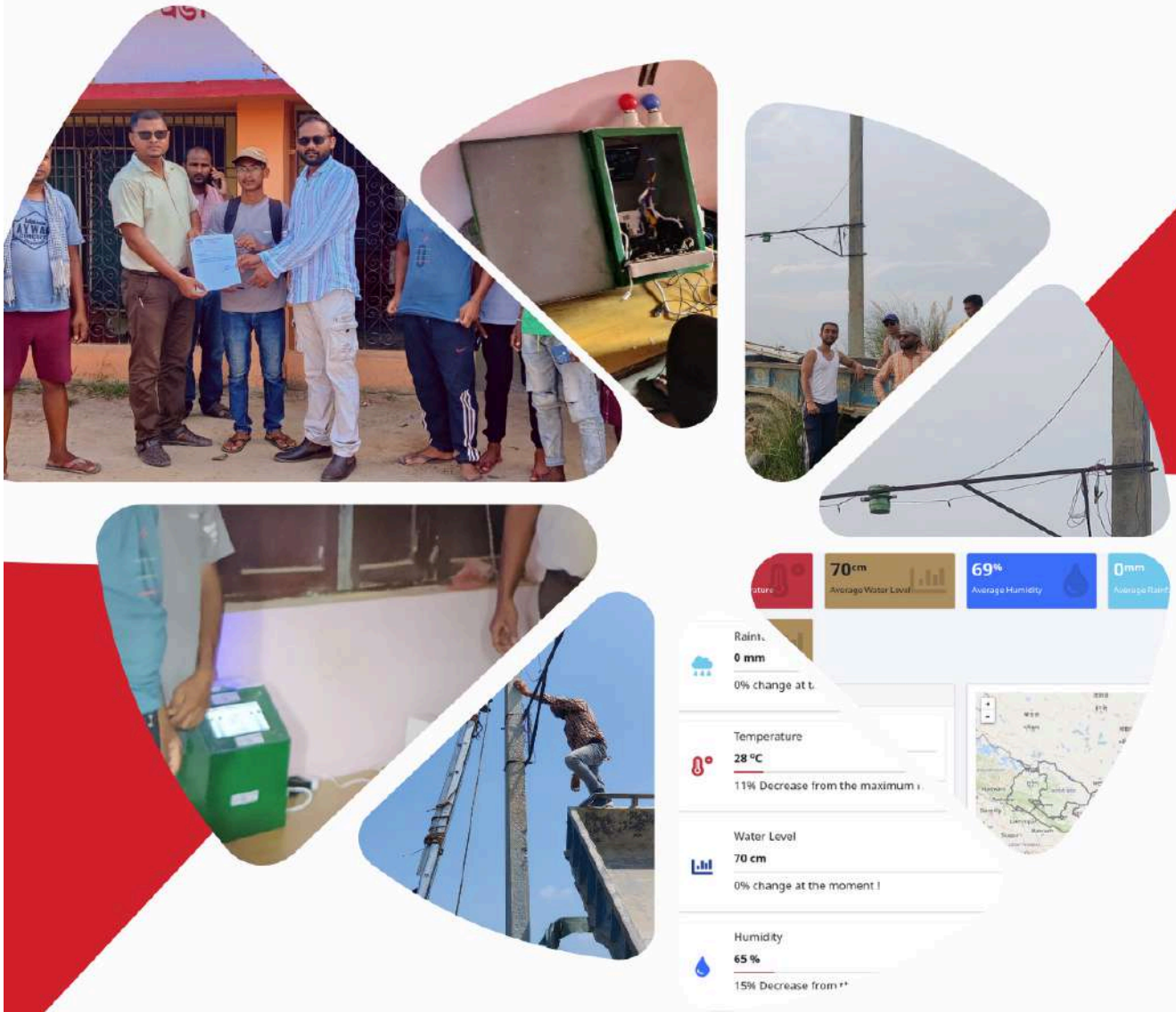
# RAKSHYAK

## AI BASED FLOOD WARNING SYSTEM




Prepared By

Robotics Association of Nepal
[between human and machine]

Partnered With

UKaid
from the British people

The Asia Foundation

Data for Development in Nepal

Partnered With

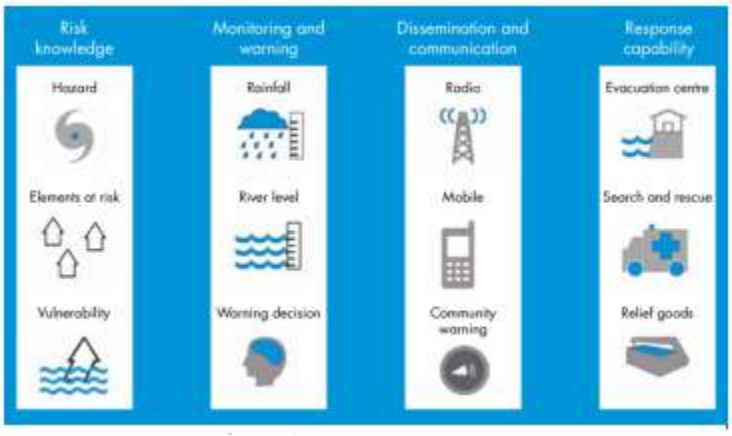
MERCY CORPS

# 1. Introduction

The occurrence of various hazardous events triggering a loss of life and damage to infrastructure, livelihood highlights the reality that society and its assets are vulnerable to such events. To understand any disaster risk, it is essential to have an understanding of hazard, its exposure, and vulnerability. The understanding of disaster risk due to flood hazard at Basbitta village of Siraha Municipality, Siraha could be explained with the knowledge of hazard as the origin or location of a flood, it's intensity or frequency, exposure as the number of people, assets, infrastructure, ecosystems located inside the Basbitta who are all exposed to potential damage from flood hazard and the vulnerability as capacities of a individuals and society in a Basbitta to cope with a hazard, physical structures in a Basbitta village, social and economic characteristics of the Basbitta area.

According to UNDRR, disaster risk is referred to the potential loss of life, injury, or destroyed or damaged assets that could occur to a system, society, or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, and capacity. Disaster Risk Reduction is aimed at preventing new and reducing existing disaster risk and managing residual risk, all of which contribute to strengthening resilience and therefore to the achievement of sustainable development.

Based on Sendai Framework for Disaster Risk Reduction 2015-2030, the implementation of this project focuses on achieving a major outcome of the framework; the substantial reduction of disaster risk and losses in lives, livelihoods, and health and the economic, physical, social, cultural and environmental assets of persons, businesses, communities, and countries. The project Automated Community Based Flood Early Warning System aims to reduce the loss or damage due to potential flood hazards with the early warning of the occurrence of a flood to the residents in the Belkundi, Tilki village. The adaptation of the framework is essential to develop systematic people-centered early warning systems. The main four priorities of the framework are understanding disaster risk, strengthening disaster risk governance to manage disaster risk, investing in disaster risk reduction for resilience, enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation, and reconstruction. Six guiding principles of the framework are adapted accordingly to develop the early warning system which includes the protection of persons and their property, health, livelihoods, and assets, dissemination of data for inclusive risk-informed decision making, capacity building of local authorities, and communities through resources, decision-making responsibilities. The development and implementation of the project also focus on achieving a total of twenty eights priority points on a national, local level, and global, regional levels with a major focus on understanding disaster risk and investing in disaster risk reduction for resilience. According to the framework, the components for the Early Warning System are identified as shown in the image.




The early warning system project is a crucial initiative aimed at mitigating the devastating effects of floods and protecting vulnerable communities. Floods pose a significant threat to people living in

flood-prone areas, leading to loss of life, damage to infrastructure, displacement, and economic setbacks. To address these challenges, implementing an early warning system becomes imperative.

