

Regional wise Weather- Based Disaster Preparedness, Sustainable Agriculture, and Hydraulic Power generation



Members



U.P. Hasin Pramodya

IT20155148

Team Leader



K.D. Hasaranga

IT20161392



C.P. Weerasinghe

IT20148836



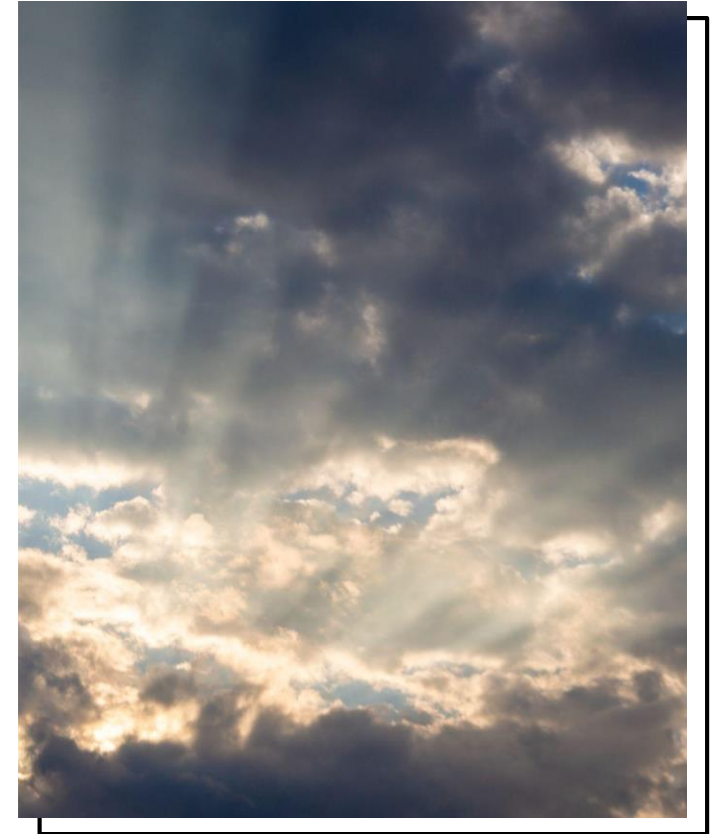
Y.D. Abeygunewardana

IT20115784



Introduction

- Rainfall forecasting is a technologically and scientifically challenging task around the world. Rainfall is one of the most important weather conditions in Sri Lanka
- Ratnapura district is at the top, among the regions with the highest annual rainfall in Sri Lanka. Thus, due to the inability to predict the heavy rainfall in the Rathnapura district in advance, many cases of natural disasters such as floods and the destruction of agricultural crops have been reported
- this study is focused on regional-based rainfall prediction for the Rathnapura district and predicting the impact of rainfall on flood, agriculture, and hydropower generation.



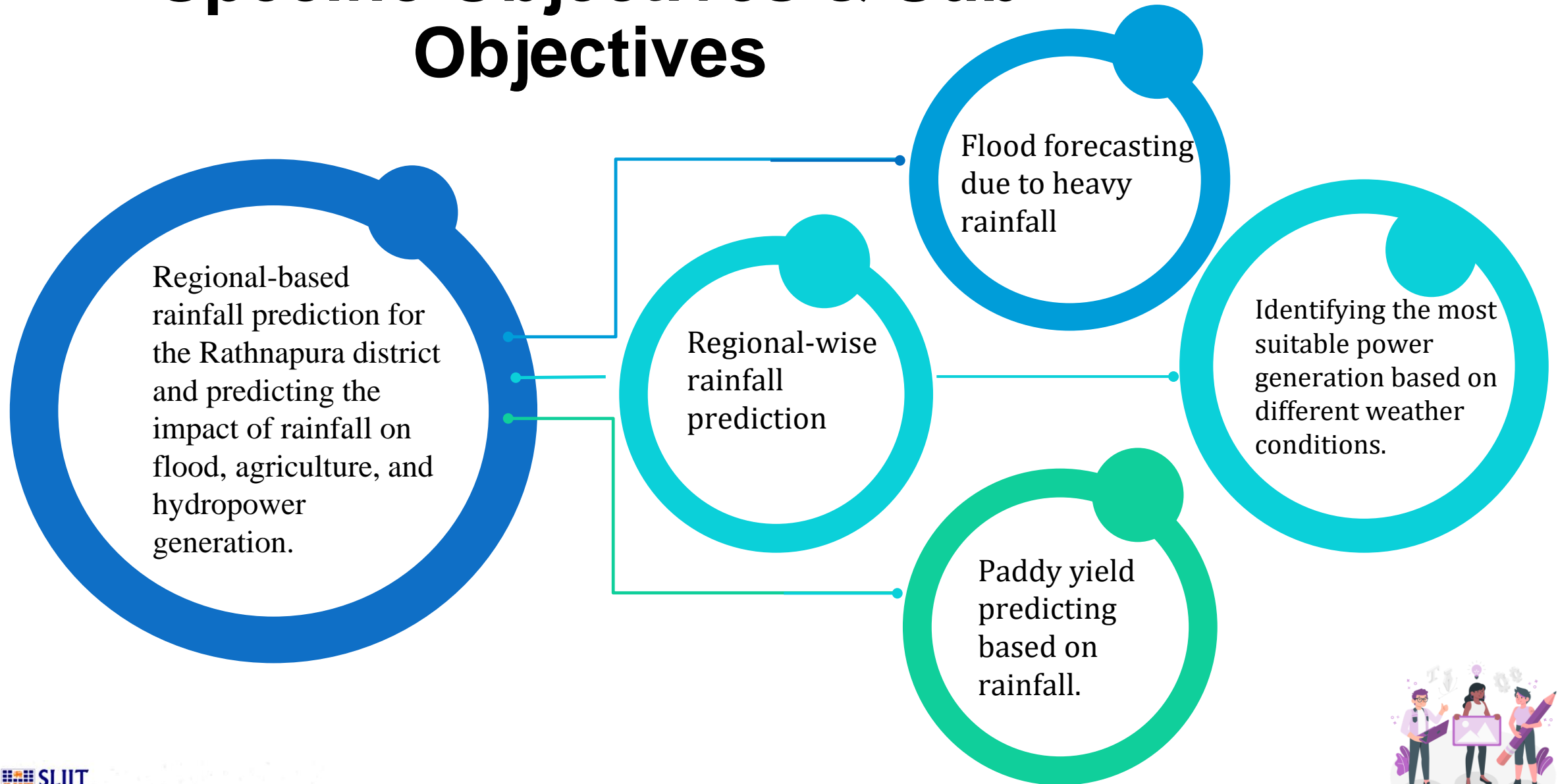
Research Problem

01

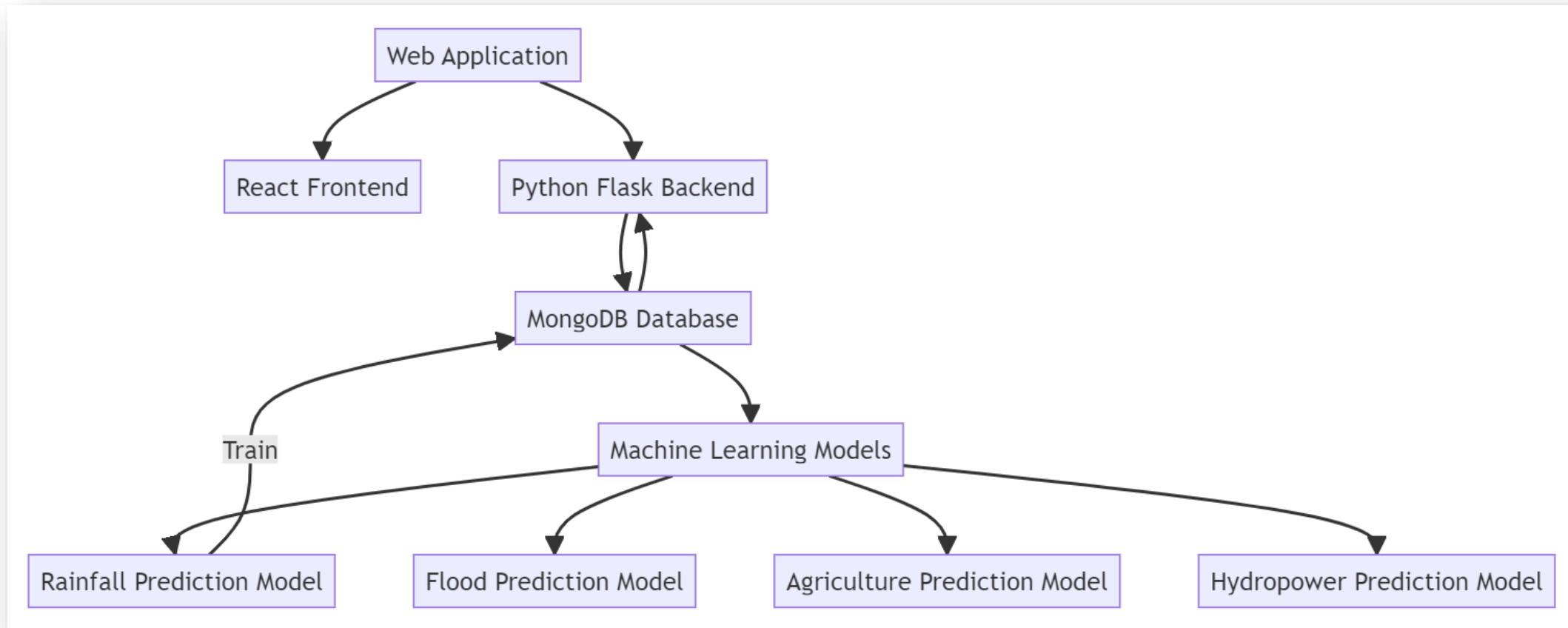
How can an accurate model be developed for flood forecasting, disaster preparedness, agriculture crop yield prediction and hydropower generation prediction based on rainfall regarding the specific region ?



