Advancing Heat Resilience

Integrated Autonomous Targeted Interventions and Equitable Adaptation .

2023-24-114

OUR TEAM

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Introduction

- There are about 21 million people living on the island country of Sri Lanka in South Asia. The labor force of the country, which has a diversified workforce, is essential to the growth and economy of the nation. Depending on the region, Sri Lanka has a variety of climates, however many of them are tropical with high humidity and temperatures, especially in the summer. During periods of excessive heat, workers in a variety of industries, including agriculture, construction, and other outdoor sectors, may have difficult working conditions.

- Although Sri Lankans may be used to hot weather, little is known about how heat waves affect the country's workers' health and safety. The relationship between average daily temperatures and work-related injuries in other nations has been the subject of existing study [1]. However, little is known about how protracted heatwave conditions, which are defined by a string of hot days, affect the health of Sri Lankan employees. Examining the consequences for occupational health and safety in the nation is crucial given that climate projections point to a probable rise in the frequency and intensity of heat waves.

- Depending on the length and severity of the heatwaves, the yearly death rate in Asia from heat waves might change from year to year. Heatwaves can cause a noticeable rise in mortality in some years, especially in areas where the infrastructure and public health systems may not be well-equipped to handle such extreme weather events.Many nations are putting heat action plans and public health initiatives into place to safeguard vulnerable people and lessen the impact on public health in order to meet the growing concern about heat waves in Asia. Early warning systems, public awareness campaigns, cooling facilities, and regulations for outdoor work in extremely hot weather are a few examples of these methods.

- The annual death rate ascribed to these intense events reflects the intensity of heatwaves in Asia. Since prolonged exposure to high temperatures can cause a variety of heat-related ailments, such as heat exhaustion, heatstroke, and other cardiovascular and respiratory problems, the effects of heatwaves on human health are a major concern. The elderly, young children, pregnant women, and people with pre-existing medical disorders are among the vulnerable groups who are more at danger during heatwaves.

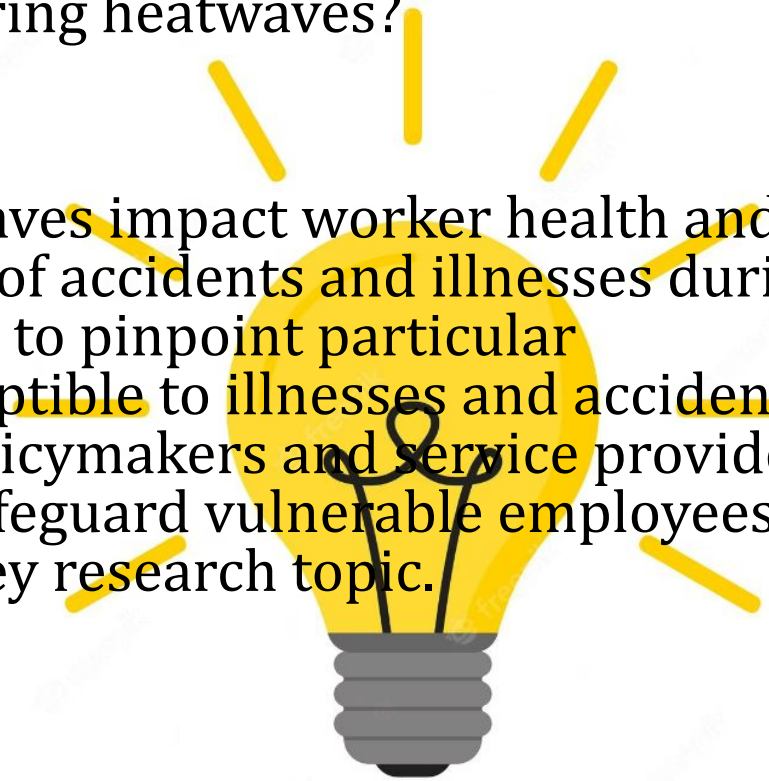
Target Audience

- Outdoor Workers
- Emergency Management Authorities
- Public Health Officials
- Occupational Health and Safety Agencies

Research Question

- 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.