This project focuses on developing and implementing an effective early warning system for the Kamala River in the Siraha district of Nepal of province 2. The Kamala River, located in a region prone to frequent flooding, poses a constant risk to the local community. The early warning system project seeks to provide timely and accurate warnings about potential flood events, ensuring that residents have sufficient time to prepare and respond appropriately. By leveraging technological advancements and comprehensive data analysis, this project aims to enhance the community's preparedness, response capabilities, and overall resilience. The primary objective of the early warning system project is to detect and monitor flood-related parameters such as water levels, rainfall patterns, and hydrological conditions. By collecting and analyzing real-time data and comparison with previous years data like designing a model, the system can identify critical thresholds and trigger timely warnings to the community by Artificial Intelligence(AI) technology. This advanced warning enables individuals to take proactive measures, such as evacuating to safer areas, securing their property, and accessing emergency services.

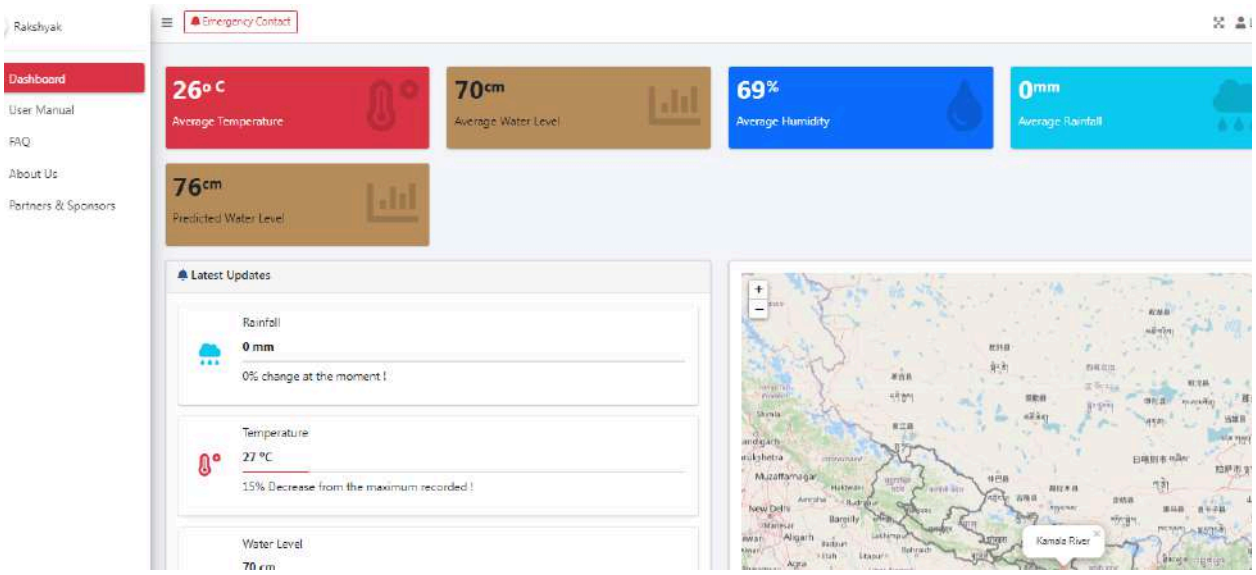
Additionally, the early warning system project focuses on establishing robust communication channels to disseminate flood warnings effectively. Leveraging various technologies such as mobile phones, sirens, loudspeakers, and digital platforms, the system ensures that warnings reach the community in a timely manner. The project also aims to develop user-friendly interfaces, interactive maps, and visualizations to enhance situational awareness, allowing residents to understand flood risks, evacuation routes, and emergency facilities.

# 2. Rakshyak for User

**STEP 1**

## Dashboard

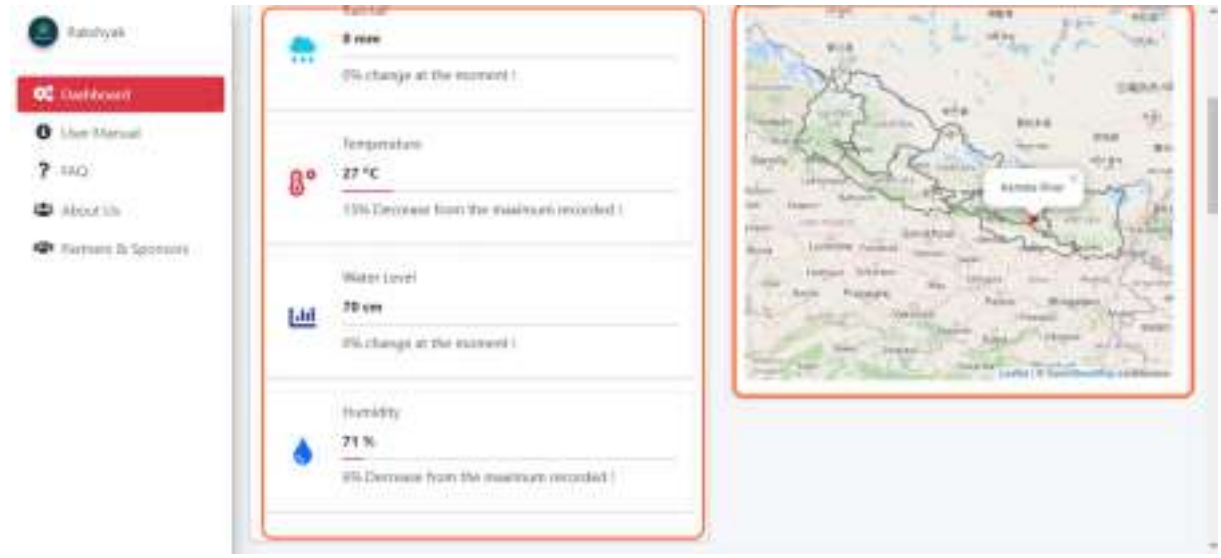
This is the default page when you reach us through https://rakshyak.ran.org.np/ and has all meteorological and hydrological information of rivers where our systems are installed. It provides you with live data that is captured by our system along with the early (odd prediction data calculated).


Rakshyak
Emergency Contact
Dashboard
User Manual
FAQ
About Us
Partners & Sponsors
26° C
Average Temperature
70cm
Average Water Level
69%
Average Humidity
0mm
Average Rainfall
76cm
Predicted Water Level
Latest Updates
Rainfall
0 mm
0% change at the moment !
Temperature
27 °C
15% Decrease from the maximum recorded !
Water Level
70 cm
Kamala River

**STEP 2**

## Continue navigating Dashboard

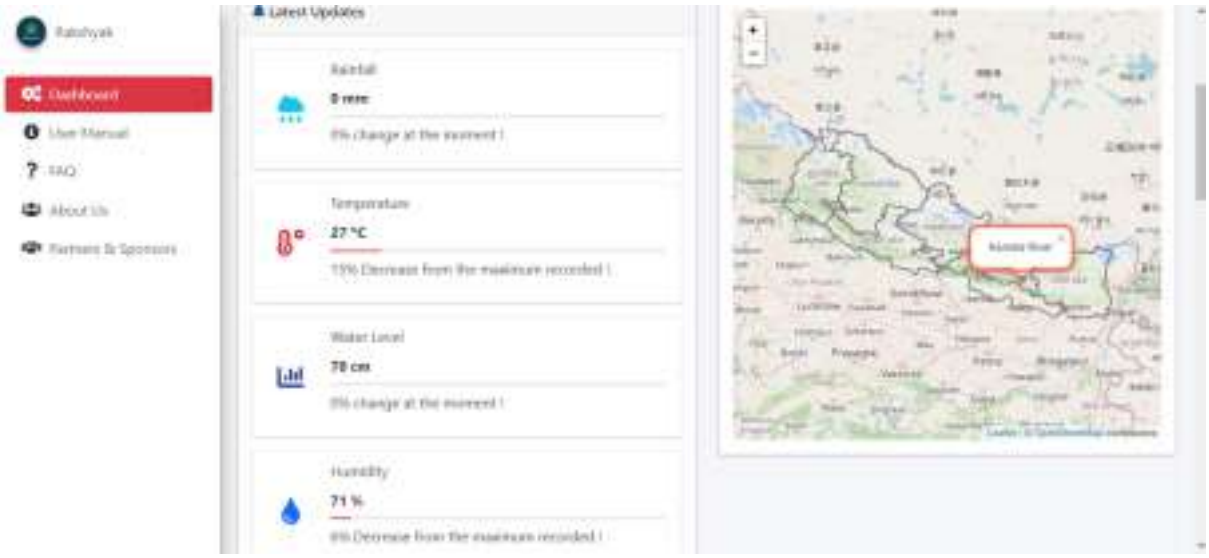
Visit current data collected from installed system (in left) and locations of installed system in the map (in right)