Specific Objectives & Sub Objectives



System Overview Diagram





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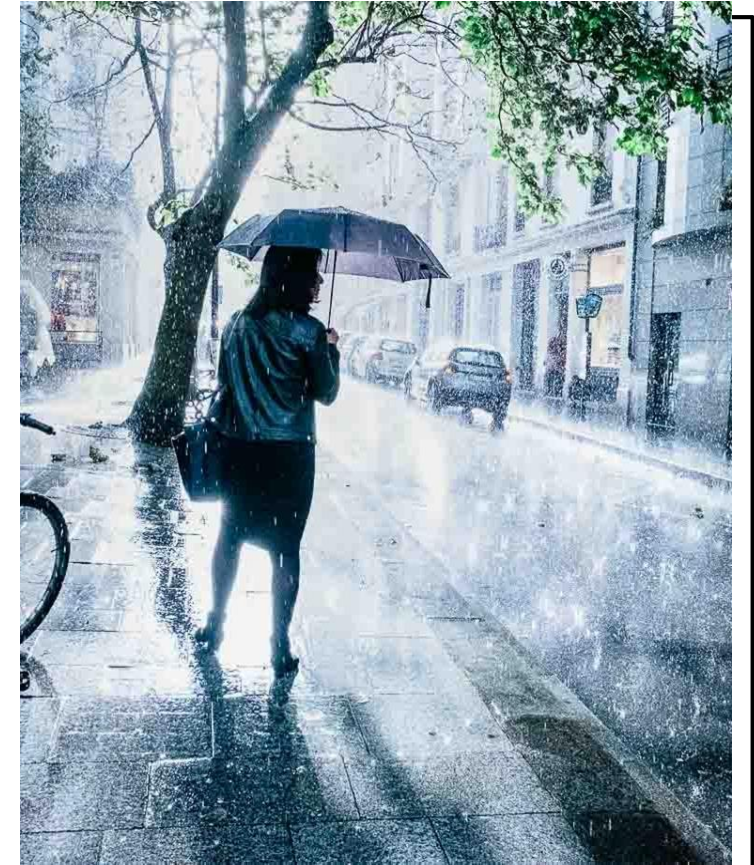
U.P. HASIN PRAMODYA

BSc (Hons) Degree in Information Technology (specialization Information Technology)



Background

- ❑ Rainfall is one of the most important weather conditions in Sri Lanka. Forecasting possible rainfall can help to solve several problems related to the tourism industry, natural disaster management, agricultural industry
- ❑ Ratnapura district is at the top, among the regions with the highest annual rainfall in Sri Lanka. Thus, due to the inability to predict the heavy rainfall in the Rathnapura district in advance, many cases of natural disasters such as floods and the destruction of agricultural crops have been reported
- ❑ Effort of rainfall forecasting for the Rathnapura district and predicted the effect of rainfall on disasters, agriculture, and hydropower generation.



Objectives

Main Objective

Main objective this study is focused on regional-based rainfall prediction for the Rathnapura district and predicting the impact of rainfall on flood, agriculture, and hydropower generation