Benefits

- Improved Worker Safety
- Better Emergency Preparedness
- Efficient Resource Allocation
- Climate Change Adaptation
- Decision-making Support

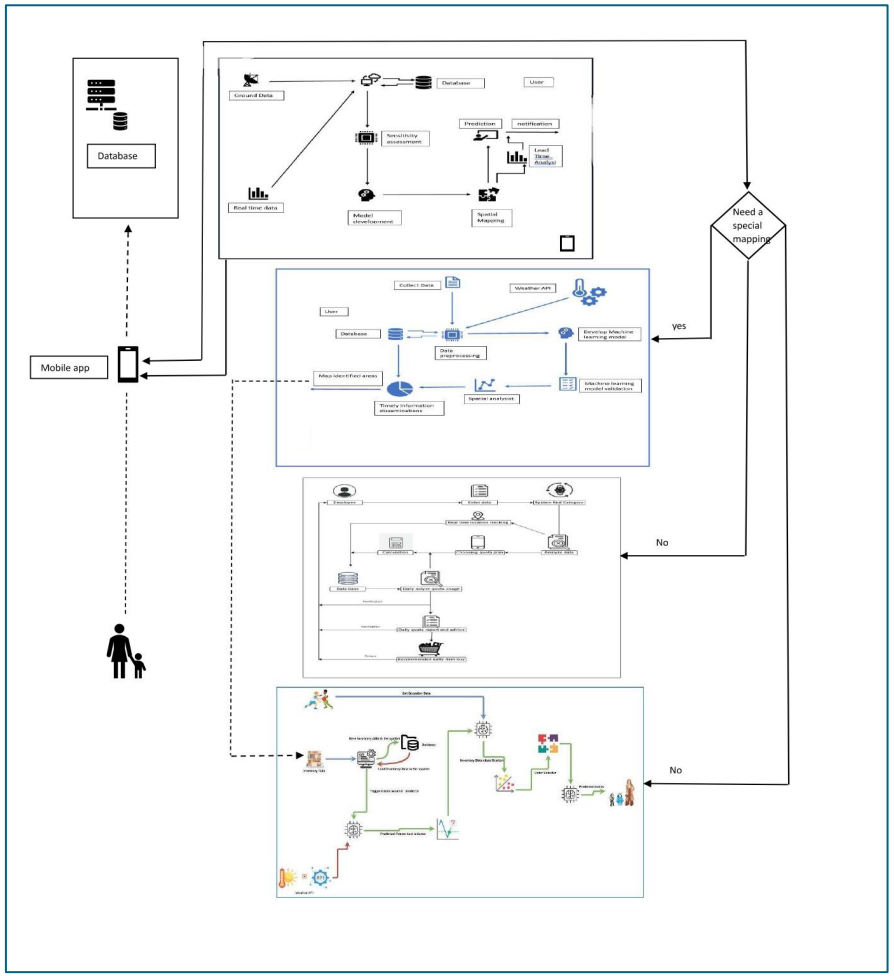
Main Objective

- The main objective of this project is to investigate the impact of heatwaves on workers health and safety and adaptation safely in Sri Lanka.

Sub Objectives

- Assess the Impact of Heatwaves on Workers.
- Identify Vulnerable Worker Groups.
- Provide evidence-based insights.
- Integrate historical and real-time data to provide comprehensive insights.

System Overall Diagram



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Introduction

- investigate the effectiveness of early warning systems in predicting and detecting heatwaves in advance. The research seeks to explore various methodologies, including real-time spatial modeling, to enhance the accuracy and lead time of heatwave predictions. Understanding the capabilities and limitations of early warning systems is crucial for developing targeted strategies to protect vulnerable populations, workers, and ecosystems from the hazards of extreme heat.

Research gap

References	[1]	[2]	[3]	[4]	[5]	our system
1.Limited Integration of Spatial Modeling	✗	✗	✗	✗	✓		
2. Inadequate Lead Time Assessment	✗	✓	✗	✗	✗	✓	
3.Limited Integration of Spatial Modeling	✗	✗	✓	✗	✗	✓	
4.Lack of Stakeholder Engagement	✗	✗	✗	✓	✗	✓	
5.Insufficient Consideration of Vulnerable Groups	✗	✗	✗	✗	✓	✓	