**STEP 3**

## Continue navigating Dashboard

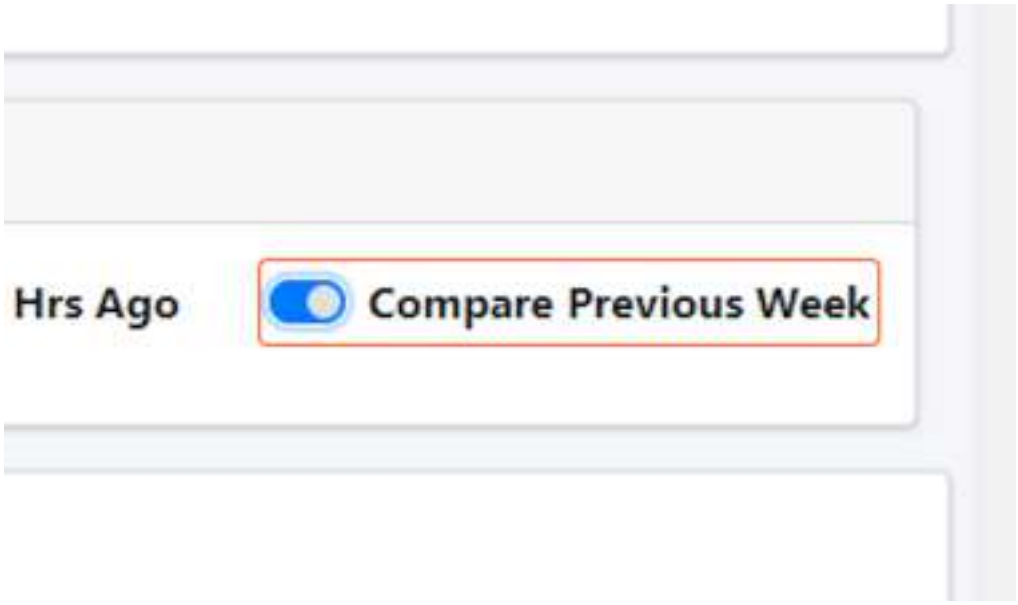
Selecting the location of installed system will provide your dashboard with details of  selected locations system




**STEP 4**

## Continue navigating Dashboard

Rainfall (in millimeters) vs water level (in centimeters) shows a comparison between rainfall and water level on selected sites at any given time. The line in blue represents the water level and the line in green represents rainfall at a given time.




**STEP 5**

## Continue navigating Dashboard

The weekly rainfall chart shows rainfall at the chosen site from one week before to today

**STEP 6**

## Continue navigating Dashboard

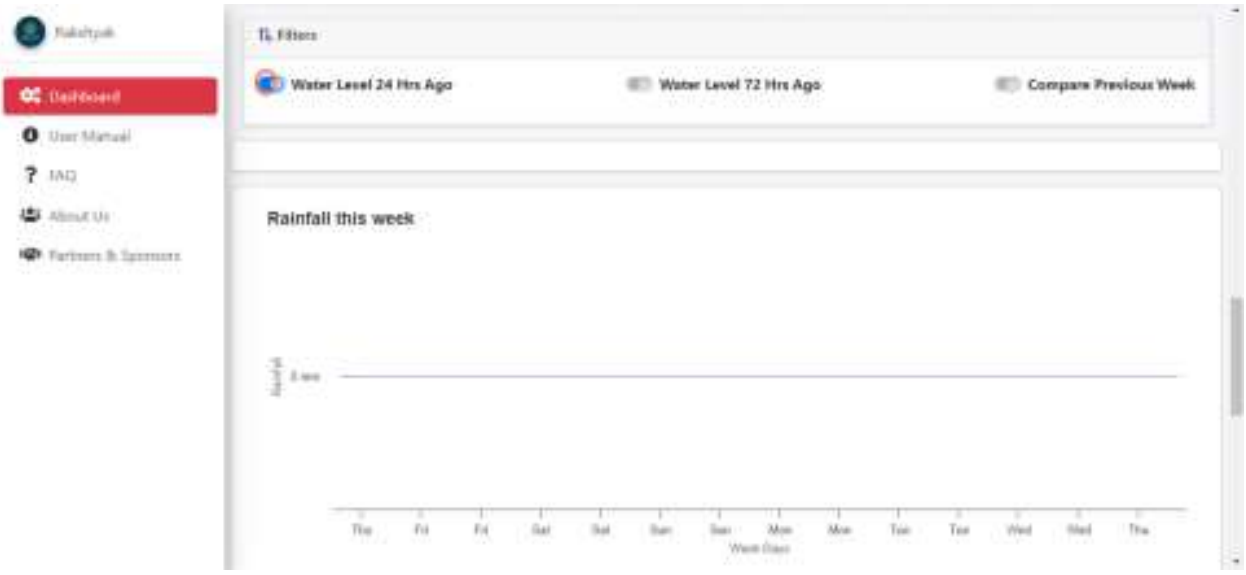
The weekly water level chart shows the water level at the chosen site from one week before to today


**STEP 7**

## Continue navigating Dashboard

Wilter option allows you as a user to control what data you want to view without being  distracted by the multitude range of data provided

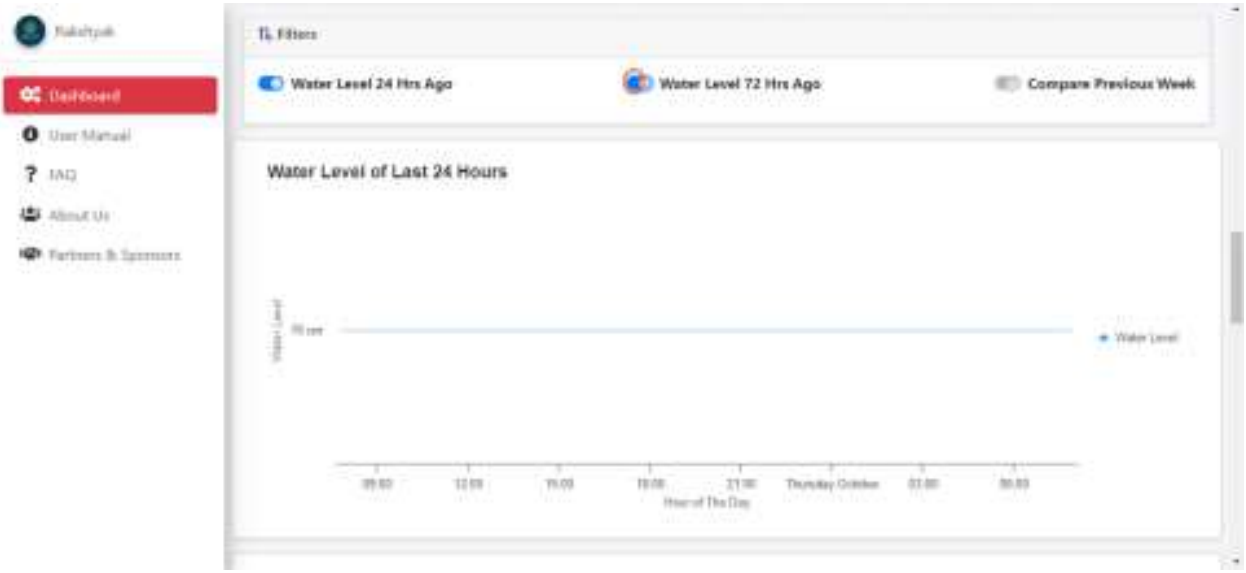
1. **Water Level 24 Hrs Ago**
   When toggled on will show you the water level chart from 25 hours ago to now in the  hourly range.




**STEP 8**

## Continue navigating Dashboard

1. **Water Level 72 Hrs Ago**
   When toggled on will show you the water level chart from 72 hours ago to now in the hourly range.

