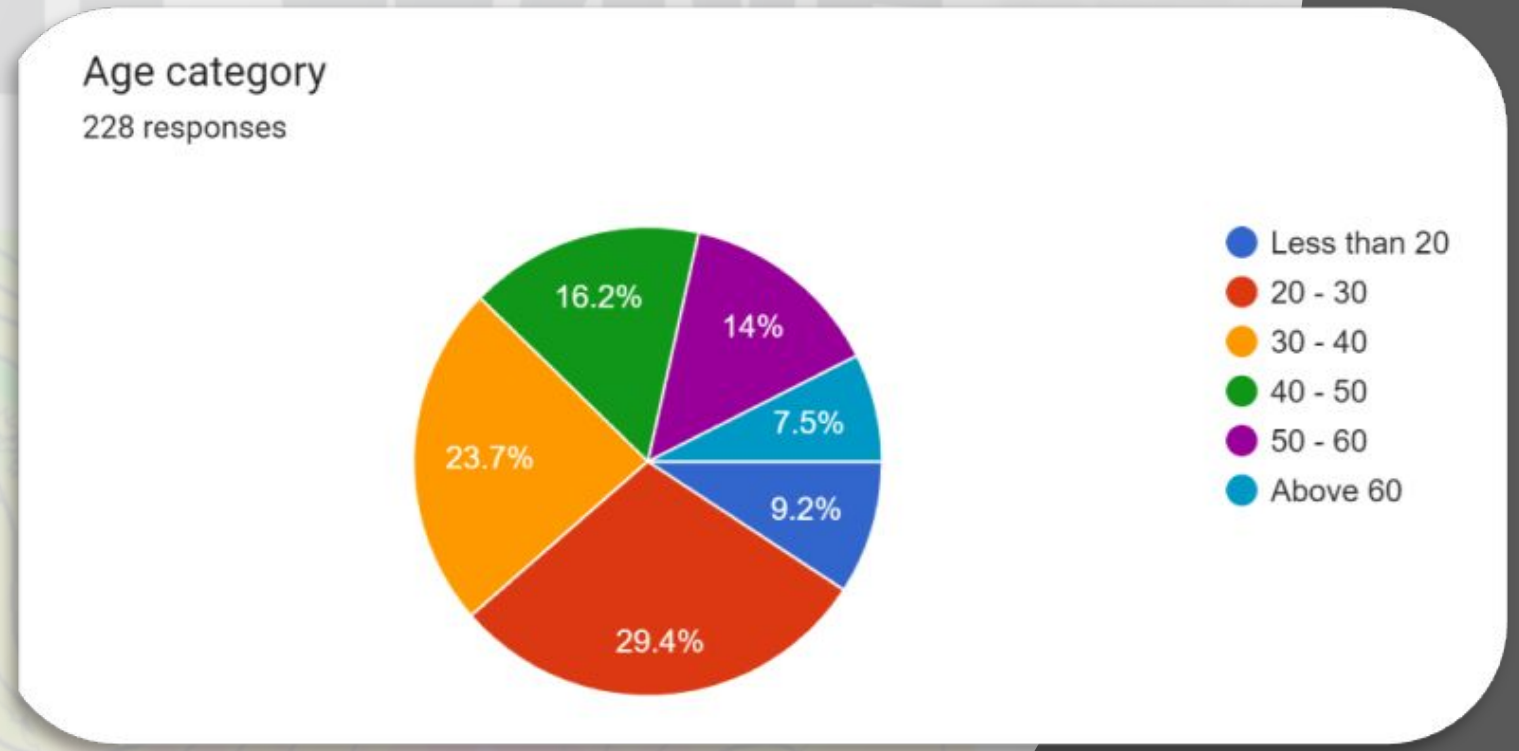
User Interface

After click see more button navigate in this page and for more advice contact us on chat.