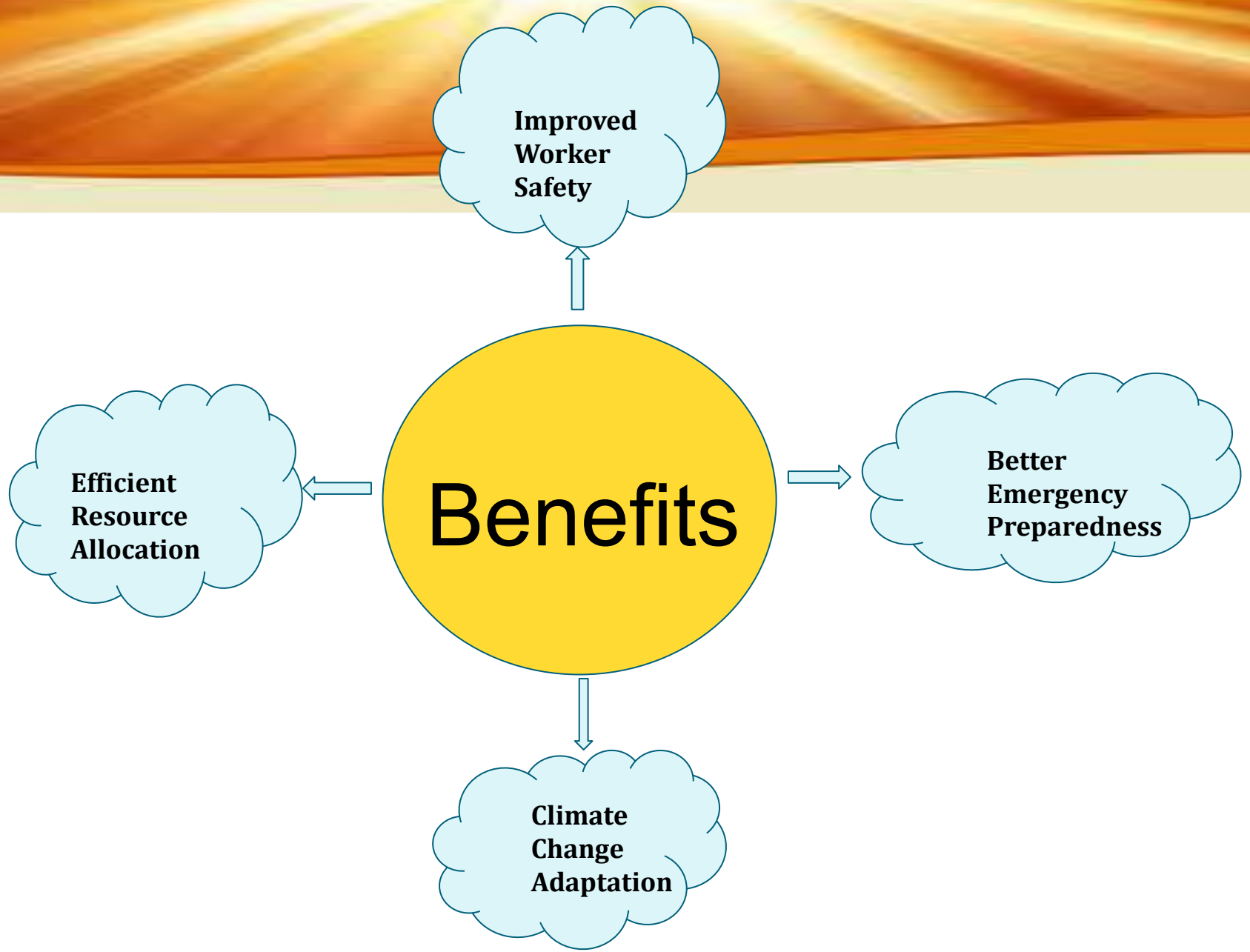
Research Problem

- Can AI-powered early warning systems effectively predict and detect heat waves in advance?

Objectives & Sub Objectives

- Data Collection and Integration
- Model Development and Validation
- Lead Time Analysis: Measure
- Spatial Heatwave Mapping
- Stakeholder Engagement