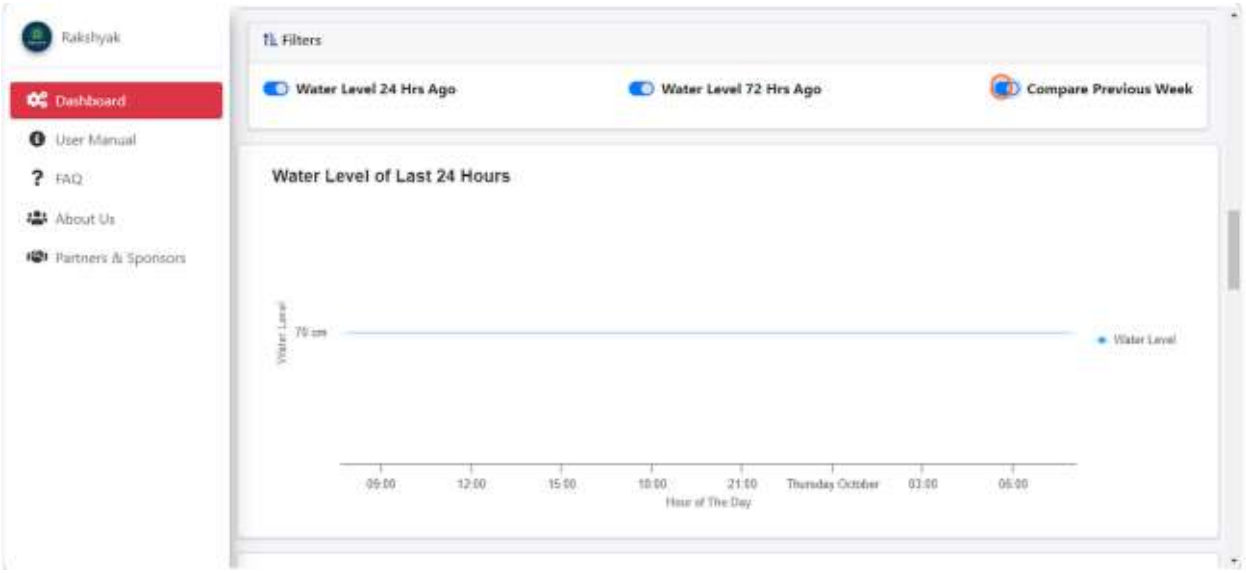



**STEP 9**

## Continue navigating Dashboard

1. **Compare Previous Week**

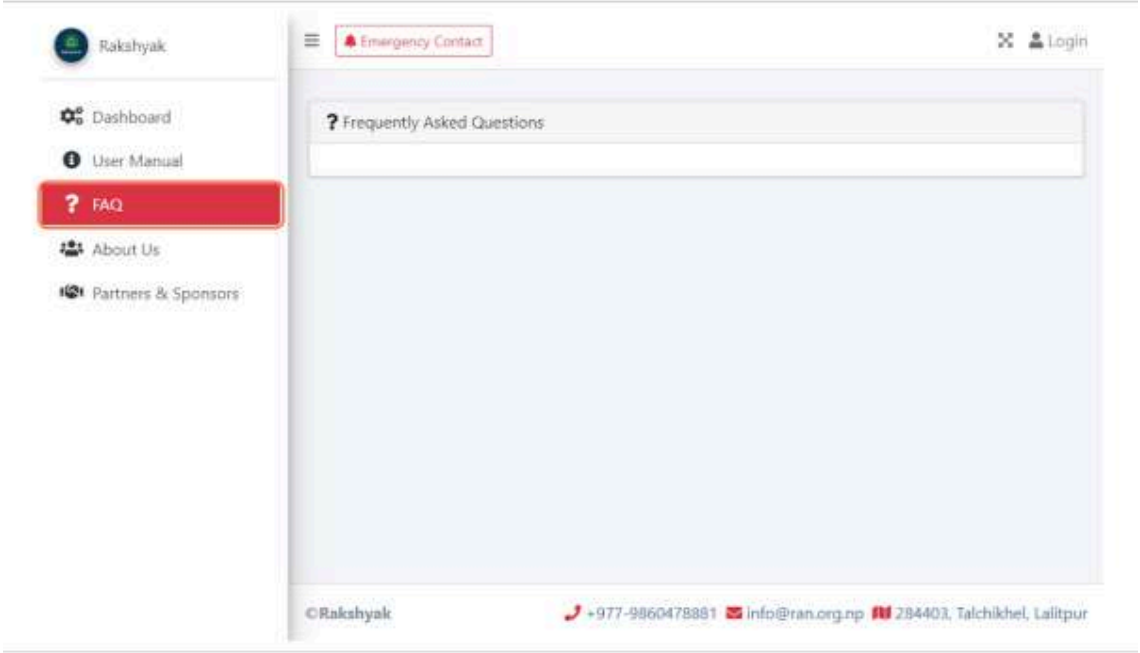
6hen toggled on will show you the water level and rainfall chart of the previous week and of the current week in the hourly range allowing you to make easier comparisons in those data.




**STEP 10**

## Frequently Asked Questions (FAQ)

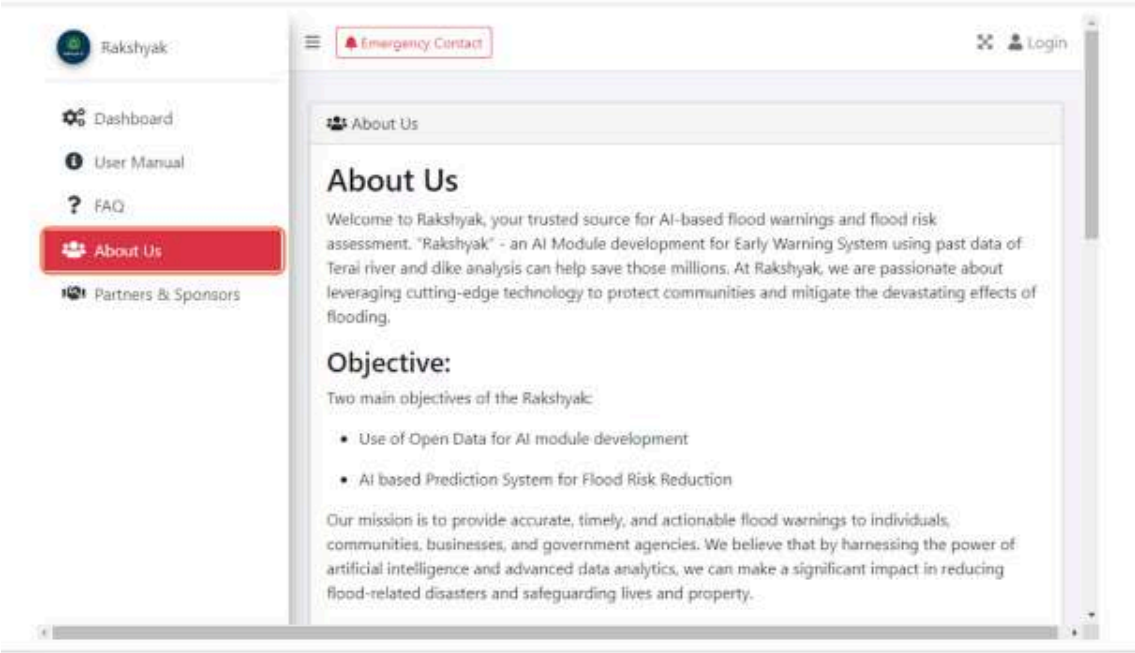
The frequently asked question page will show you all information about our site and service.