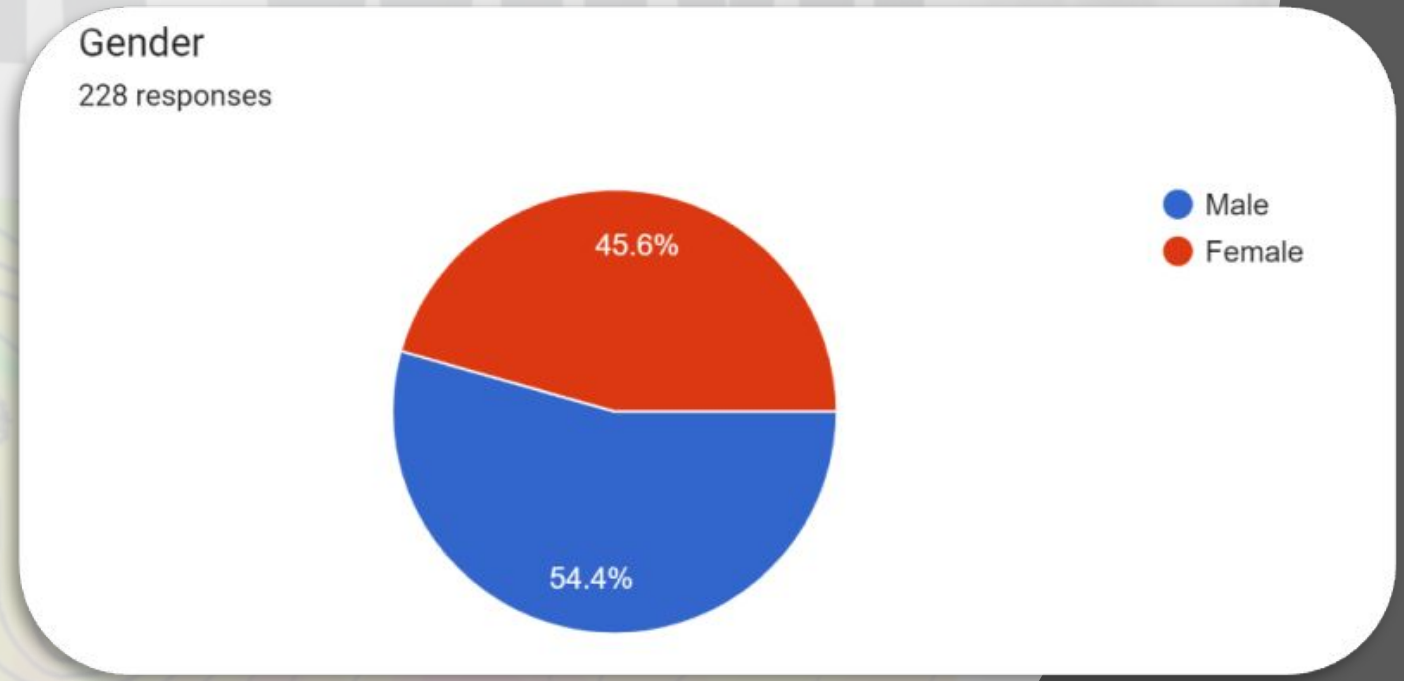
Research Respondents' Age Category Analysis

The most common age category of the research respondents was 20-30 which had 29.4% participants. The age category of 30-40 had 23.7% respondents which was the second highest.