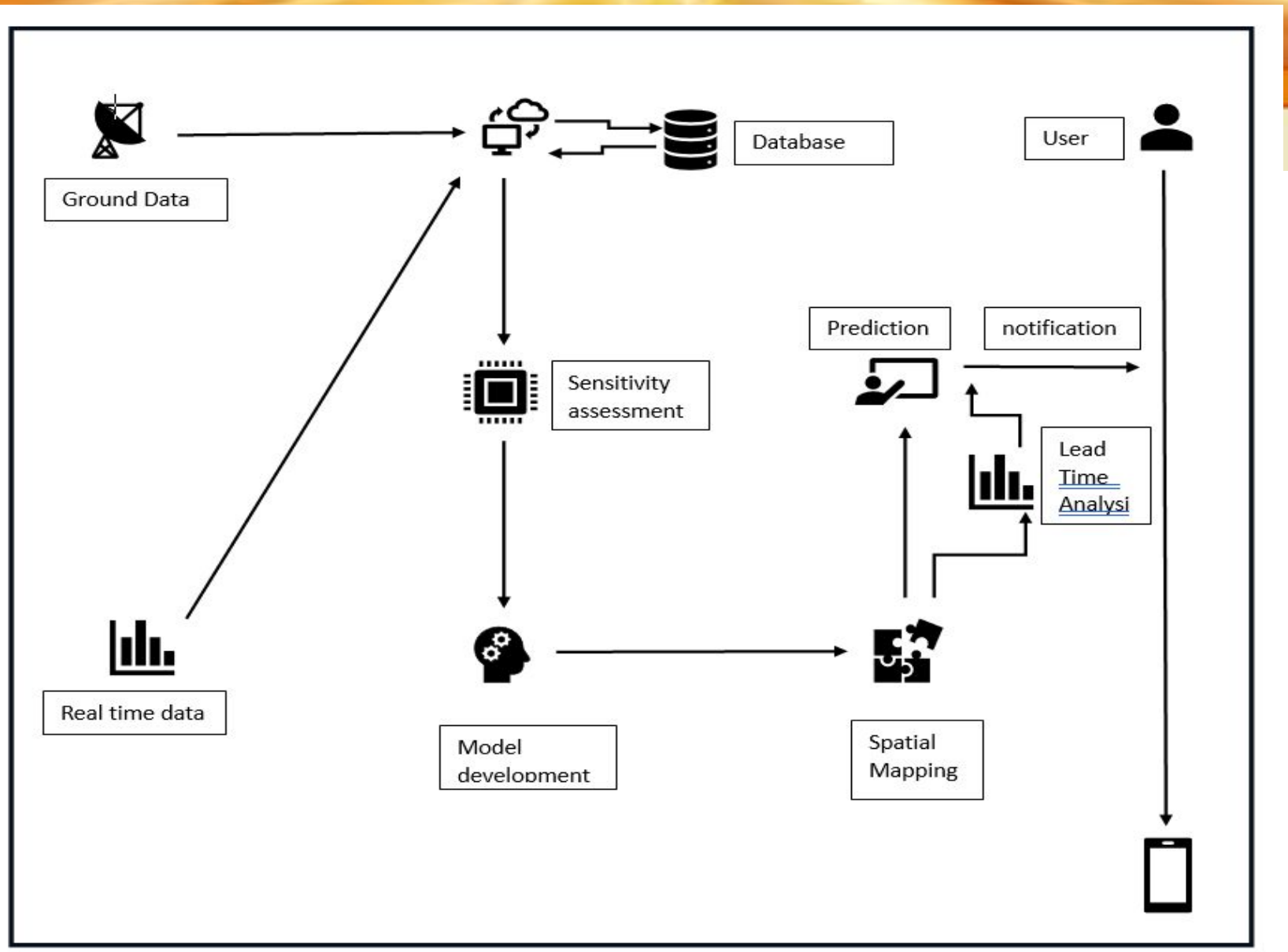
Benefits


Improved Worker Safety
Efficient Resource Allocation
Benefits
Better Emergency Preparedness
Climate Change Adaptation

Methodology

- Data Collection
- Model Development
- Sensitivity Analysis
- Case Studies

System Overview



Work Breakdown

Task Name	2023							2024					
	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
Project Initiation													
Topic Eveluation													
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Final Presentation													
Final Report													

references

[1] Vargo, J., & Stone Jr, B. (2019). Urban Heat Wave Vulnerability in the U.S. Southwest: The Role of Socioeconomics, Infrastructure, Land Use, and Fresh Water Resources. Environmental Science & Technology, 53(17), 10209-10219.Guo, Y., Gasparrini, A., Armstrong, B. G., Li, S., Tawatsupa, B., Tobias, A., ... & Hales, S. (2017). Global variation in the effects of ambient temperature on mortality: a systematic evaluation. Epidemiology, 28(6), 781-789.