**STEP 11**

## About Us

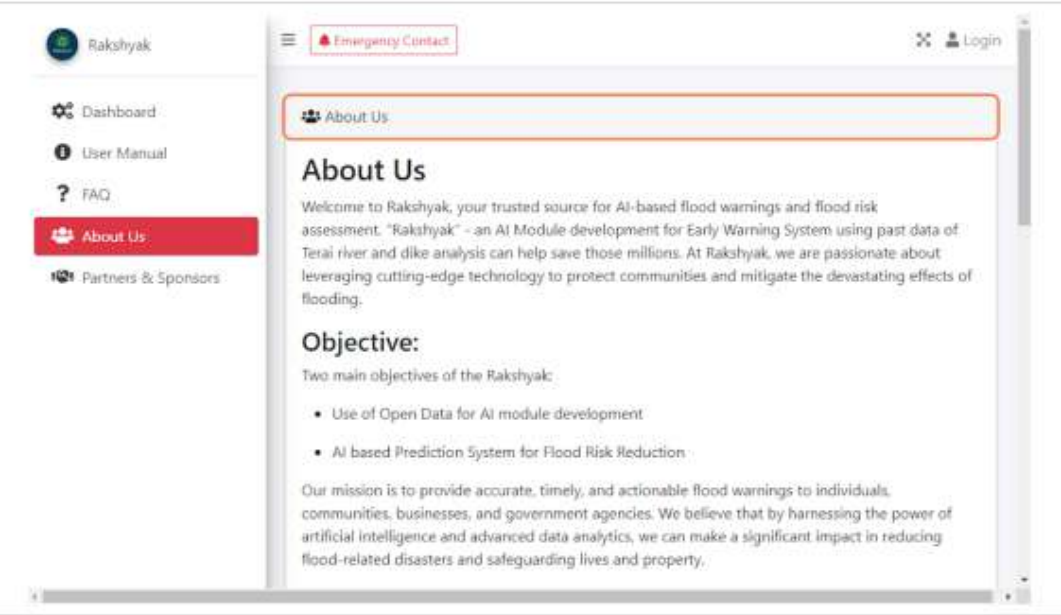
This page will provide you insight as to who we are what we are trying to achieve and members involved in this project.




**STEP 12**

## Continue on About Us

This shows information about this site and its objective.




**STEP 13**

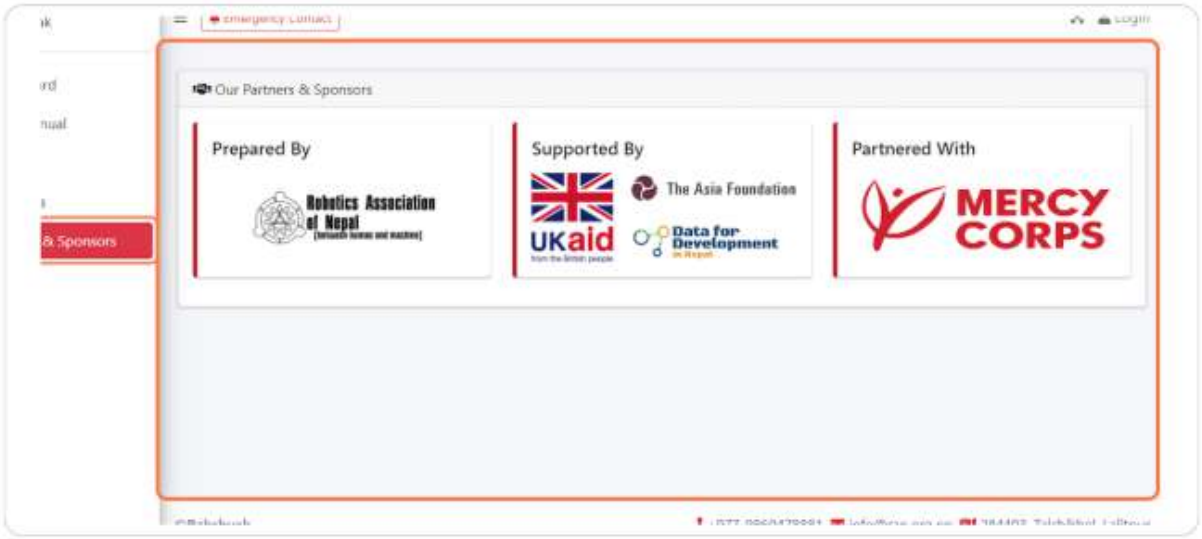
## Continue on About Us

This provides insight and acknowledgment to all the team members of the proOect.

**STEP 14**

## Partners & Sponsors

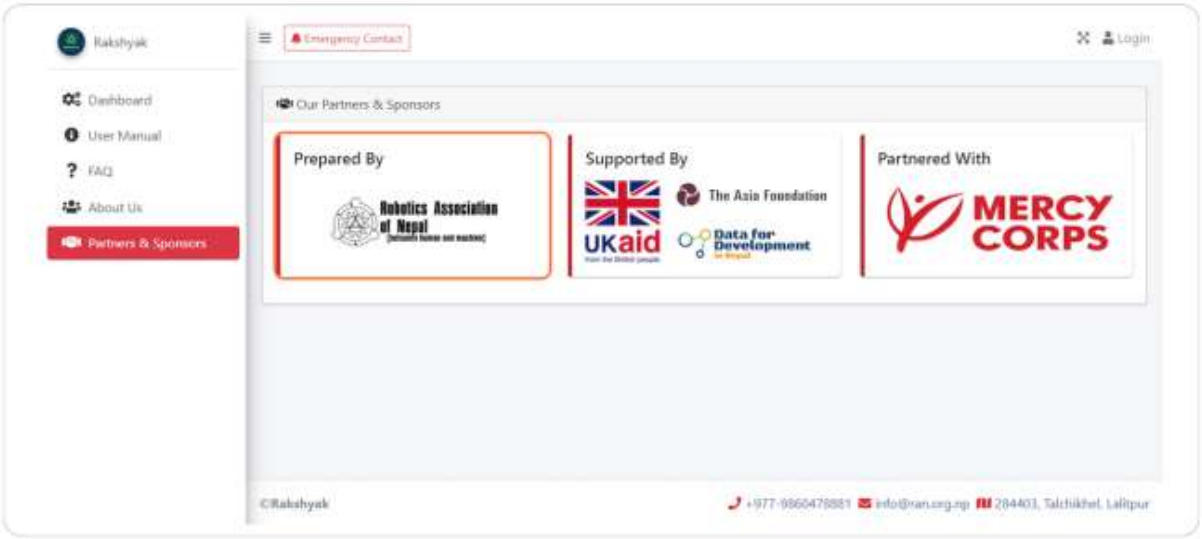
This page shows acknowledgement to organizations involved in this project. when you click  on their banners it will open their individual page in new tab.




**STEP 15**

## Continue on Partners & Sponsors

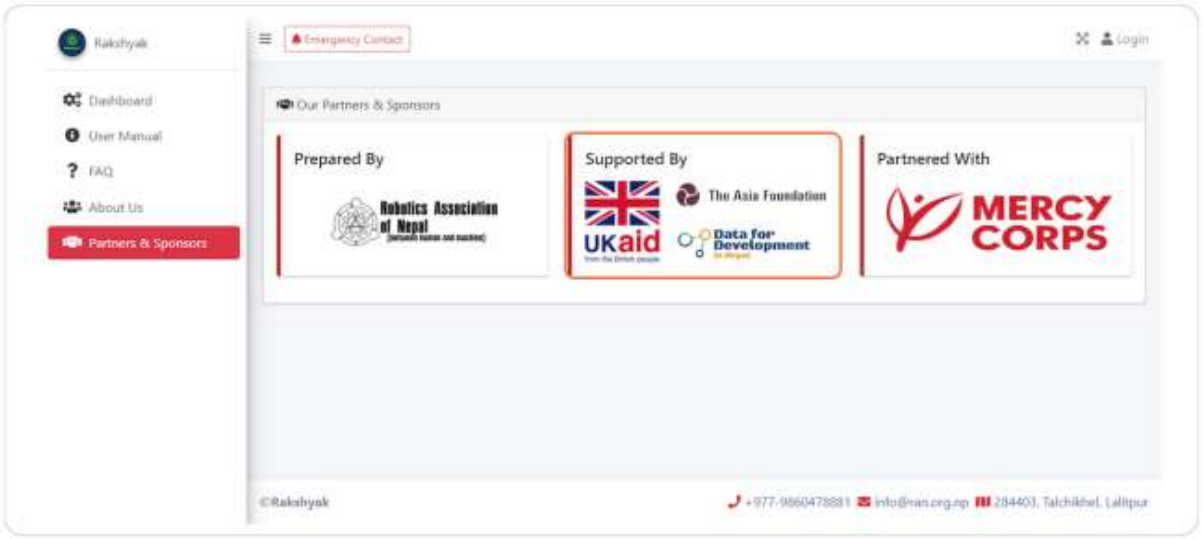
This shows the banner of the preparer of this Rakshyak project when clicked will take you  to their website https://roboticsassociationofnepal.business.site/



