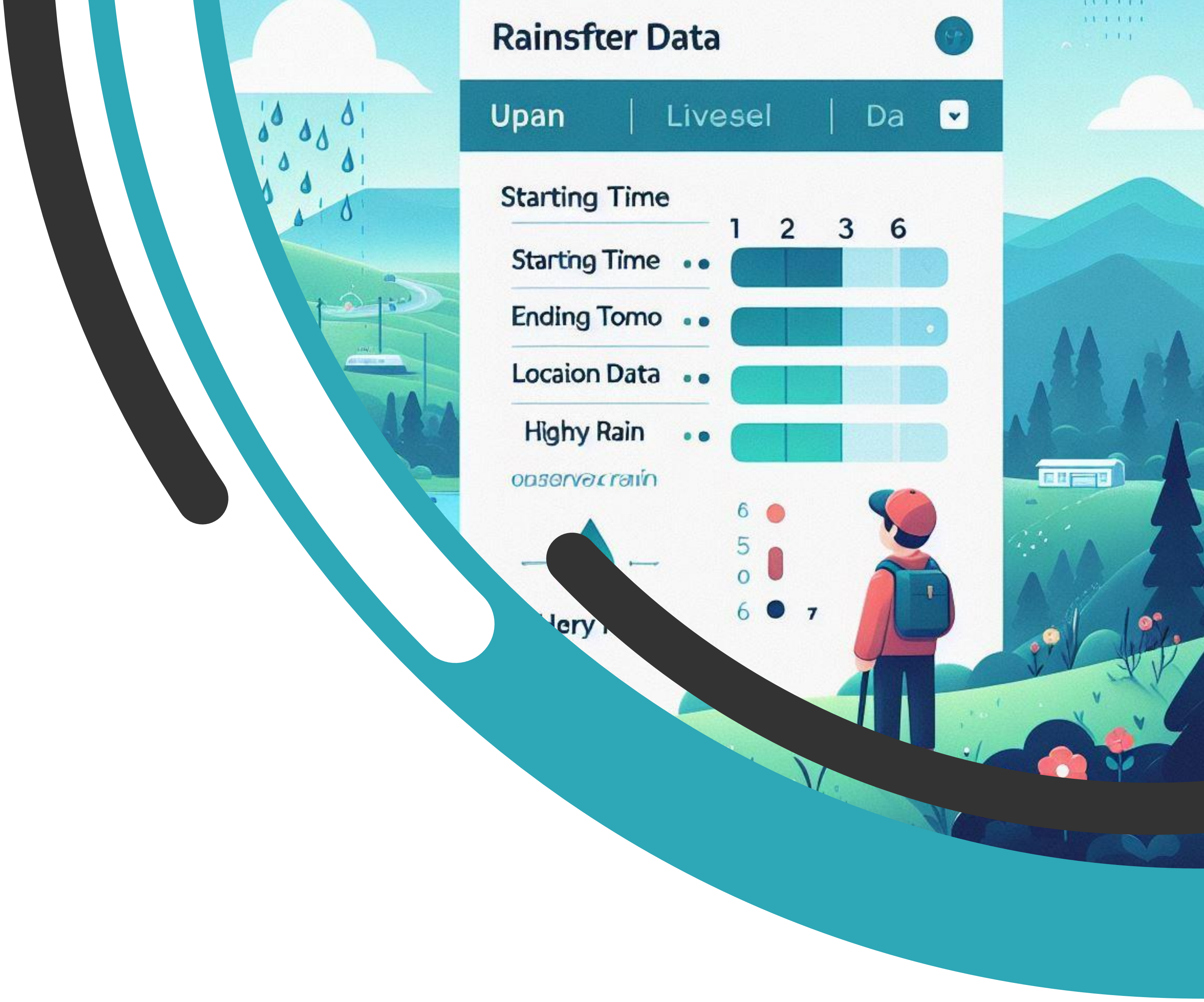

In22-S2-CS1040

Project 01

Integrated Rainfall Observation System for Sri Lanka

Project Team: Code Busters

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1.0 Introduction:

1.1 Background:

The Weather Prediction System for Sri Lanka aims to improve the accuracy of weather forecasts by collecting and analyzing rainfall data from individuals across the country. This system will allow users to record the starting time, location (GPS data), ending time, and location data, as well as the amount of observed rain in a scale of Heavy rain, Upper high intensity, Lower high intensity, Higher low intensity, Upper low intensity, and Light rain. The collected data will be sent to a database server for creating a dataset that can be used in a machine learning/artificial intelligence software product.