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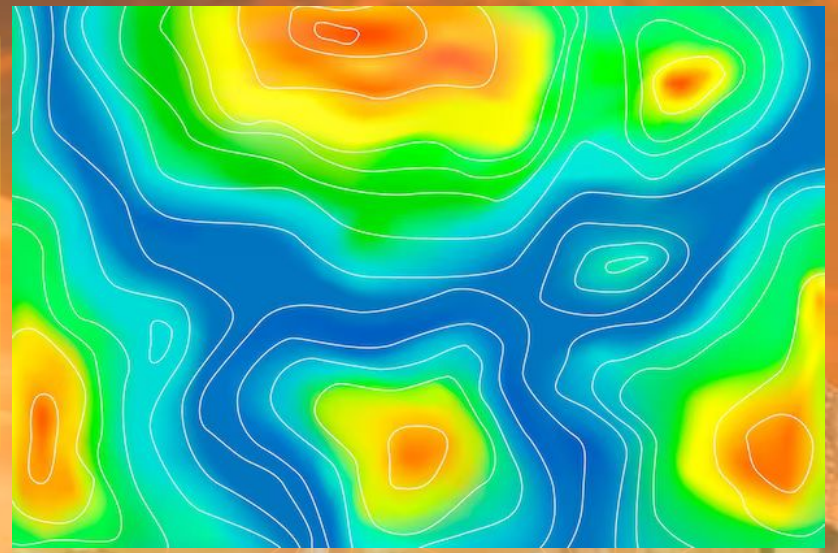
Introduction

Heatwaves have become a pressing concern as their frequency and intensity rise due to **climate change**. To address this challenge effectively, this research focuses on leveraging machine learning and AI algorithms to map vulnerability to heat waves across different spatial scales. By integrating data from diverse sources, such as satellite imagery, demographic data, and climate datasets, the aim is to identify areas and populations most susceptible to heat-related risks. This automated approach aims to provide policymakers and planners with accurate and timely information for targeted interventions, ultimately enhancing climate resilience and public health.



Research gap

References	[1]	[2]	[3]	[4]	[5]	our system
1. Limited Integration of Green Infrastructure in Vulnerability Mapping	✗	✓	✗	✗	✗	✓
2. Data Uncertainty and Bias in Vulnerability Assessments	✗	✗	✗	✓	✗	✓
3.Spatial and Temporal Scale Mismatch	✓	✗	✗	✗	✗	✓
4.Limited Consideration of Future Climate Scenarios	✗	✗	✓	✗	✗	✓
5.Inadequate Evaluation of Intervention Effectiveness	✗	✗	✗	✗	✓	✓

Research Problem

How can machine learning and AI algorithms effectively combine satellite imagery, demographic data, and climate datasets to identify areas and populations most vulnerable to heat waves at different spatial scales, enabling timely and targeted interventions for policymakers and planners?