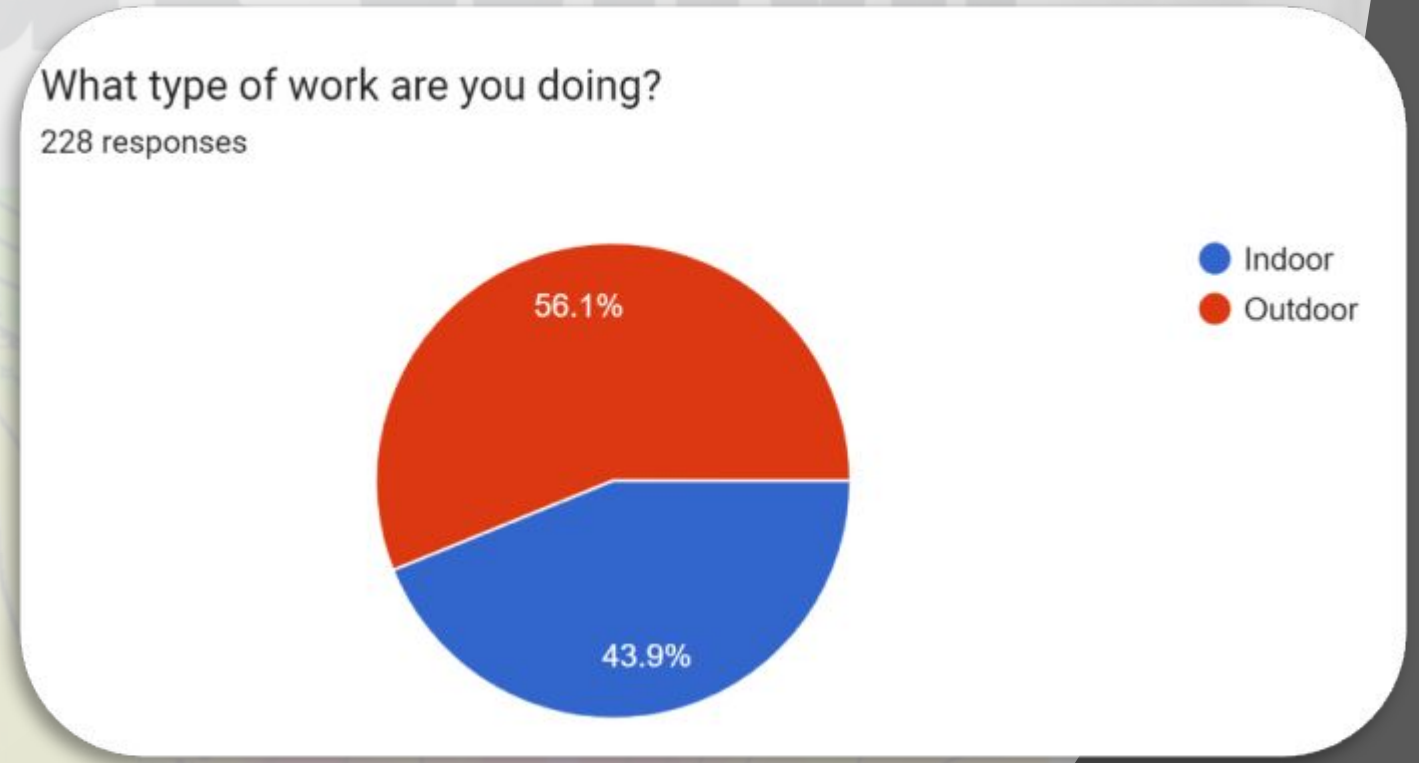
Research Respondents' Gender Analysis

Male respondents show a higher percentage (54.4%) here.



What type of work are you doing?

It shows that more percentage (56.1%) of respondents work outdoors.