Methodology

Model Development

- Rainfall Prediction Model

Model implementation

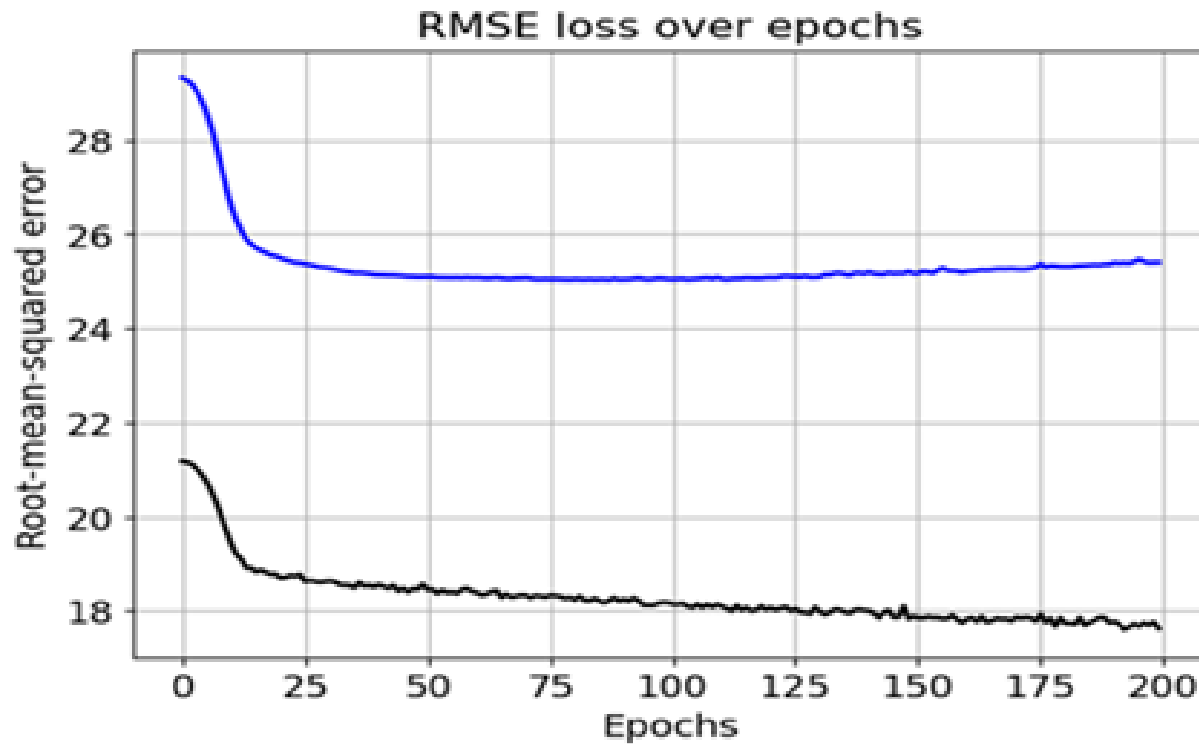
- Auto Arima
- Neural Prophet
- LSTM

The Best Model - LSTM Model



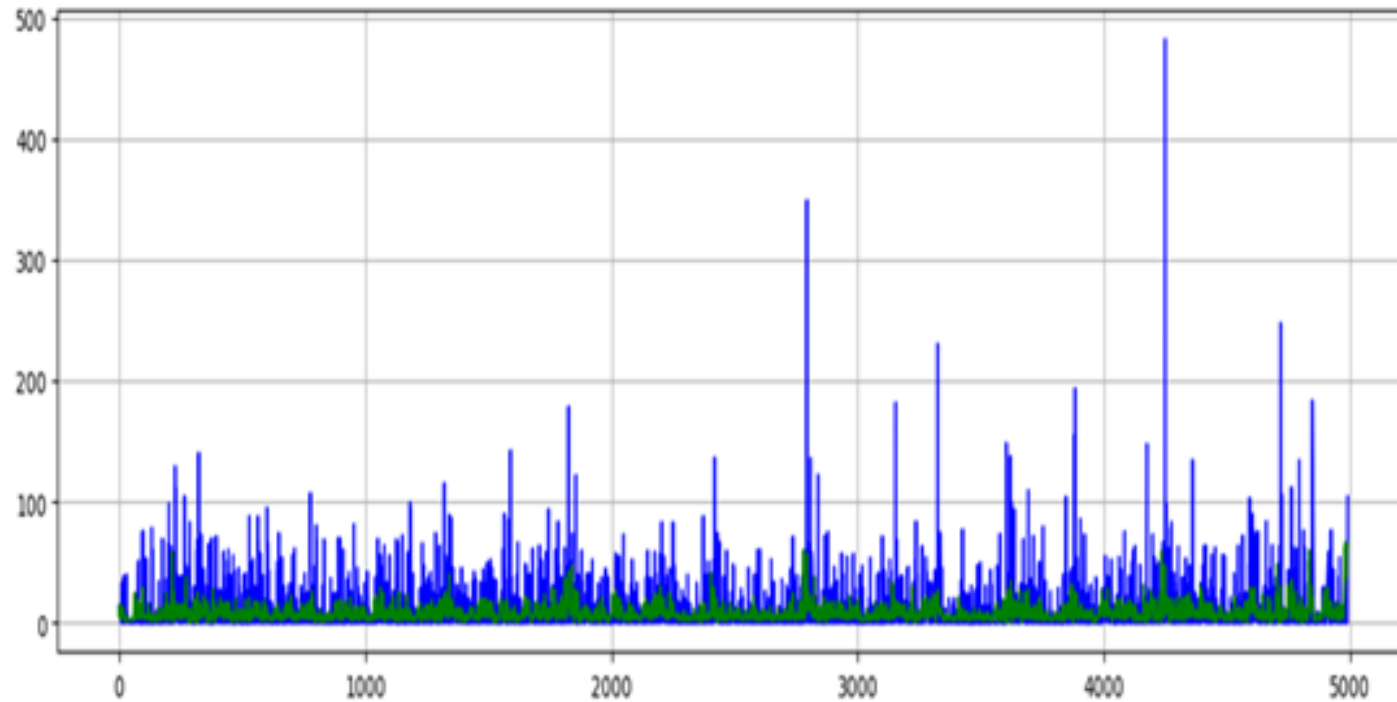
Methodology

Results of rainfall Prediction model



Root mean squared error of Rainfall prediction Model





Model prediction (Blue – actual, Green – predicted)

Data-Driven Rainfall Impact on Game Model Components

×

Home


Precipitation

Flood

Paddy production

Power

Dashboard

 **Dashboard**

Enter precipitation data

Date

2023/10/29

Value


0.00

— +

Save

Enter bulk precipitation data.

CSV file should have 'date'(dd/mm/yyyy) and 'precipitation' columns

 RUNNING... Stop



Data-Driven Rainfall Impact on Game Model Components

×

Home

Precipitation

Flood

Paddy production

Power

Dashboard

RUNNING...

Stop

Enter bulk precipitation data.

CSV file should have 'date'(dd/mm/yyyy) and 'precipitation' columns

Choose a file

Drag and drop file here

Limit 200MB per file • CSV


Browse files

Last updated date

04/09/2023

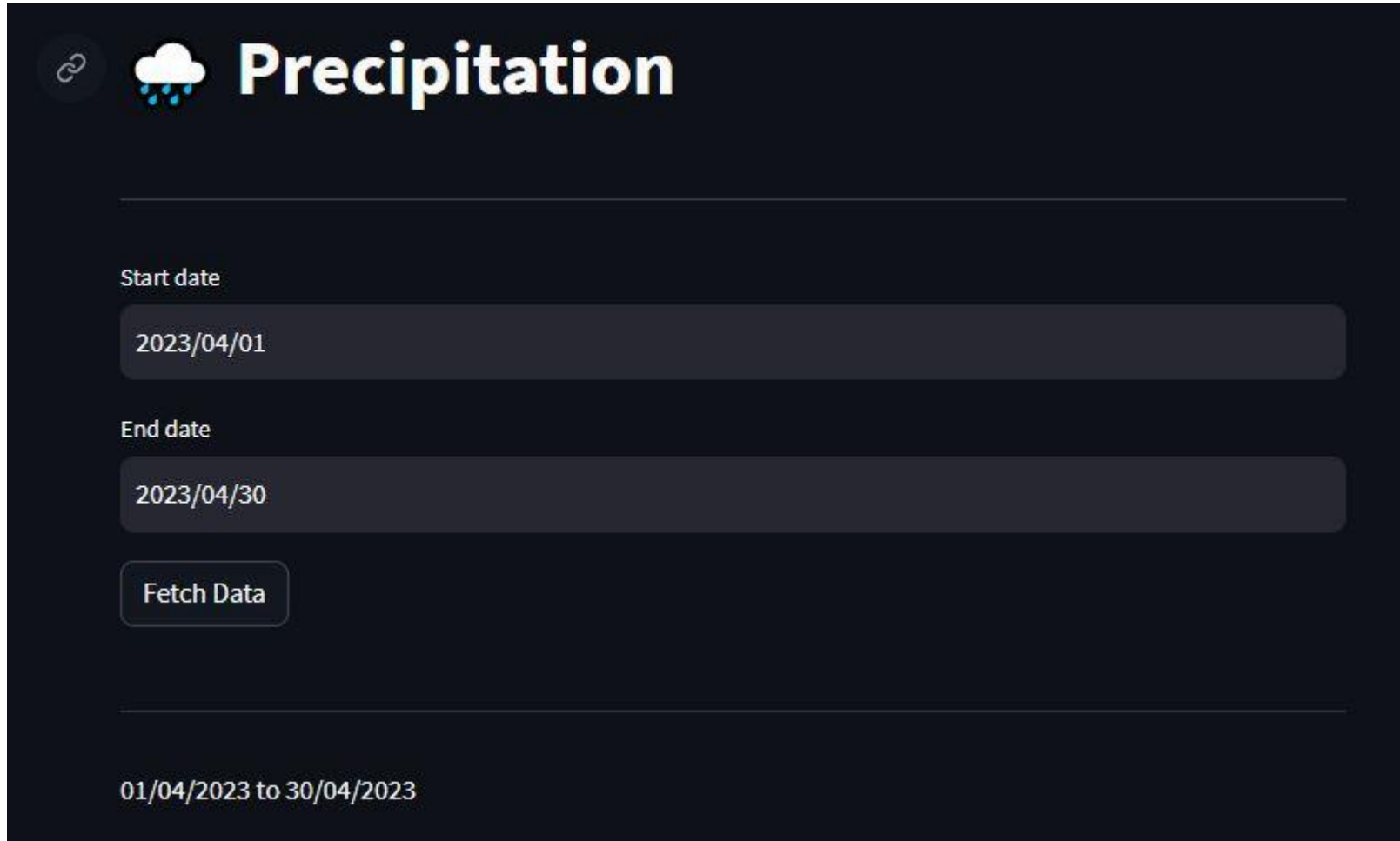
Model status

Online



 **SLIIT**
FACULTY OF COMPUTING

14

Developed Solution



The screenshot shows a web application interface with a dark theme. At the top left, there is a circular icon with a chain link. Next to it is a cloud with rain icon followed by the word "Precipitation" in a large, bold, white font. Below this, there are two input fields for dates. The first is labeled "Start date" and contains the text "2023/04/01". The second is labeled "End date" and contains the text "2023/04/30". Below these fields is a button labeled "Fetch Data". At the bottom of the interface, there is a text label "01/04/2023 to 30/04/2023".