**STEP 16**

## Continue on Partners & Sponsors

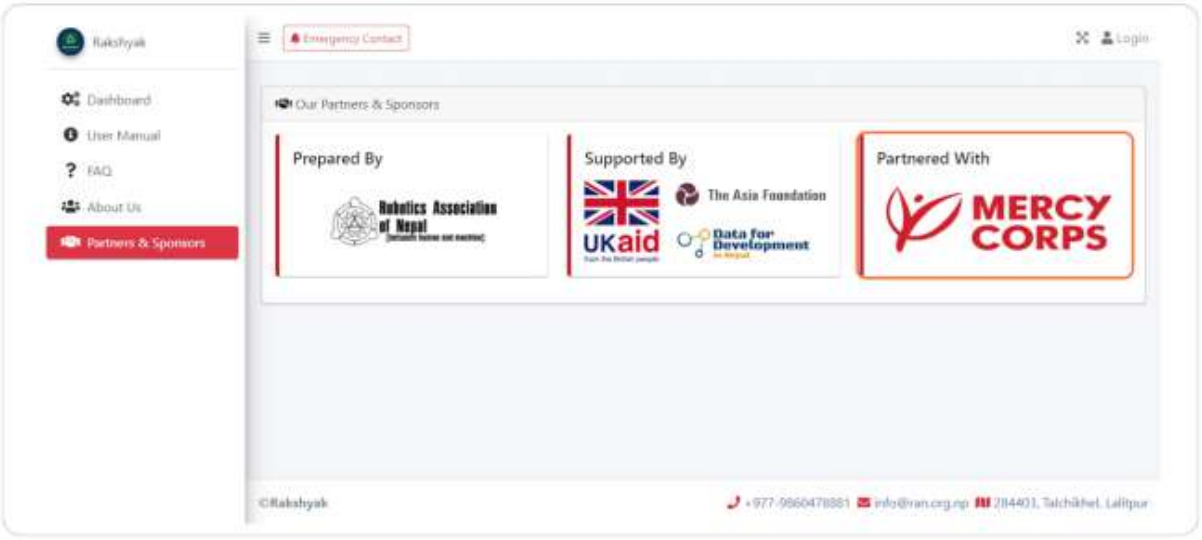
This shows the banner of the supporter of this Rakshyak project when clicked will take you to their website https://www.d5dnepal.org/



**STEP 17**

## Continue on Partners & Sponsors

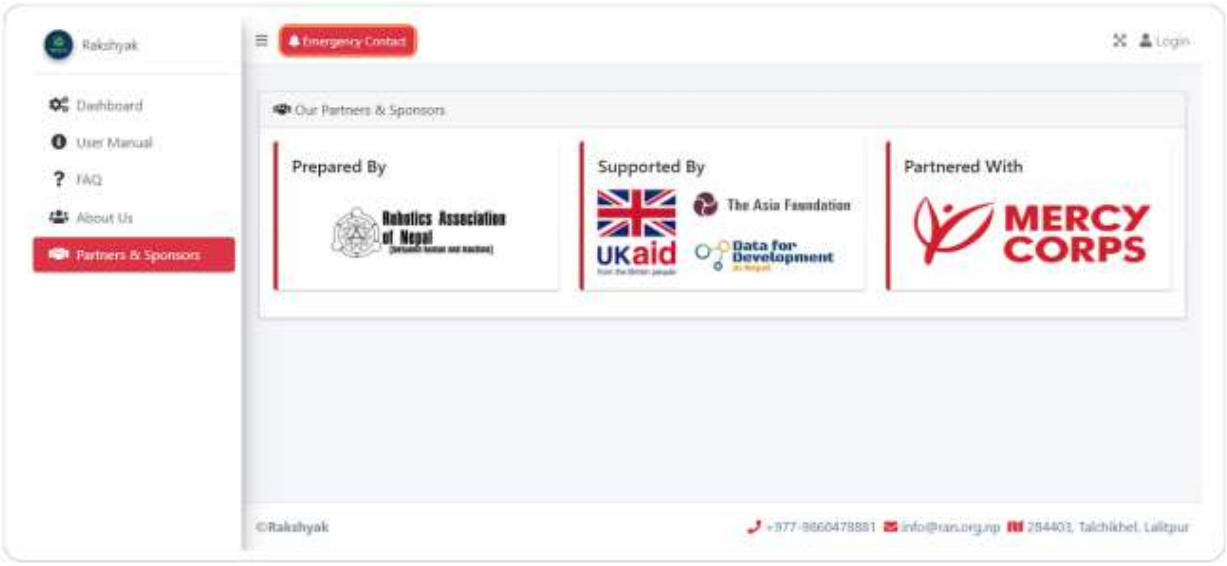
This shows the banner of the partner of this Rakshyak proOect when clicked will take you to their website [https://nepal.mercycorps.org/](https://nepal.mercycorps.org/)




**STEP 18**

## Emergency Contact

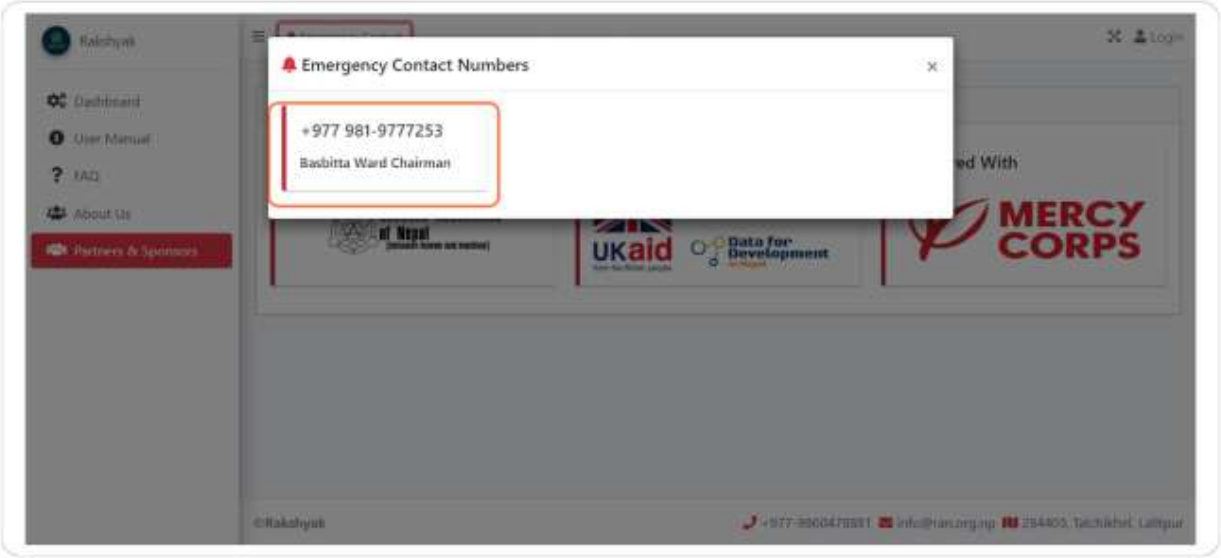
This button on click will provide you with contact information to reach out in case of an emergency event regarding this project.