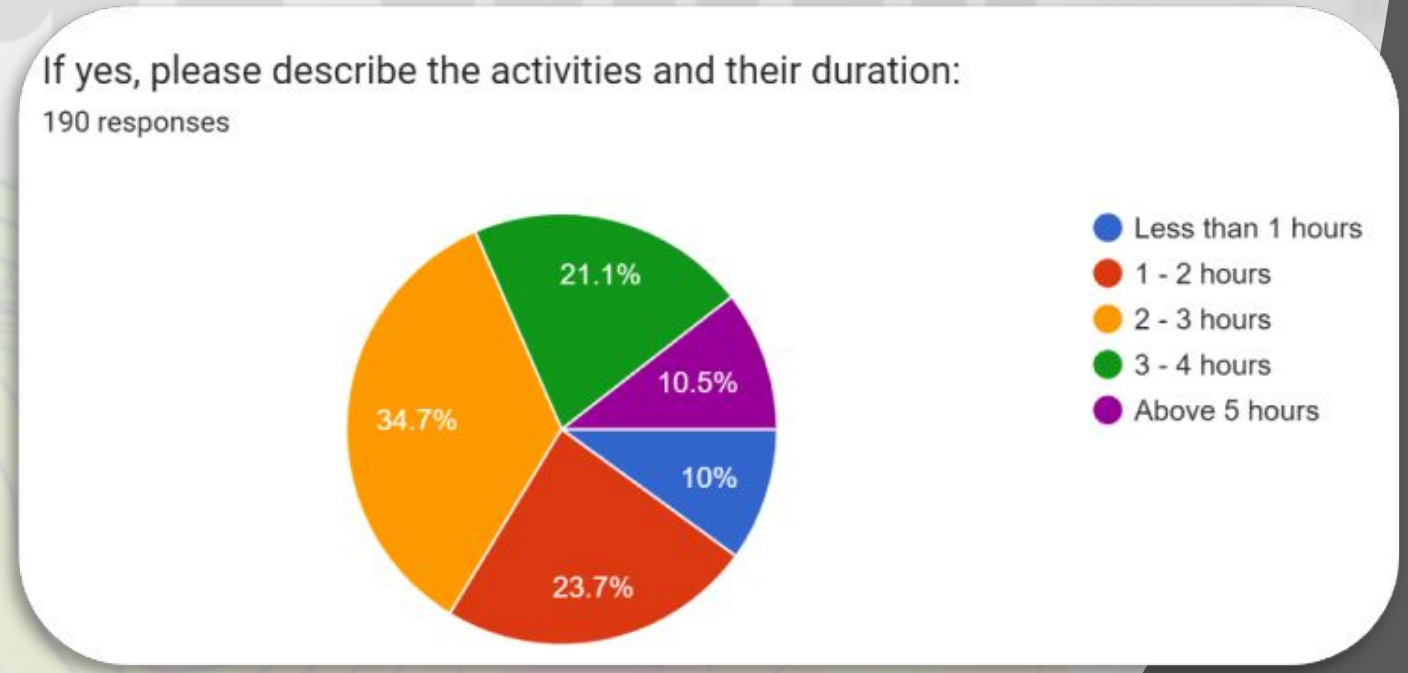


Specific Outdoor Activities Analysis

74.1% of respondents are engaged in specific outdoor work.