  **Precipitation**

Start date

2023/04/01

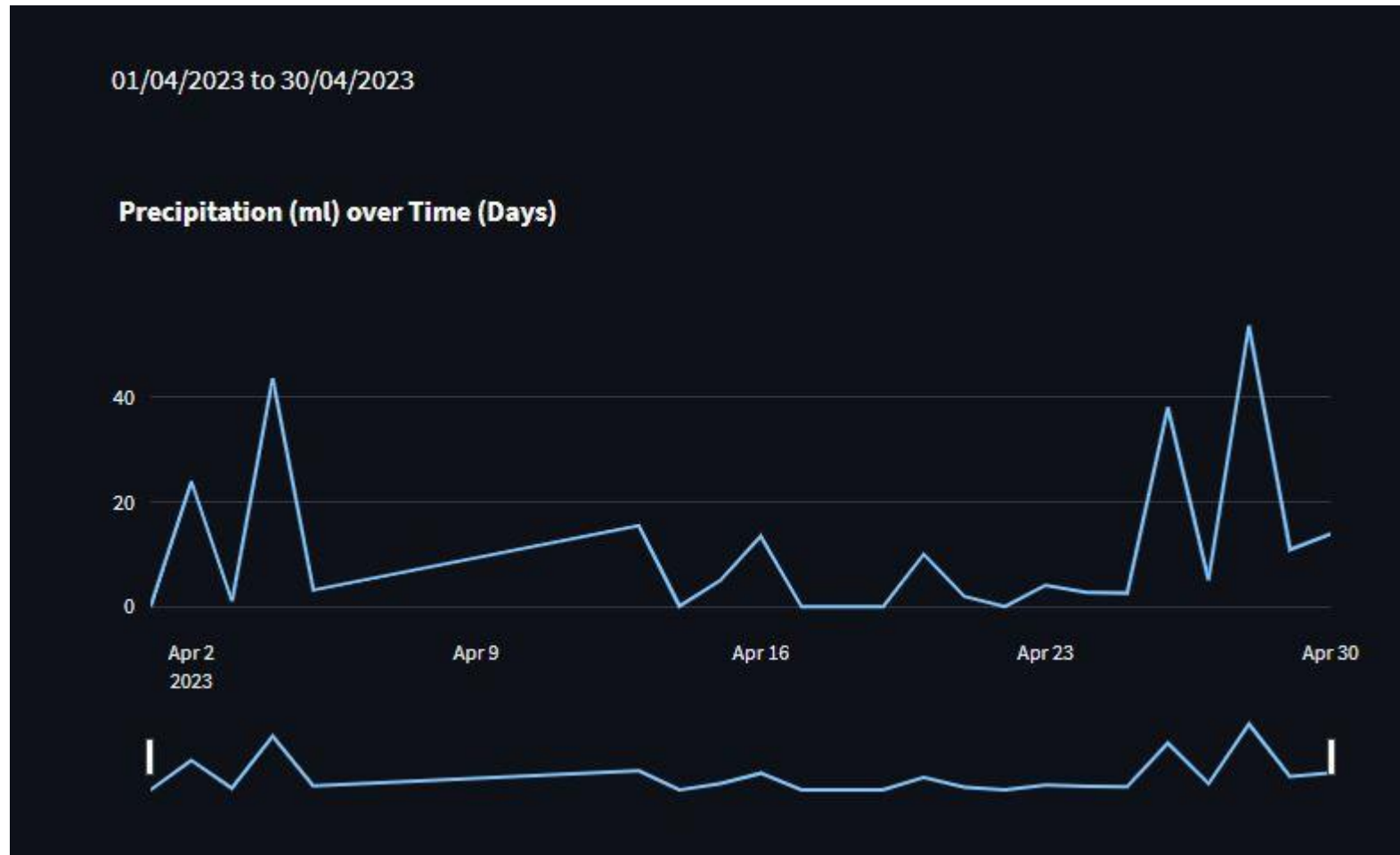
End date

2023/04/30

Fetch Data

01/04/2023 to 30/04/2023

Developed Solution





IT20161392

K.D.HASARANGA

BSc (Hons) Degree in Information Technology (specialization Information Technology)



Regional wise natural disaster forecasting due to adverse weather extremes



Background

- In Sri Lanka, which is prone to floods, droughts, landslides, and cyclones, **flooding emerges** as one of the most frequently occurring and damaging natural disasters.
- It affects human life, the infrastructure, agriculture, and the social and economic systems of a country.
- This study delves into flood forecasting in Rathnapura District, using hydro meteorological data and advanced machine learning techniques.



Objective

Main Objective



The Regional-based flood forecasting and disaster preparedness due to heavy rainfall based on the Kalu Ganga River basin in Rathnapura district .



Methodology

Model Development

- Flood forecasting Model

Model implementation

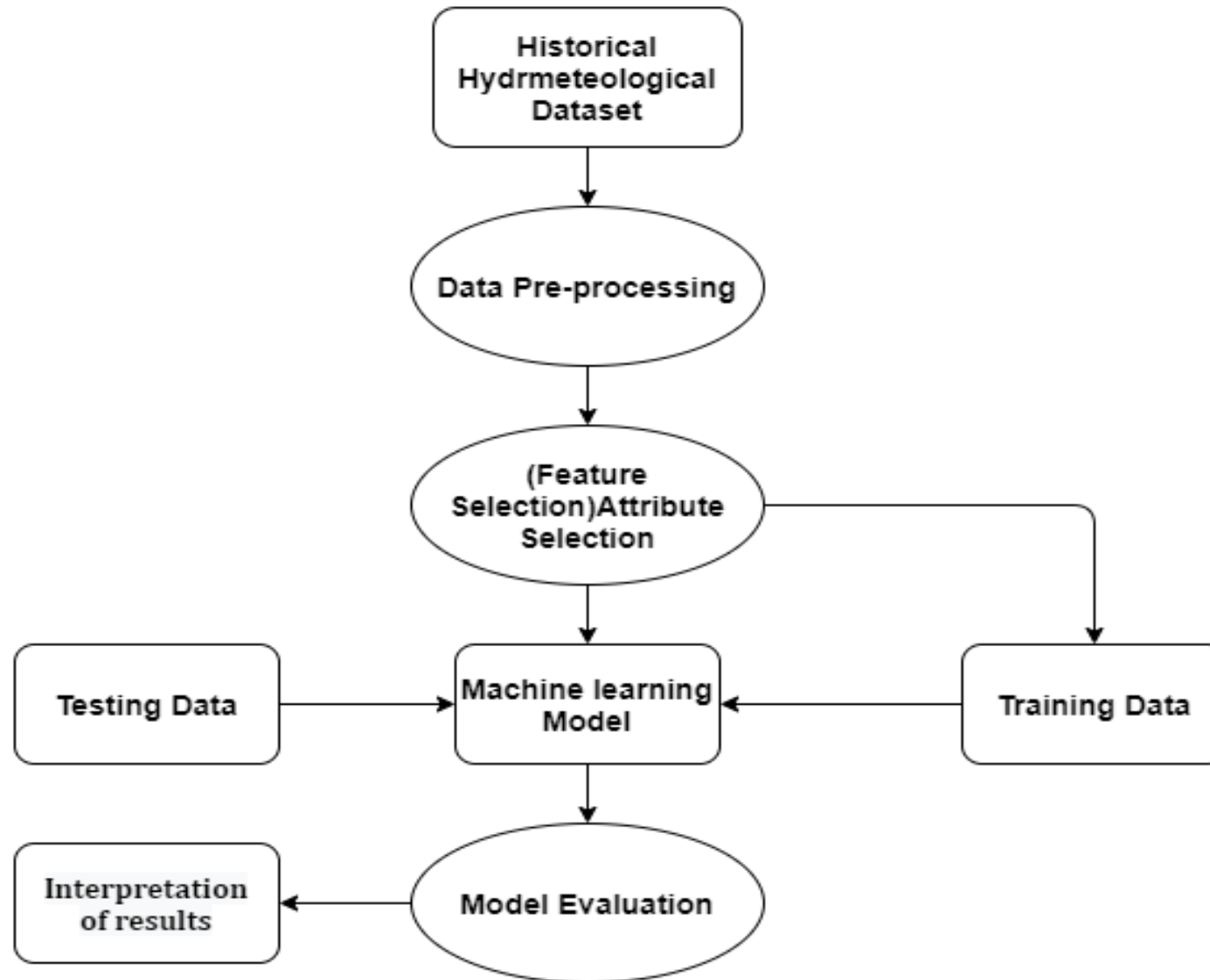
- LSTM Model - Accuracy 45.6%
- KNN Model - Accuracy 96.73%

```
Accuracy: 96.73%  
Precision: 96.51%  
Recall: 94.02%  
F1 Score: 95.25%
```

The Best Model - KNN Model

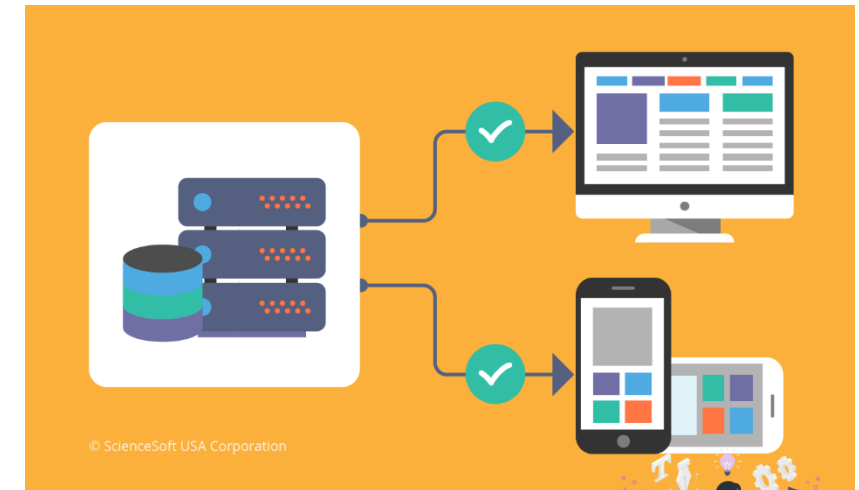


Proposed architecture



Completion of the Project

- Predicting the occurrences of the Flood situations.
- Machine learning model development and preview the interpretation of the result through a web application.