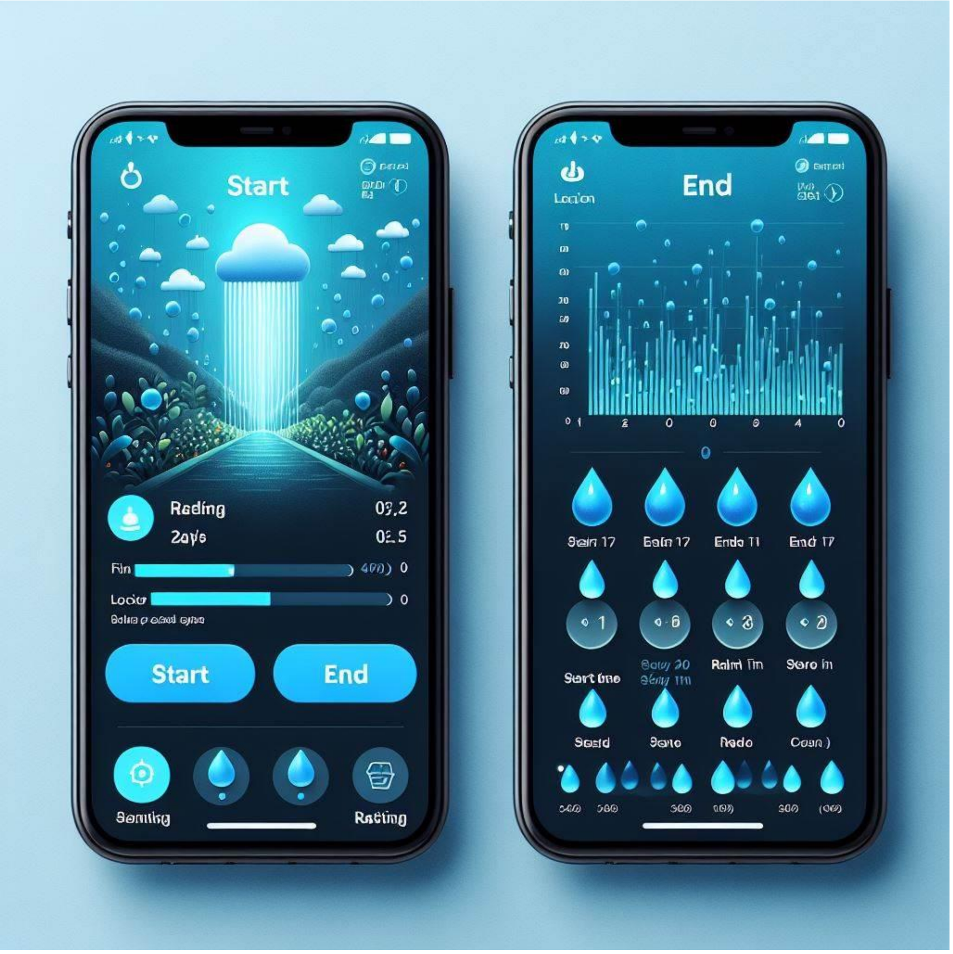


Figure 1-1 – Sample User Interface

1.2 Project Description:

The Integrated Rainfall Observation System for Sri Lanka is a mobile-based solution designed to collect and evaluate real-time rainfall data across the country. Through a user-friendly mobile app, individuals can easily report rainfall events, providing essential information such as start and end times, along with location details via GPS. Users are prompted to rate the intensity of the rain on a scale from 1 to 6, ranging from Light to Heavy rain.

To ensure data accuracy, the system employs robust error filtering mechanisms. It calculates the distance between reported start and end locations, dismissing data with distances exceeding 1 km. Additionally, user ratings are monitored, and deviations from the norm may result in rating adjustments to maintain data consistency.

Furthermore, an error filtering mechanism is applied based on average rainfall scale, dismissing data points significantly different from the norm. Validated data is then transmitted to a centralized database server for storage and analysis, facilitating the training of machine learning and artificial intelligence models to enhance weather forecasting accuracy.