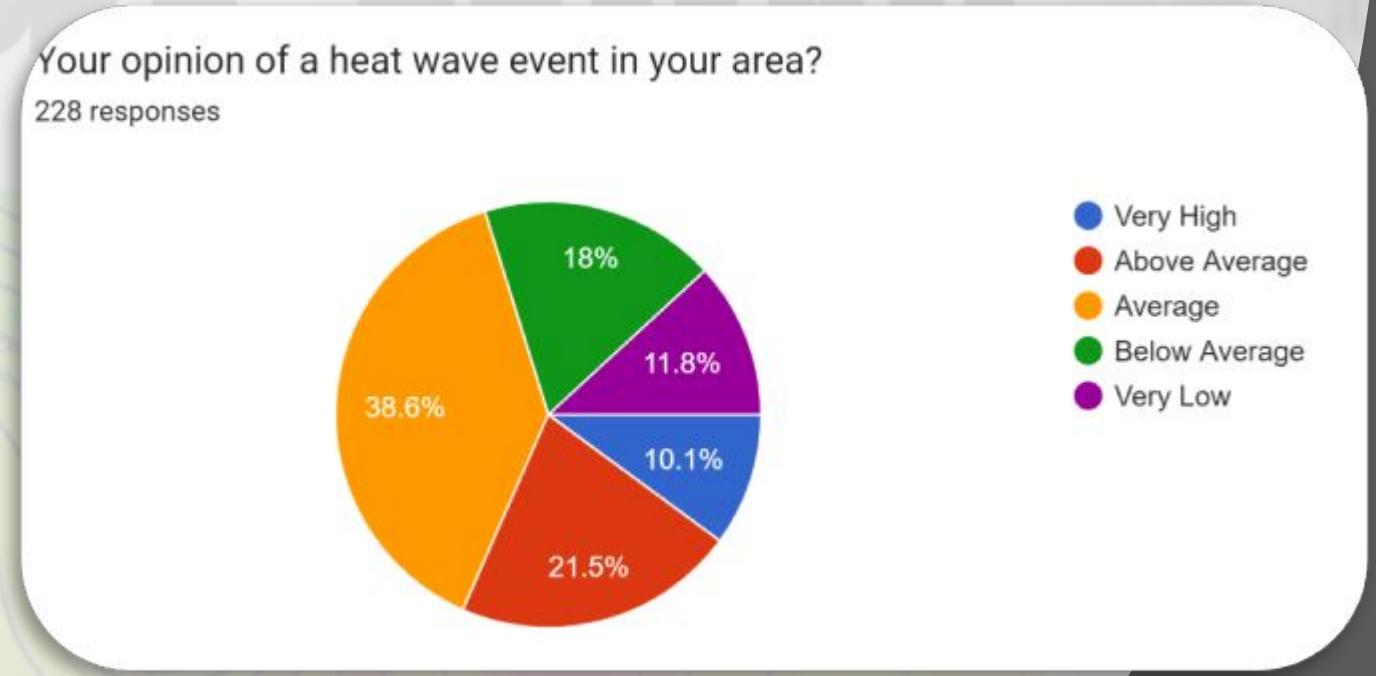
Duration Analysis

34.7% of respondents indicate that they are engaged in 2-3 hours of work.