Developed Solution



The screenshot displays the 'Flood' application interface. At the top left is the 'Flood' logo, which consists of a blue wave icon and the word 'Flood' in white. Below the logo is a horizontal line. The interface features two date selection fields: 'Start date' with the value '2023/09/04' and 'End date' with the value '2023/09/30'. Below these fields is a 'Fetch Data' button. At the bottom of the interface, a date range '04/09/2023 to 30/09/2023' is displayed.

Flood

Start date

2023/09/04

End date

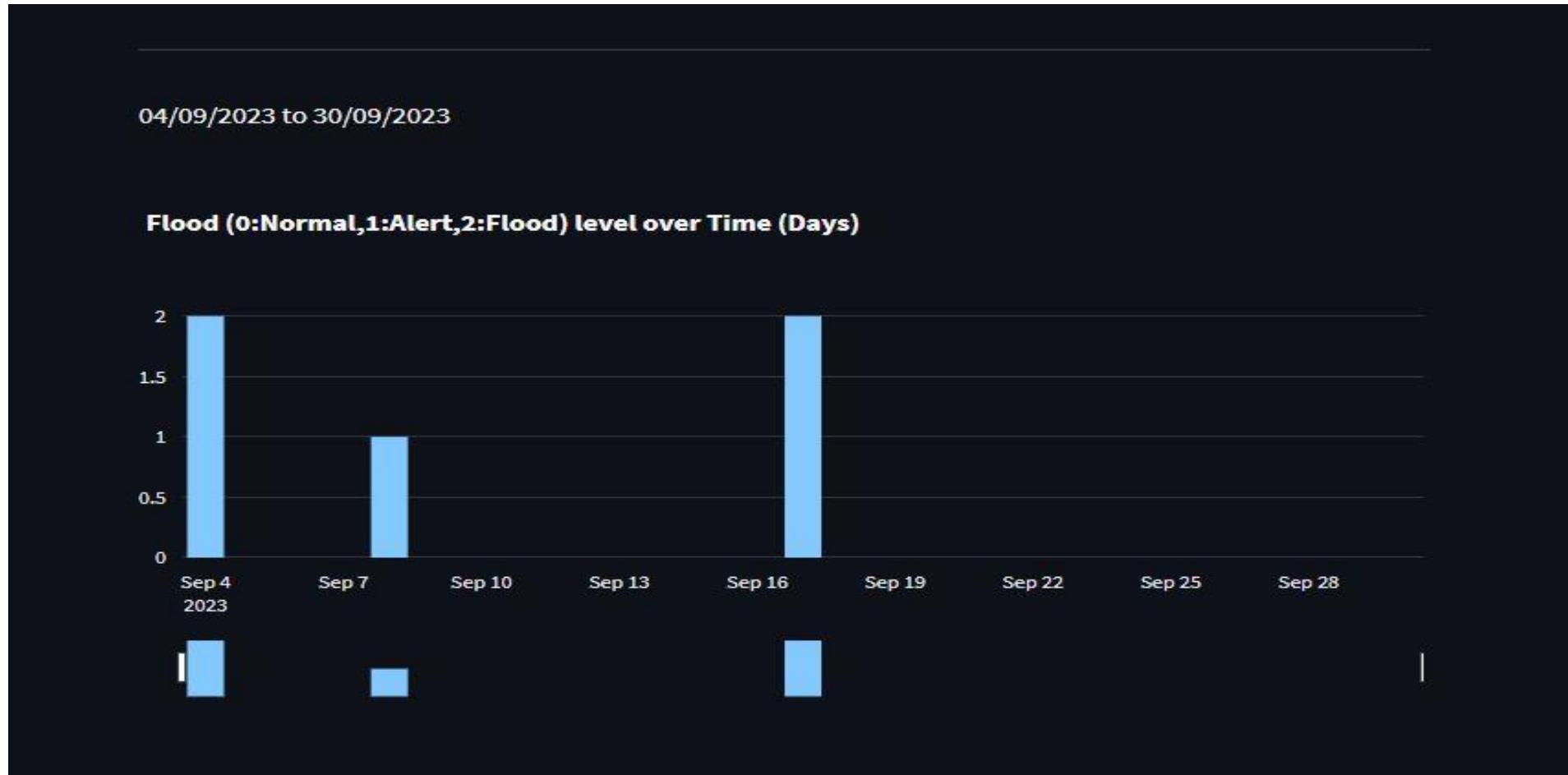
2023/09/30

Fetch Data

04/09/2023 to 30/09/2023

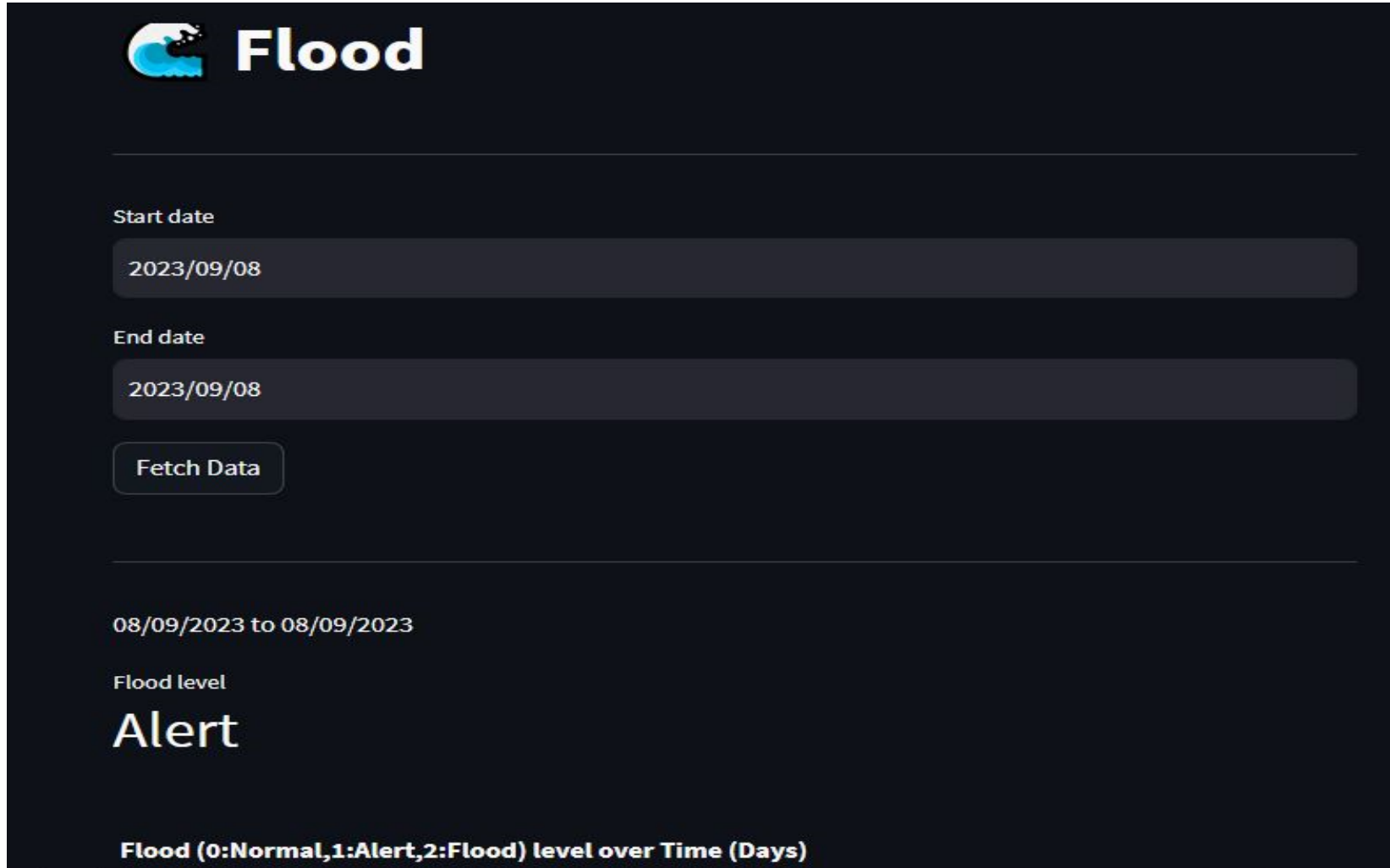
Developed Solution

For Date Range



Developed Solution

For a Specific Date



The screenshot displays a web application titled "Flood" with a blue wave icon. It features two date input fields, both set to "2023/09/08", labeled "Start date" and "End date". A "Fetch Data" button is positioned below these fields. The interface shows the selected date range "08/09/2023 to 08/09/2023" and a "Flood level" section with the word "Alert" in large text. At the bottom, a legend states "Flood (0:Normal,1:Alert,2:Flood) level over Time (Days)".