**STEP 19**

## Continue Emergency Contact

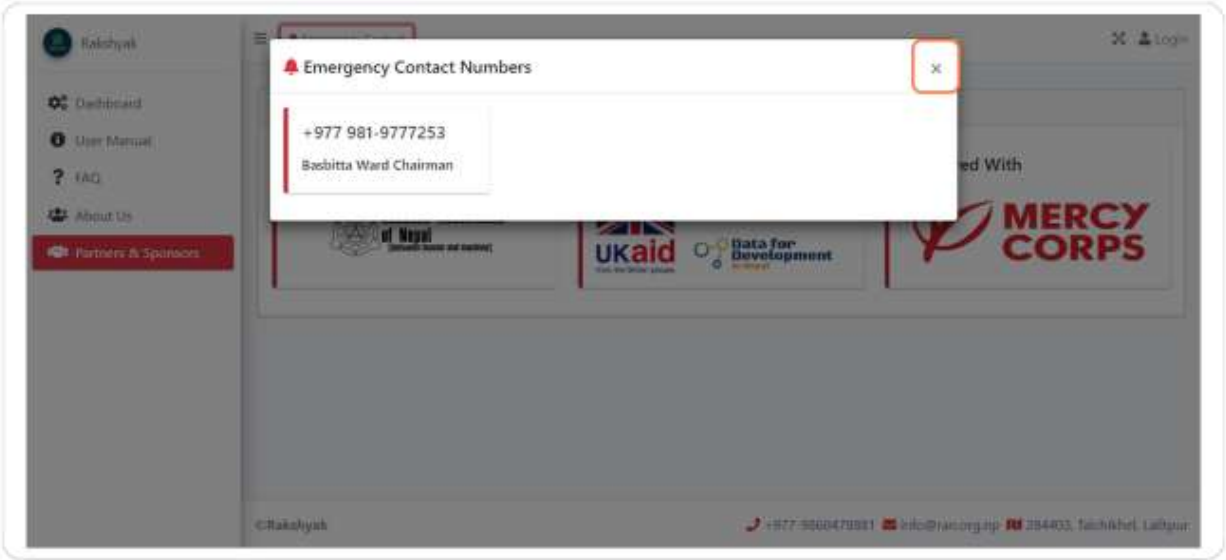
This popup contains emergency contacts to reach out to.




**STEP 20**

## Continue Emergency Contact

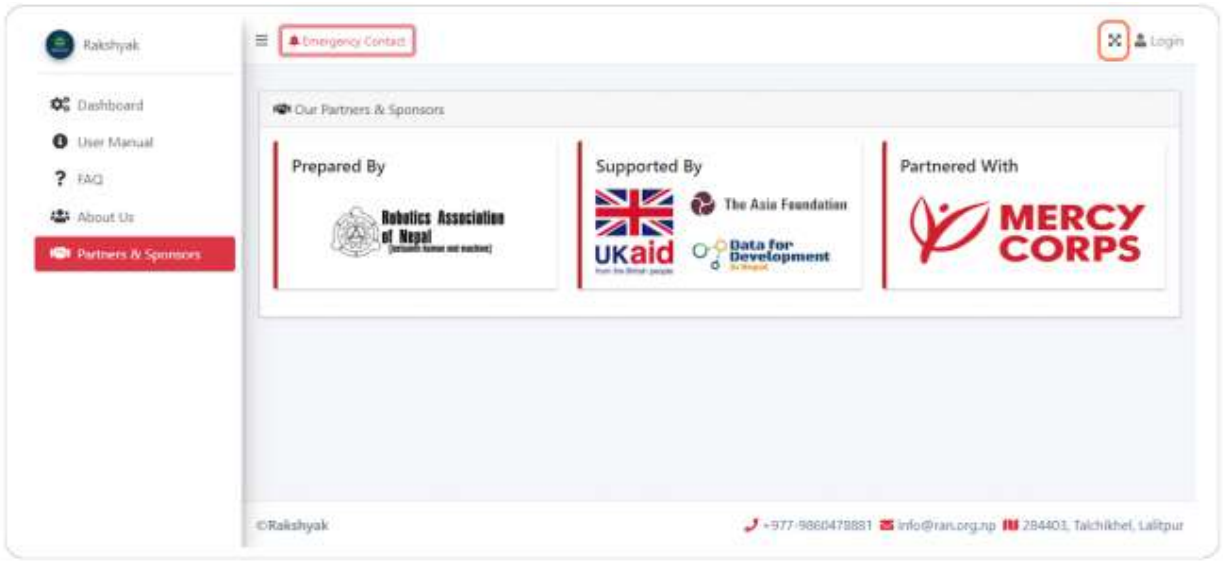
Clicking the cross (x) icon will close the popup window and show you the window you previously were in.



**STEP 21**

## Full-Screen window

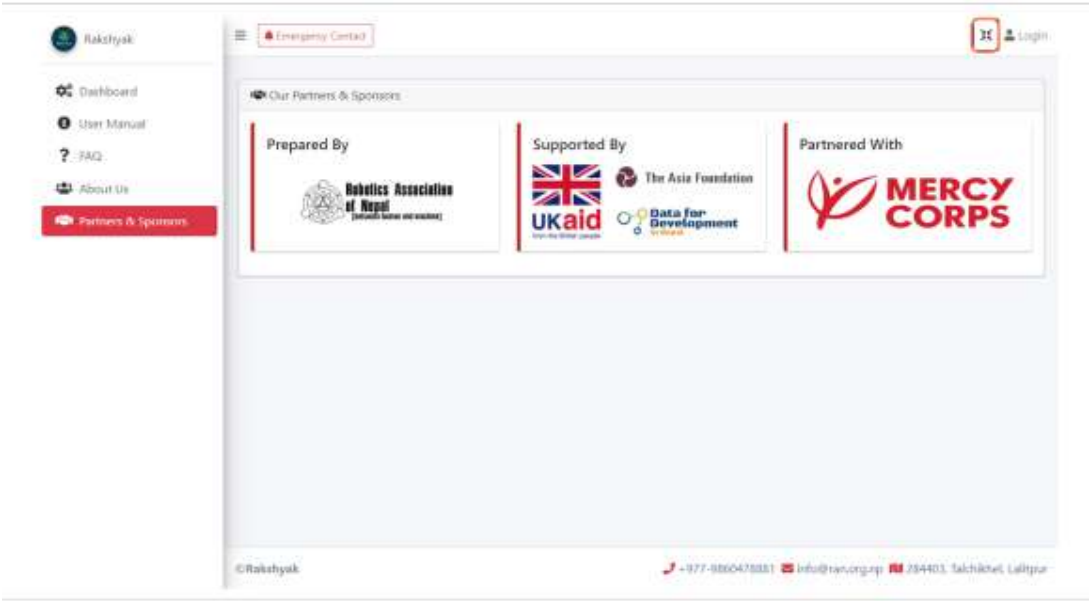
This button on click will open the tab in full screen mode.




**STEP 22**

## Return to normal view

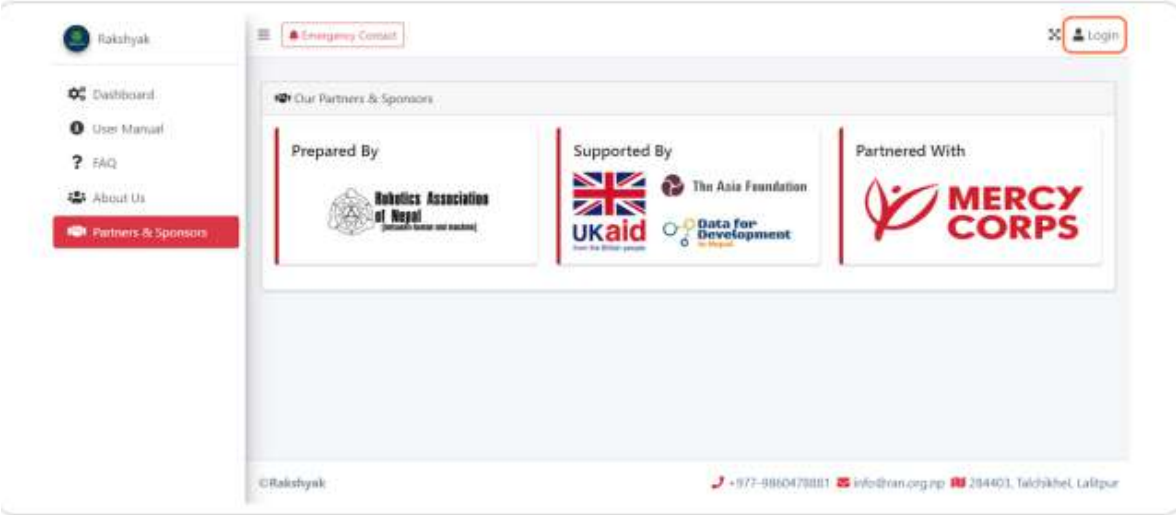
This button on click will close full screen mode to normal view.