Objectives & Sub Objectives

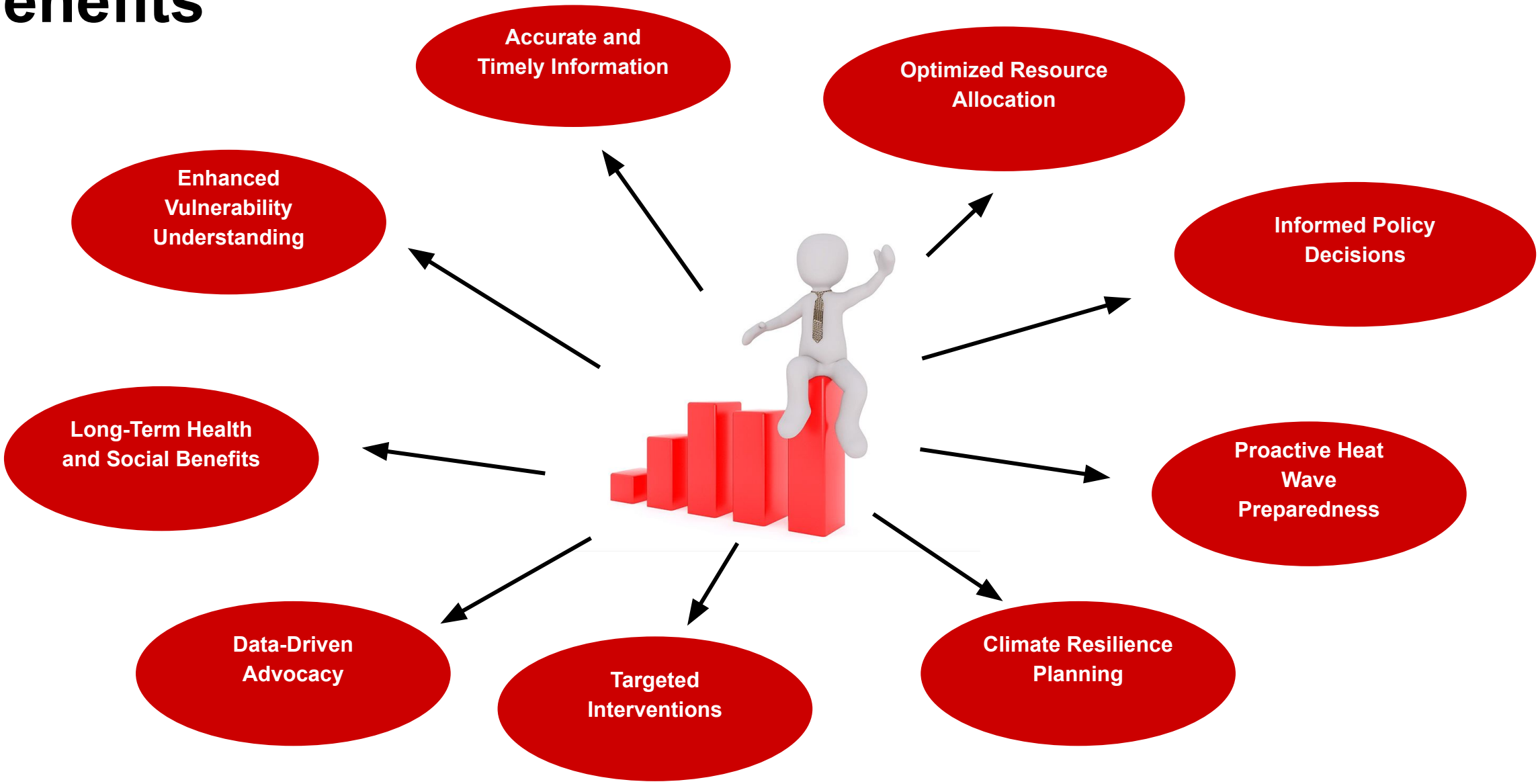
Objectives :

- ★ Develop machine learning algorithms for heatwave vulnerability mapping.
- ★ Integrate satellite imagery, demographic, and climate data for vulnerability assessment.
- ★ Identify vulnerable areas and populations at different spatial scales.
- ★ Provide timely information for targeted interventions to policymakers and planners.

Sub-Objectives :

- ★ Explore suitable machine learning techniques for vulnerability assessment.
- ★ Preprocess and harmonize diverse data sources effectively.
- ★ Map vulnerability hotspots using geospatial analysis.
- ★ Create a user-friendly interface for presenting vulnerability maps.
- ★ Collaborate with stakeholders to facilitate intervention implementation.