IT20148836

C.P.WEERASINGHE

BSc (Hons) Degree in Information Technology (specialization Information Technology)



Weather Prediction and Optimal Power Generation for Hydraulic Turbines: A Machine Learning Approach



Enhancing Hydropower Generation and Management through Integrated Weather Prediction and Machine Learning

Background

- ❑ Highlight the historical significance of hydropower and its current role as a renewable energy source.
- ❑ Emphasize the importance of optimizing hydropower generation and managing water resources efficiently.
- ❑ Introduce the challenges posed by water availability, which is influenced by weather conditions.



Main Objective

The main objective of this research is to develop an integrated machine learning-based framework that combines weather prediction, power generation prediction, and power consumption prediction models to optimize the operation of hydraulic turbines under various weather conditions in a specific area.



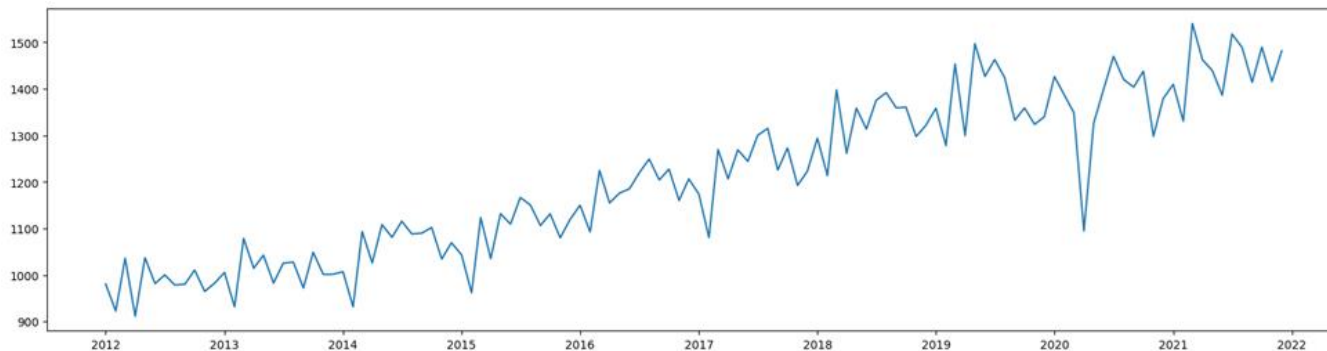
Model Development

- Power Generation Prediction Models
- Power Consumption Prediction Models



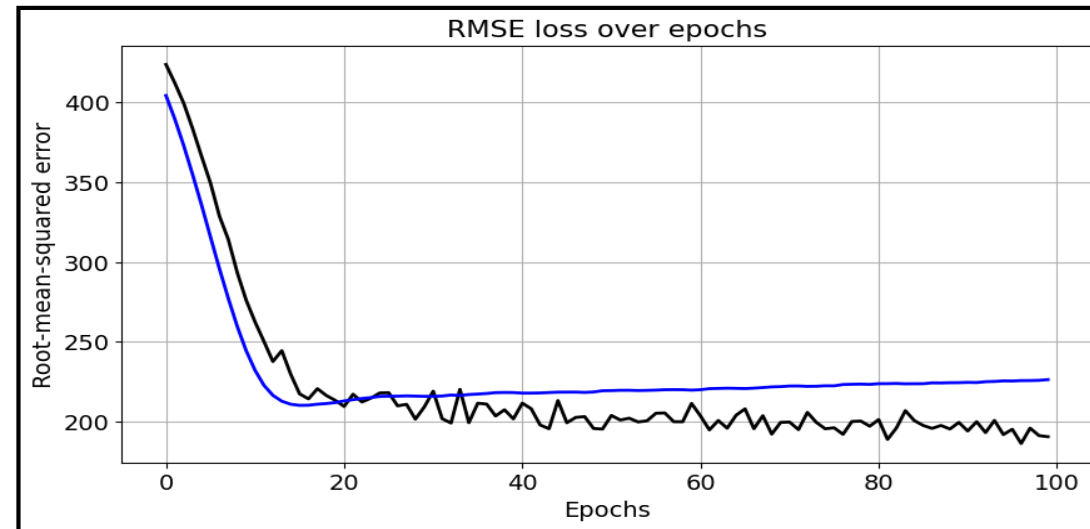
Methodology

- **Power Consumption Prediction**
Model implementation.
 - Performed Auto ARIMA
 - Best model: $\text{ARIMA}(2,0,0)(1,0,2)$



Methodology

- **Hydro power prediction**
Model implementation.
 - Artificial neural network (ANN)



Developed Solution

×

Home

Precipitation


Flood

Paddy production

Power

Dashboard

⋮

 **Power**

Start date

2023/01/01

End date

2023/05/29

Fetch Data

01/01/2023 to 31/05/2023

Power (Gwh) over Time (Months)



Developed Solution

2023/09/01

End date

2023/09/30

Fetch Data

01/09/2023 to 30/09/2023

Hydro gen - Gwh

26.4

Usage - Gwh

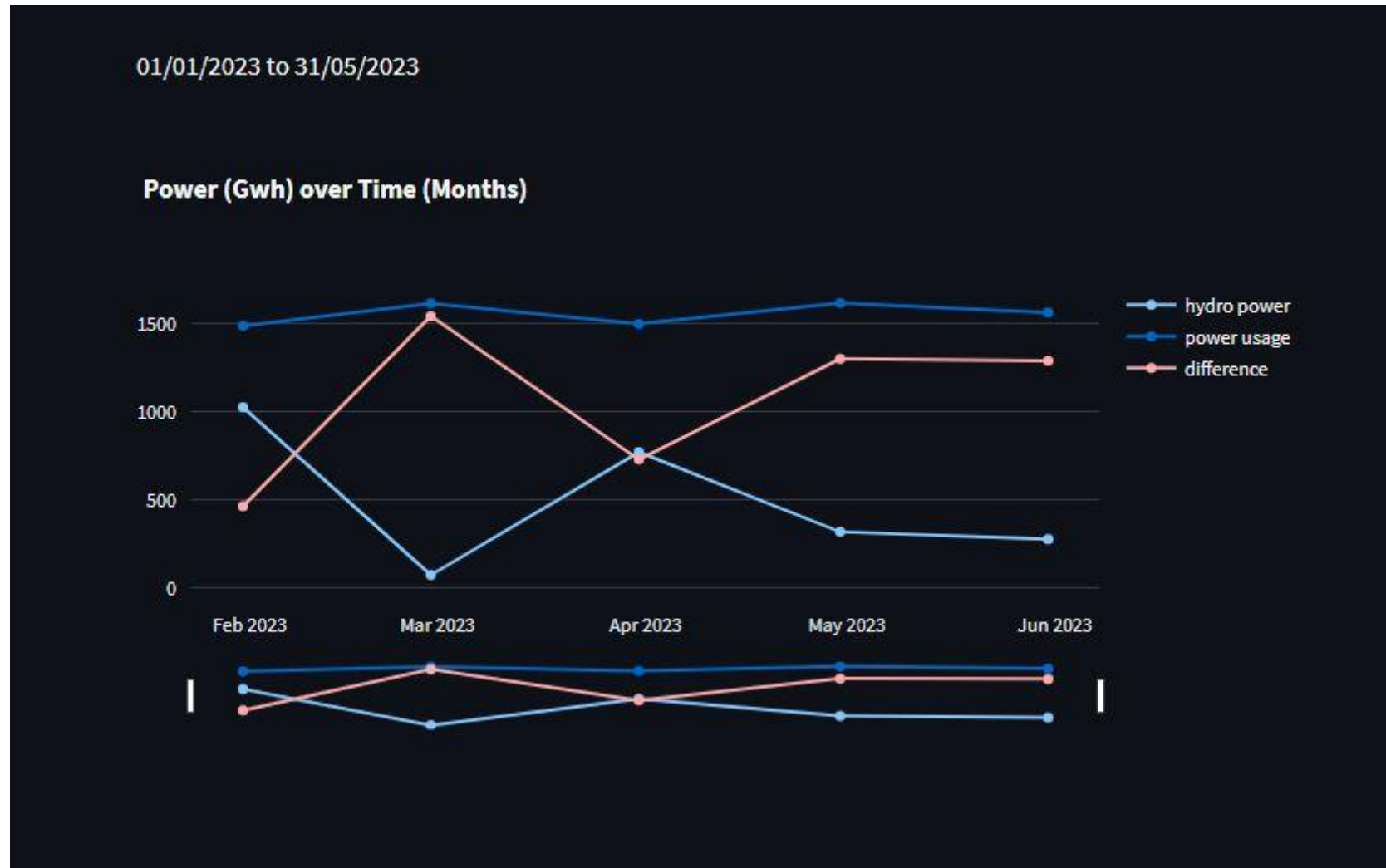
1573.22

Diff - Gwh

1546.82



Developed Solution





IT20115784 | Y.D ABEYGUNewardANA

BSc (Hons) Degree in Information Technology (specialization Information Technology)



Paddy yield predicting using rainfall.