**STEP 23**

## Login

This button on click will provide a login popup for admins to use to manage content on this site.



# 3. Receiver system deployment and its manual

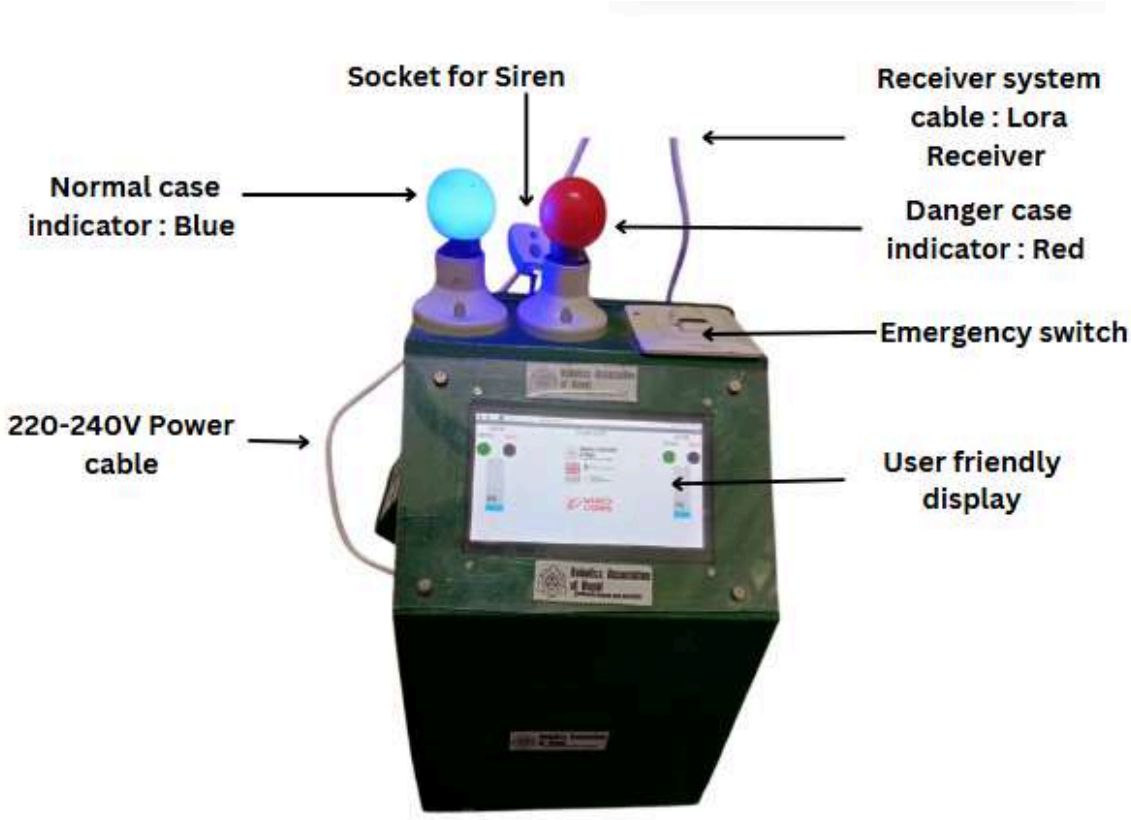



**Figure: The user friendly receiver and data processing system**

The above system is a user-friendly display with an integrated data receiver and processing unit. This system receives data wirelessly from a LoRa receiver and transmits it to the cloud, where the data is processed for future predictions.

Once the data is received, the system displays both real-time and predicted river water levels on the display. For real-time data, the following indicators are used:

- A **red bulb** glows to indicate a danger situation when the river level exceeds 3.5m.
- A **blue bulb** glows to signify normal conditions when the river level is below 3.5m.

Additionally, the system includes a siren socket to connect a siren. If the river level exceeds 3.5m, the siren will automatically buzz as a danger alert. There is also an emergency switch that allows the siren to be activated manually during emergency situations.

This setup ensures timely alerts and facilitates quick action to mitigate potential risks.

**How data is sent and processed with an AI model ?**

The receiver system gathers real-time data from sensors monitoring river conditions. This data is transmitted to a cloud-based platform for storage and processing. In the cloud, advanced algorithms analyze the data to predict river levels, taking into account historical patterns, environmental factors, and current readings. Once the prediction is generated, it is uploaded back to the cloud and made accessible to the system. The system retrieves the predicted data and displays it in an intuitive format, enabling users to monitor potential flood risks and river level fluctuations effectively. This seamless integration of data collection, cloud processing, and result dissemination ensures timely and accurate predictions. By leveraging cloud computing, the system achieves high scalability, real-time processing, and easy access to critical information, making it a robust tool for flood early warning and river level management.

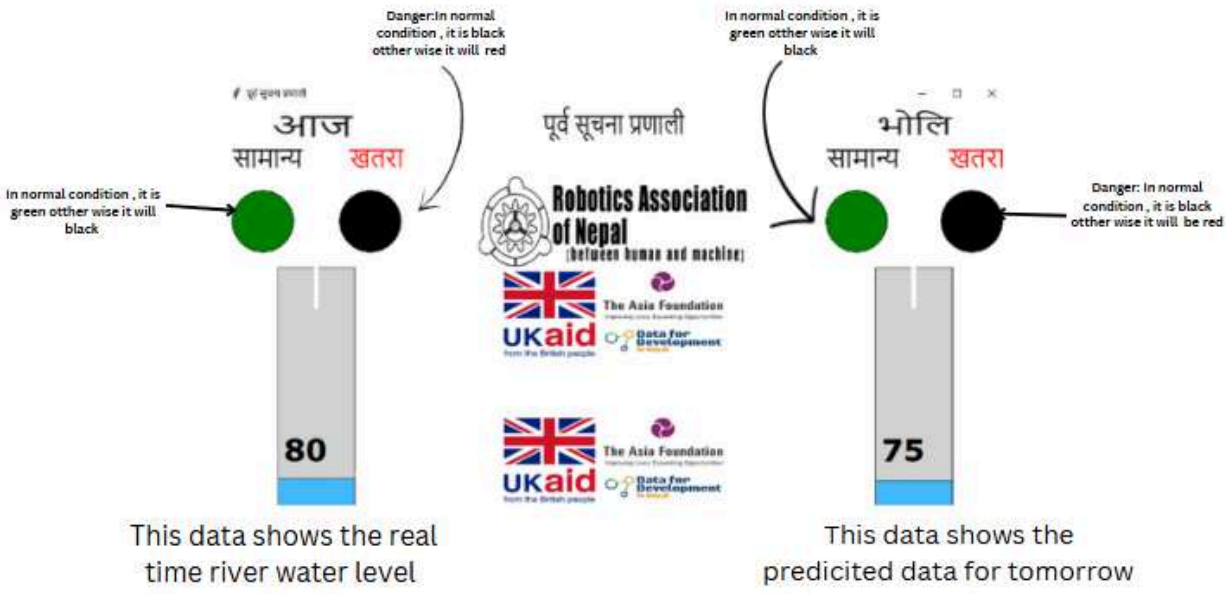



Figure: Image of User Friendly Display

This is a user-friendly display system integrated into the receiver (community) for the flood early warning system.

- **Left Indicator**: The left indicator represents the real-time river water level. A green light signifies normal conditions, indicating that the river level is below 3.5m. If the indicator turns red, it signifies a danger situation, meaning the river level has exceeded 3.5m.
- **Right Indicator**: The right indicator provides the predicted river water level for the following day. The conditions are the same as the real-time indicator. A green light indicates a normal condition with river levels below 3.5m, while a red light warns of a danger situation where the level exceeds 3.5m.