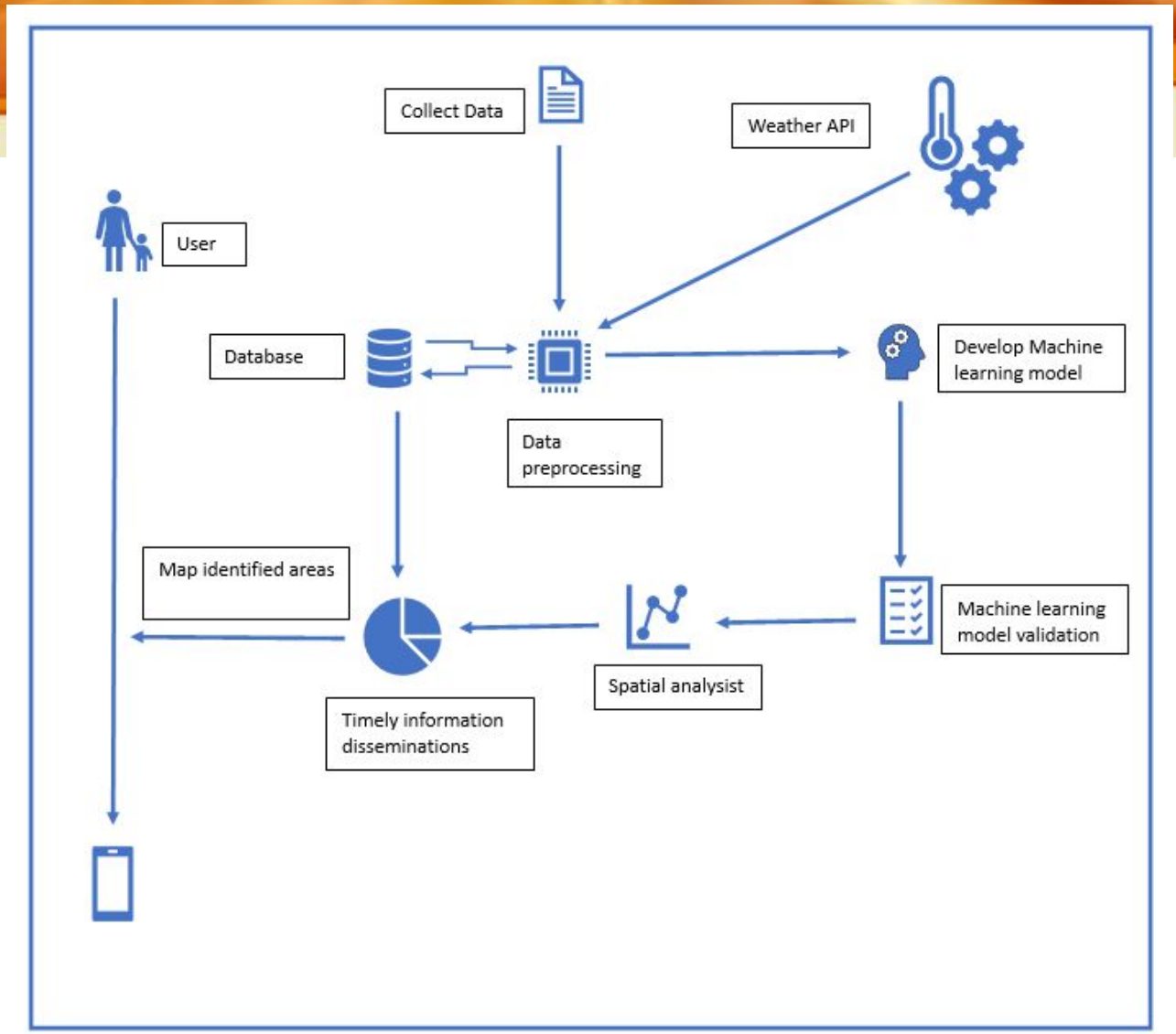
Benefits


Accurate and Timely Information
Optimized Resource Allocation
Enhanced Vulnerability Understanding
Informed Policy Decisions
Long-Term Health and Social Benefits
Proactive Heat Wave Preparedness
Data-Driven Advocacy
Targeted Interventions
Climate Resilience Planning

Methodology

- ➔ Data Collection
- ➔ Data Preprocessing
- ➔ Feature Engineering
- ➔ Machine Learning Model Selection
- ➔ Model Training and Validation
- ➔ Vulnerability Mapping
- ➔ Spatial Analysis
- ➔ Interface Development
- ➔ Timely Information Dissemination
- ➔ Collaboration and Implementation

System Overview



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Completion of the project

The project on "Automated Vulnerability Mapping to Heatwaves using Machine Learning and Diverse Data Sources" has been successfully completed. We developed machine learning algorithms and integrated diverse data to map vulnerability at various scales. The research provides timely information for policymakers, enhances climate resilience planning, and optimizes interventions to protect vulnerable communities.

Commercialization

The successful completion of the research project has paved the way for the commercialization of the developed technology and methodologies. The vulnerability mapping system utilizing machine learning and diverse data sources presents significant opportunities for various commercial applications and industries.

- Potential Commercialization Avenues
- Government and Municipal Applications
- Insurance and Risk Management
- Environmental Consulting Services
- Healthcare and Public Health
- Real Estate and Property Development
- Disaster Response Technology
- Climate Change and Environmental Organizations

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Introduction

- 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.

Research Questions

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

Research gap

References	[1]	[2]	[3]	[4]	[5]	our system
1.They should be classified according to their age limits	✗	✗	✗	✗	✓	✓
2. Track your location and notify if your location is safe or not	✗	✓	✓	✗	✗	✓
3.Inform them daily about the number of effects of heat waves on the body	✓	✗	✗	✗	✗	✓
4.The system should know about the work and activities you do	✓	✗	✗	✓	✗	✓
5. System performance issues	✗	✓	✗	✓	✓	✓

Objectives & Sub Objectives

Main objectives

How does the body protect itself from heat waves in an industry or activity that involves a lot of heat waves on a daily basis?