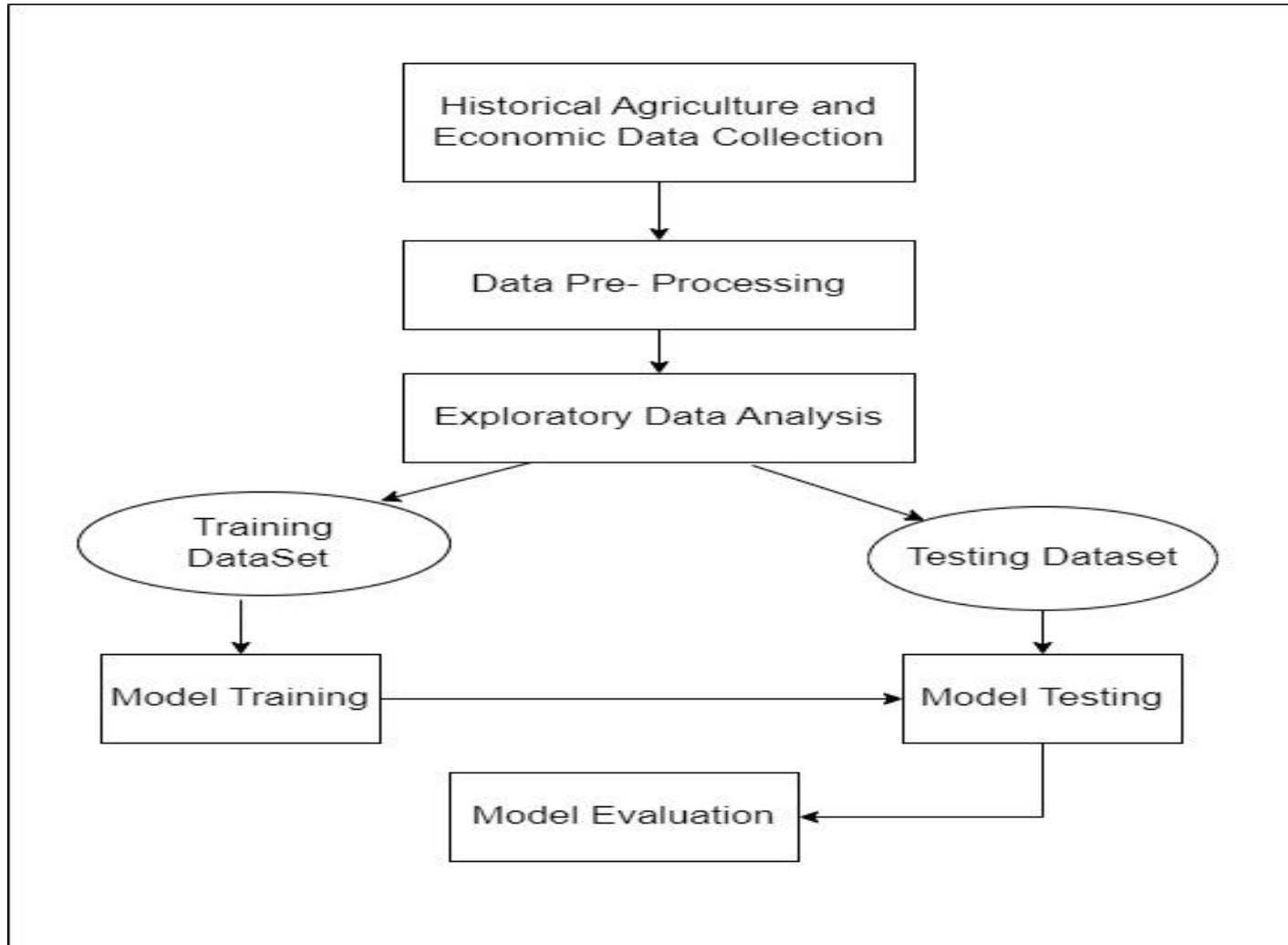
Background

Paddy is one of the main sectors of the Sri Lankan economy

Sri Lanka has a rich agricultural history



Proposed architecture



Methodology

paddy Attributes

Harvested(hectares)
paddy Yield (mt)
rainfall(mm) monthly mean avg

Data available

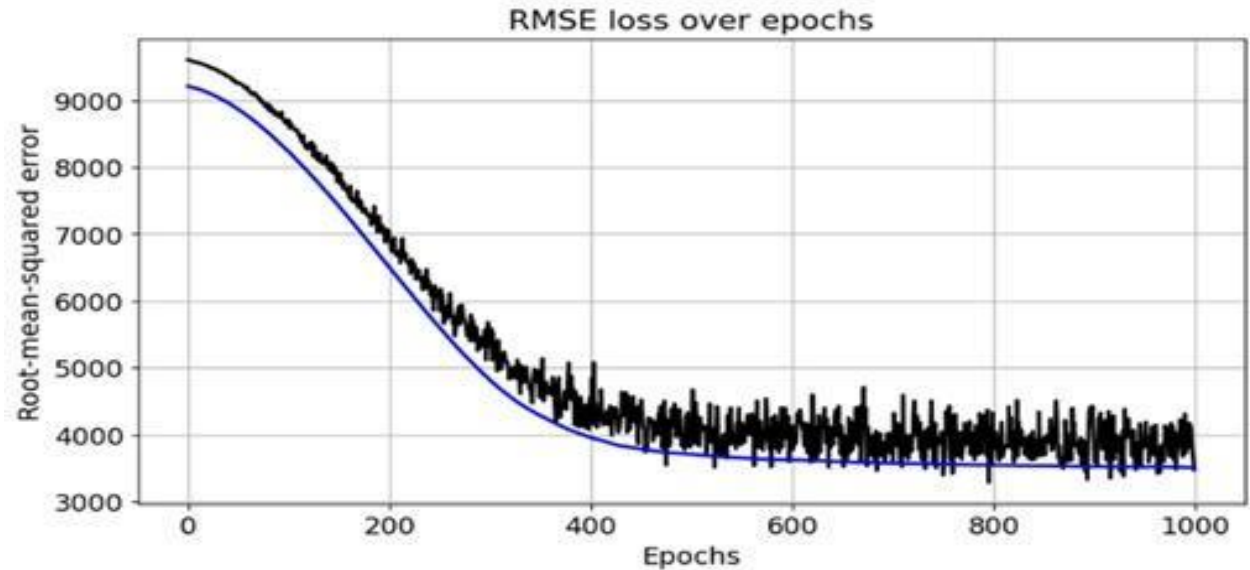
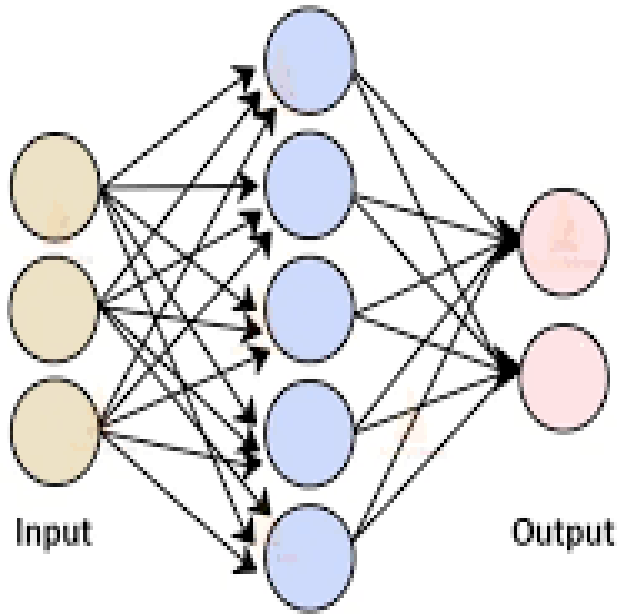
Department of Agriculture
Socio Economic Planning center Peradeniya. (SEPC)
Ministry of Agriculture Battaramulla.