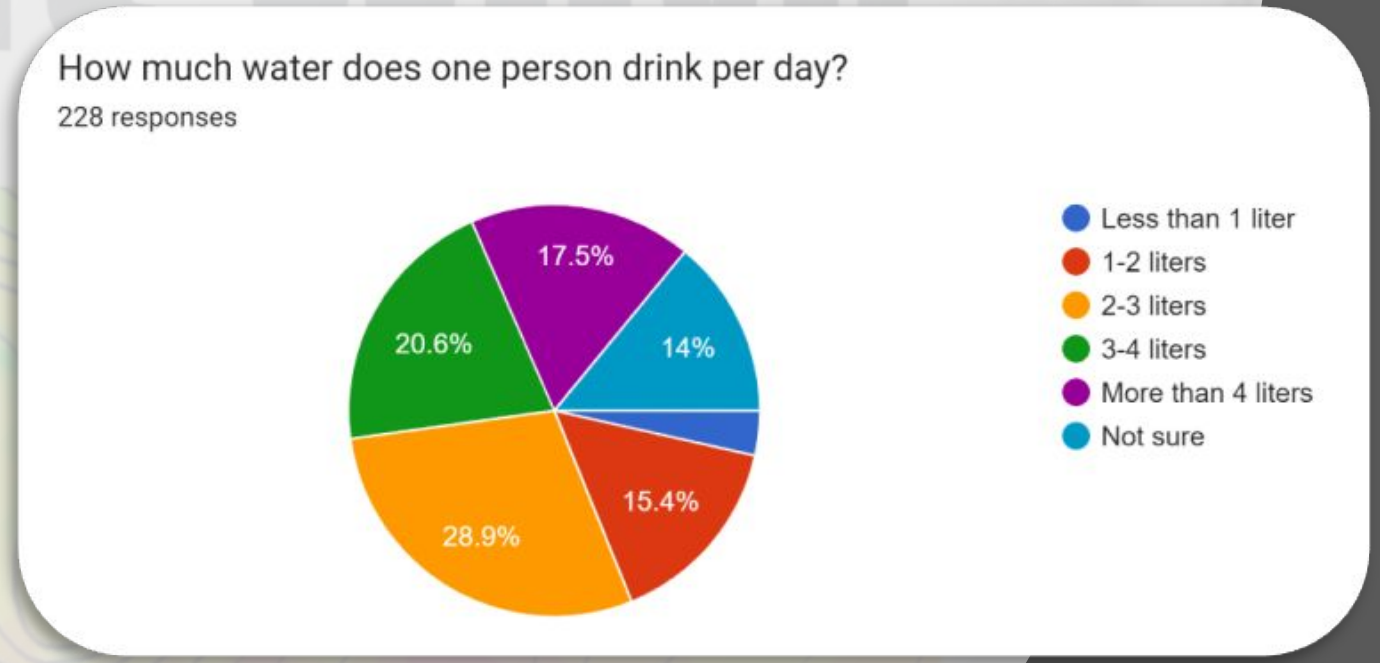
Area Analysis

38.6% of the respondents indicate that the area they work in is average.