In summary, the Integrated Rainfall Observation System aims to revolutionize how rainfall data is collected and utilized, leveraging mobile technology and community engagement to improve weather forecasting capabilities in Sri Lanka.

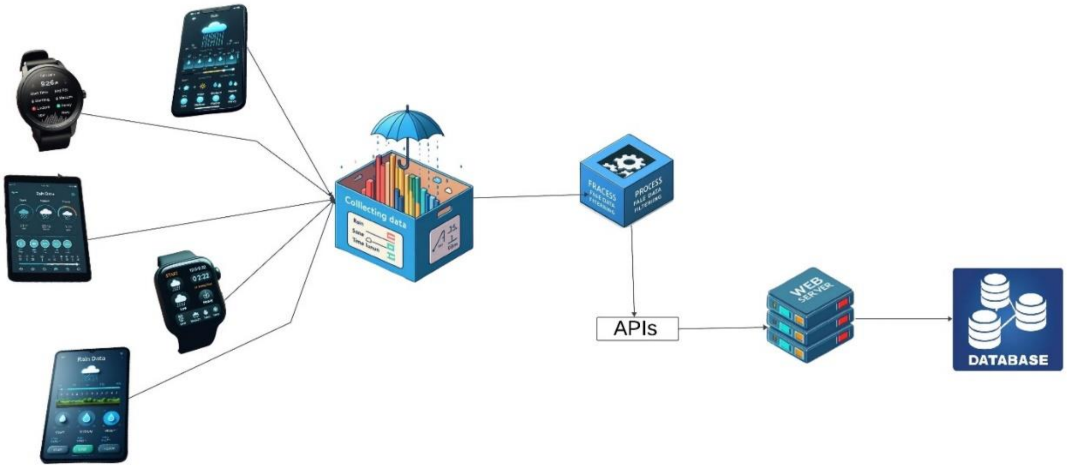


Figure 1-2

1.3 Importance and Usefulness:

Sri Lanka experiences diverse weather patterns, and accurate rainfall prediction is crucial for various sectors, including agriculture, disaster management, and infrastructure planning.

The current weather prediction system in Sri Lanka is not very reliable, as it relies on manual data collection from a few main cities, which may not reflect the actual weather conditions in different regions of the island. Moreover, the manual data collection process is time-consuming and prone to errors.

Accurate rainfall data helps in creating more precise weather predictions, aiding in proactive decision-making for various stakeholders.

2.0 System Requirements Analysis:

1. Operating System Compatibility
2. Minimum OS Version
3. Database Server
4. GPS capability for location-based weather updates.
5. Internet Connection
6. Permissions
7. Storage Space
8. Battery Consumption

3.0 Systems Requirements Specification:

1. Operating System is Compatible with Android and iOS.

2. Minimum OS Versions are iOS 13.0 and Android 10.

3. The database server should possess data handling capabilities, ensure data security, exhibit scalability for accommodating future growth, and provide real-time access to collected data.

4. The app requires an active internet connection to fetch user data.

5. Outline any necessary permissions, the app requires access to location services, storage, or network.

6. Size of installation files vary from 20 MB to 50 MB depending on the version you wish to download, and typical installation requires ~30 MB Storage Space.

7. The app runs in the background frequently, so the app consumes significant battery power.

4.0 Software Requirements Analysis

4.1 Functional Requirements:

1. User Authentication
2. Data Input
3. Data Storage
4. Data Export
5. Offline Data Collection
6. Real-time Updates

4.2 Non-functional Requirements:

1. Performance
2. Scalability
3. Data Security
4. Usability
5. Compatibility
6. Error Handling
7. Integration with External Systems
8. Database schema
9. Data Validation

5.0 Software Requirements Specification (SRS):

5.1 Functional Requirements:

1. User Authentication: create user accounts and rate them depending on the accuracy of the information given.
2. Data Input: Record Starting time, Ending time and location
3. Data Storage: Store collected data securely and efficiently in a database
4. Data Export: Export collected data to the database.
5. Offline Data Collection: Support data collection even when the device is offline, with sync functionality for later upload.
6. Real-time Updates: Provide real-time updates and notifications.