Machine learning algorithm/models

LSTM

Artificial Neural Network(ANN)



Root mean squared error of paddy yield prediction model



Developed Solution

Paddy Production

Start

Year start

2020



Kannya start

Yala



Fetch Data

End

Year end

2024



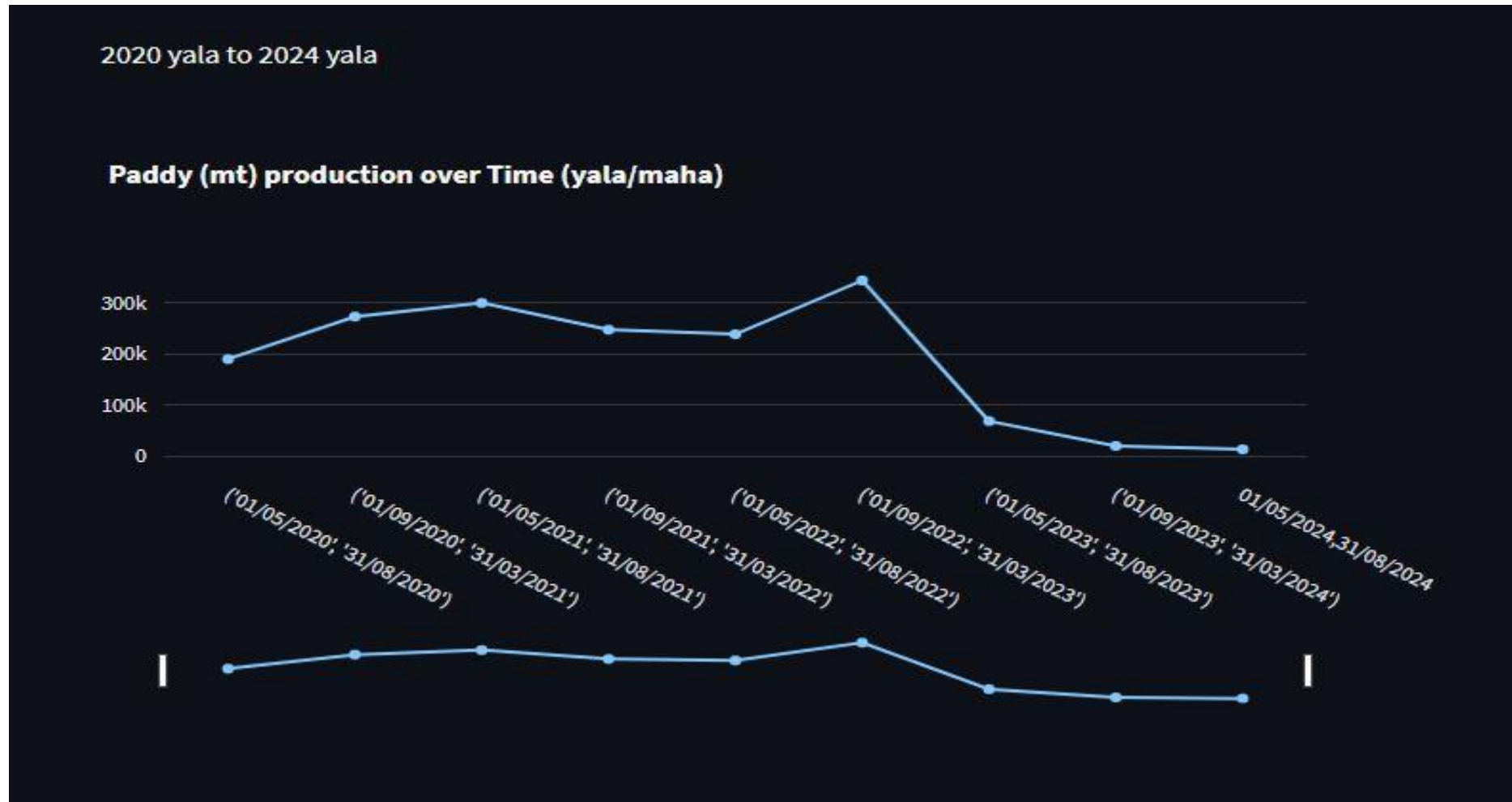
Kannya end

Yala



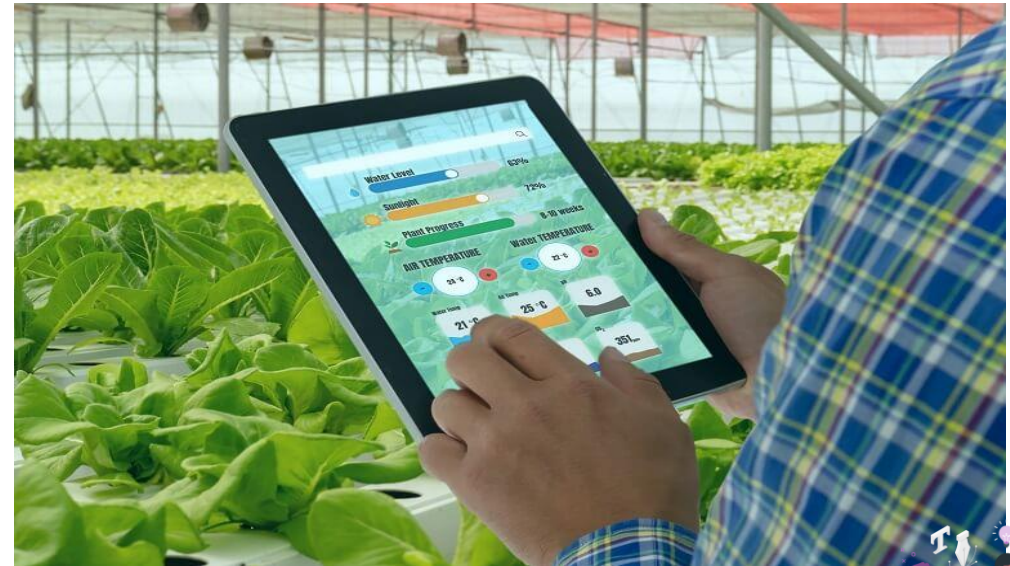
2020 yala to 2024 yala

Developed Solution



Completion of the project

- Prediction of paddy yield using web application.
- Help full for
 - Government
 - Farmer
 - Import market
 - Export market



Technologies and Tools



POSTMAN



References

1. Maya Gopal P. S. and Bhargavi R. School of Computing Science and Engineering, VIT University, Chennai, India (Performance Evaluation of Best Feature Subsets for Crop Yield Prediction Using Machine Learning Algorithms)
2. Shelestov, A.; Lavreniuk, M.; Vasiliev, V.; Shumilo, L.; Kolotii, A.; Yailymov, B.; Kussul, N.; Yailymova, H. Cloud Approach to Automated Crop Classification Using Sentinel-1 Imagery. IEEE Trans. Big Data 2020, 6, 572–582.
3. College of Resources and Environment, Southwest University, Chongqing 400716, China; love960223@email.swu.edu.cn (Mapping Rice Paddy Based on Machine Learning with Sentinel-2 Multi-Temporal Data: Model Comparison and Transferability)
4. Grain yield prediction of rice using multi-temporal UAV-based RGB and multispectral images and model transfer – a case study of small farmlands in the South of China
5. Remote Sensing Laboratory (LATUV), University of Valladolid, Paseo de Belen 11, 47011 Valladolid, Spain * Correspondence: diego.gomez.aragon@gmail.com or diego@latuv.uva.es (Potato Yield Prediction Using Machine Learning Techniques and Sentinel 2 Data)
6. Wan, L.; Cen, H.; Zhu, J.; Zhang, J.; Zhu, Y.; Sun, D.; Du, X.; Zhai, L.; Weng, H.; Li, Y.; et al. Grain yield prediction of rice using multi-temporal UAV-based RGB and multispectral images and model transfer—A case study of small farmlands in the South of China. Agric. For. Meteorol. 2020, 291, 108096. |



Commercialization

Commercialization:

- We Plan to commercialize this by targeting mainly on civilians in relevant regions.
- We hope to provide this system as a recommendations system to the department of Meteorology and the Department of Disaster Management.



THANK YOU !



Q & A