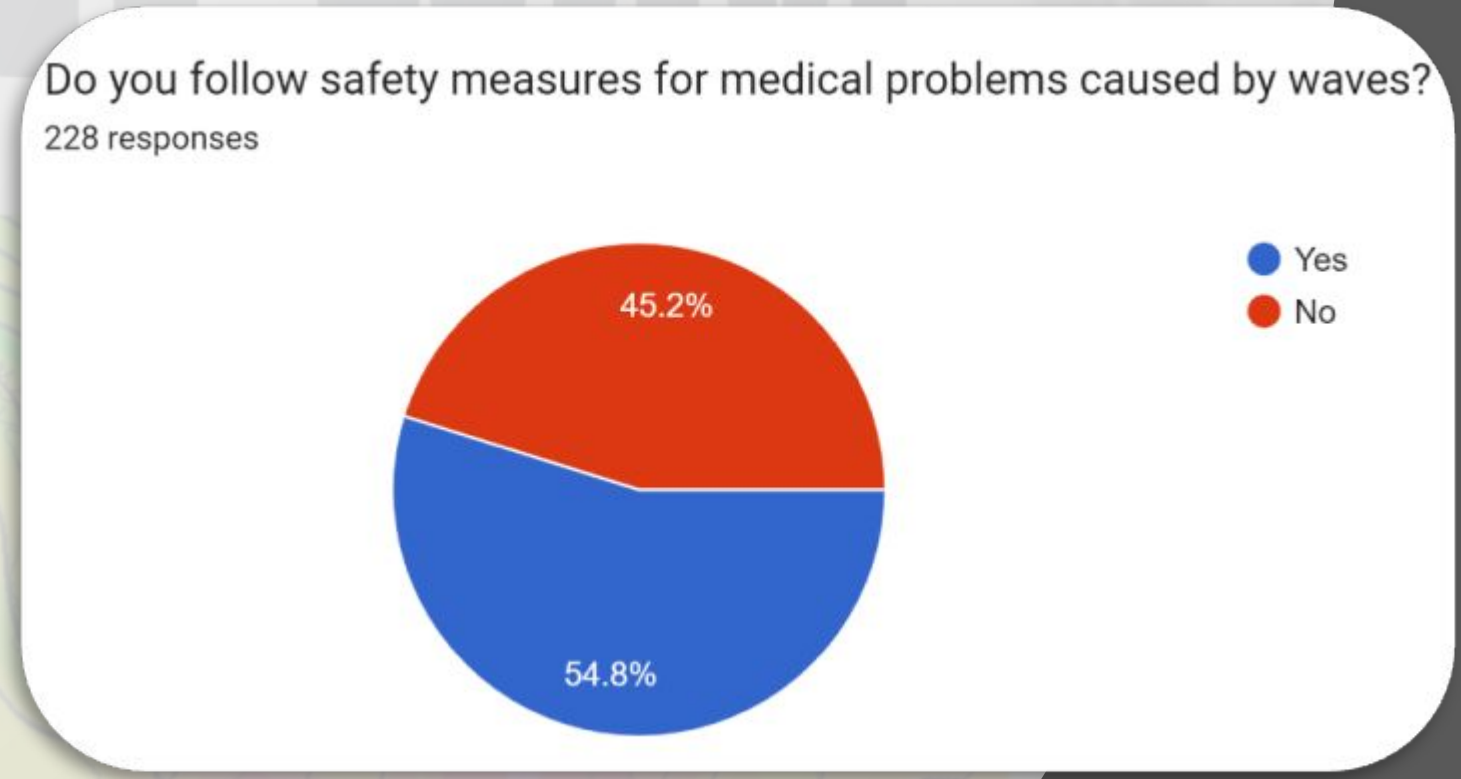
Analysis of water Intake

28.9% of the respondents indicate that they drink water.



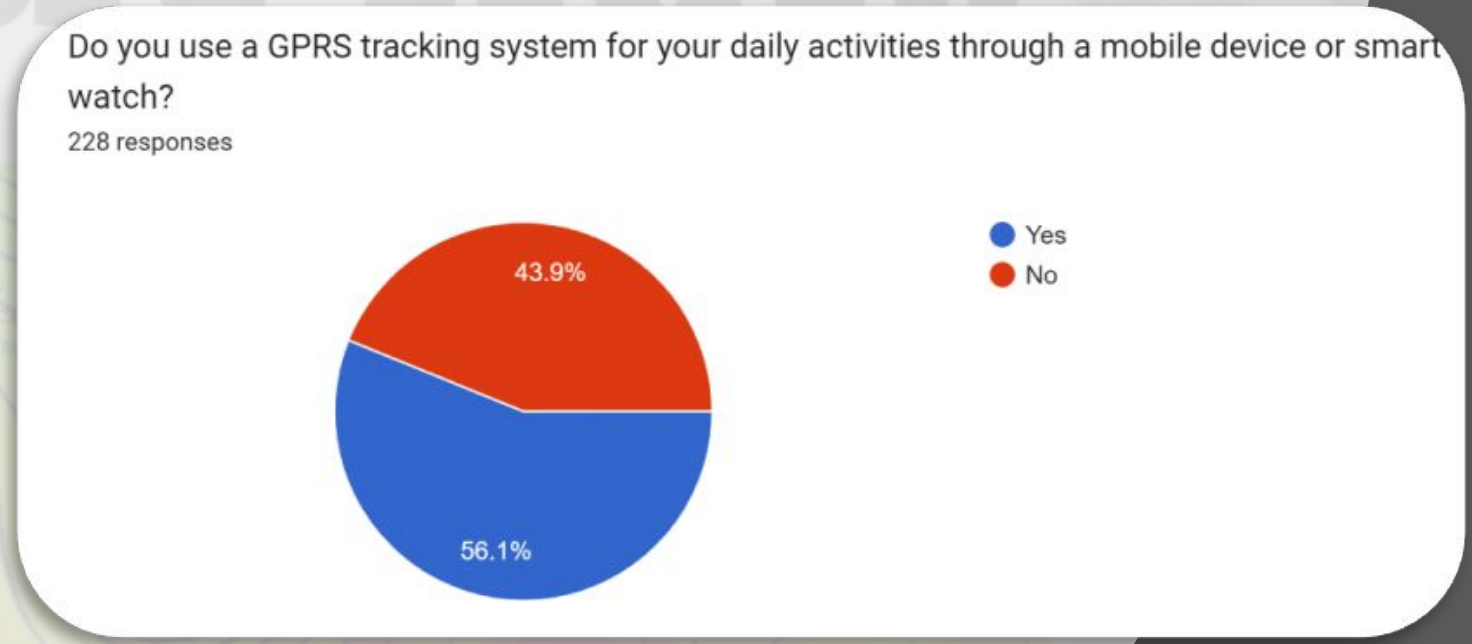
Safety Measures for medical problems Analysis

It shows that 54.8% of the respondents use safety measure.



Use a GPRS Tracking System Analysis

It shows that 56.1% of the respondents use GPRS tracking system.




Thank
you