5.2 Non-functional Requirements:

1. Performance: The app should respond quickly to user interactions and data queries, with minimal latency.
2. Scalability: The app should be able to handle increasing numbers of users and data volume without significant performance degradation.
3. Data Security: Implement robust security measures to protect sensitive user data, including encryption and access controls. Encryption for data transmission to the database server.
4. Usability: The app should have an intuitive user interface, with clear navigation and easy-to-use features, to ensure user satisfaction and adoption.
5. Compatibility: The app should be compatible with a wide range of devices such as smart phones, tablets and smart watches to reach a broad user base.

6. Error Handling: The app should handle errors gracefully, providing informative error messages and logs to assist users and administrators in troubleshooting issues.
7. Database schema: Structure the database to efficiently store and retrieve collected data for ML/AI training.

```
{
"Starting time": { type: Date }
"Starting location":
"Ending time": { type: Date }
"Ending location":
"rain_scale":
 }
```

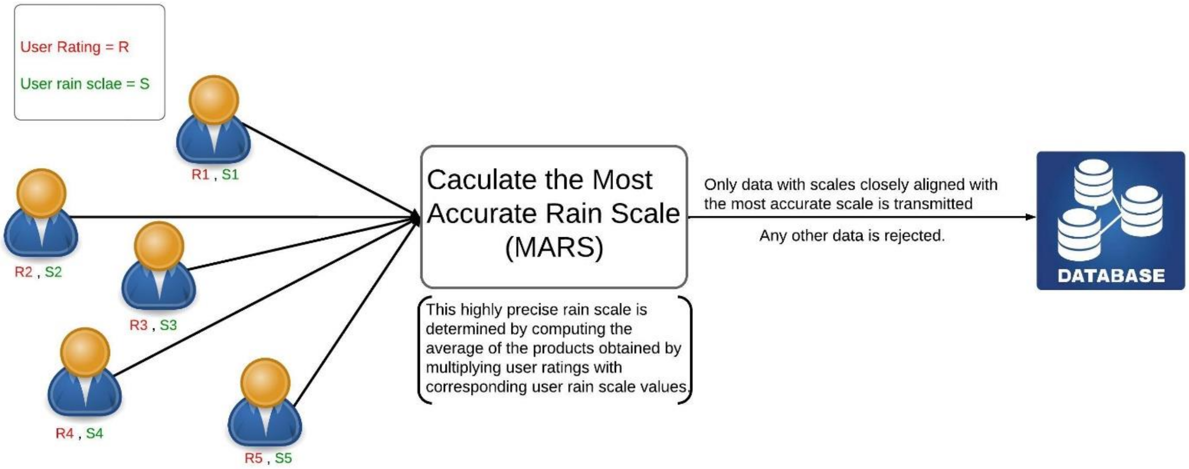
8. Integration with External Systems: Enable integration with other systems or APIs for data export and automation.
9. Data Validation: Ensure the accuracy and integrity of collected data through validation rules.

Validation rules

i. The distance between the starting and the ending locations should not exceed 1 km.
ii. Compare all time durations recorded from a selected location and eliminate any outliers or odd values.
iii. Leverage the user's past data contributions to assign a rating and use this rating as a criterion to filter and eliminate inaccurate data from the dataset.

Table 5-1

Data Validation Mechanism :



Only data with scales closely aligned with the most accurate scale is transmitted

Any other data is rejected.

This highly precise rain scale is determined by computing the average of the products obtained by multiplying user ratings with corresponding user rain scale values.

Figure 5-1

Sample Situation

Consider a situation where, Given the provided data R1, R2, R3, R4, R5 are 1, 0.9, 0.96, 0.2, 0.93, and S1, S2, S3, S4, S5 are 2, 3, 2, 6, 2, the Mean Average Rain Scale (MARS) is calculated by taking the average of the products of corresponding user ratings and rain scale values:

$$MARS=\frac{(R1\times S1)+(R2\times S2)+(R3\times S3)+(R4\times S4)+(R5\times S5)}{5}$$

$MARS \approx 1.936$

Since the calculated MARS is around 1.936, which falls within the range of 2-3, the data point with a rain scale of 6 is considered inaccurate, and it will not be sent to the database.