Sub Objectives

Identify	Age	Area
Identify the person concerned and classify them according to the activity or occupation they engage in.	Classification according to their age limits	Classification according to the area in which they work

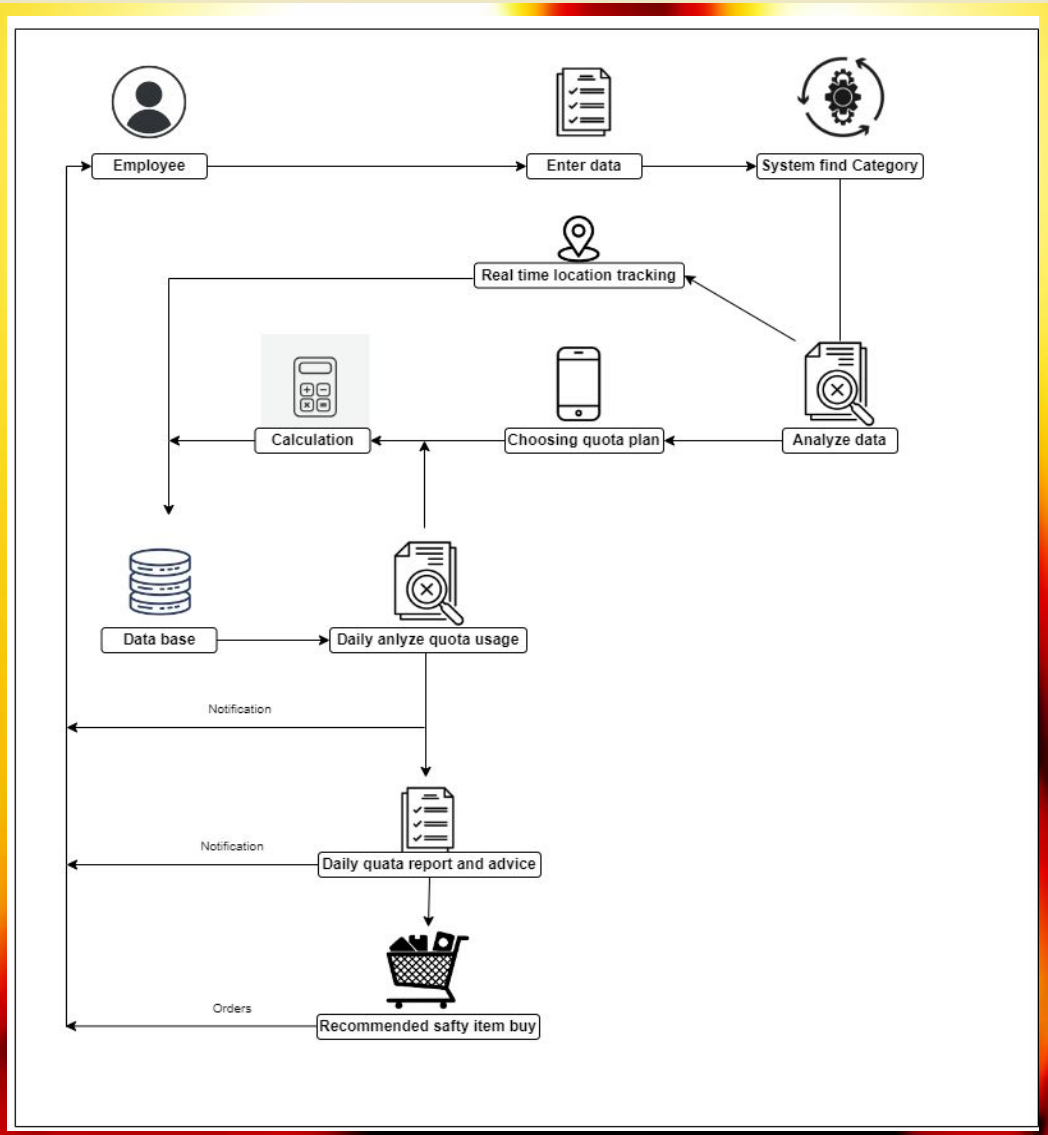
Benefits


01
Improved Reliability
02
Minimizing Skin Problems
03
Reduced Risk of Heatstroke
04
Avoiding Heat Stress
05
Maintaining Hydration
06
Preventing Heat-Related Illnesses

Methodology

- Study Design and Data Collection
- Task Analysis
- Heat Stress Monitoring
- Work-Rest Cycles and Quota Plan Development:
- Job Rotation and Task Scheduling

System Overview



work distribution

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Reference

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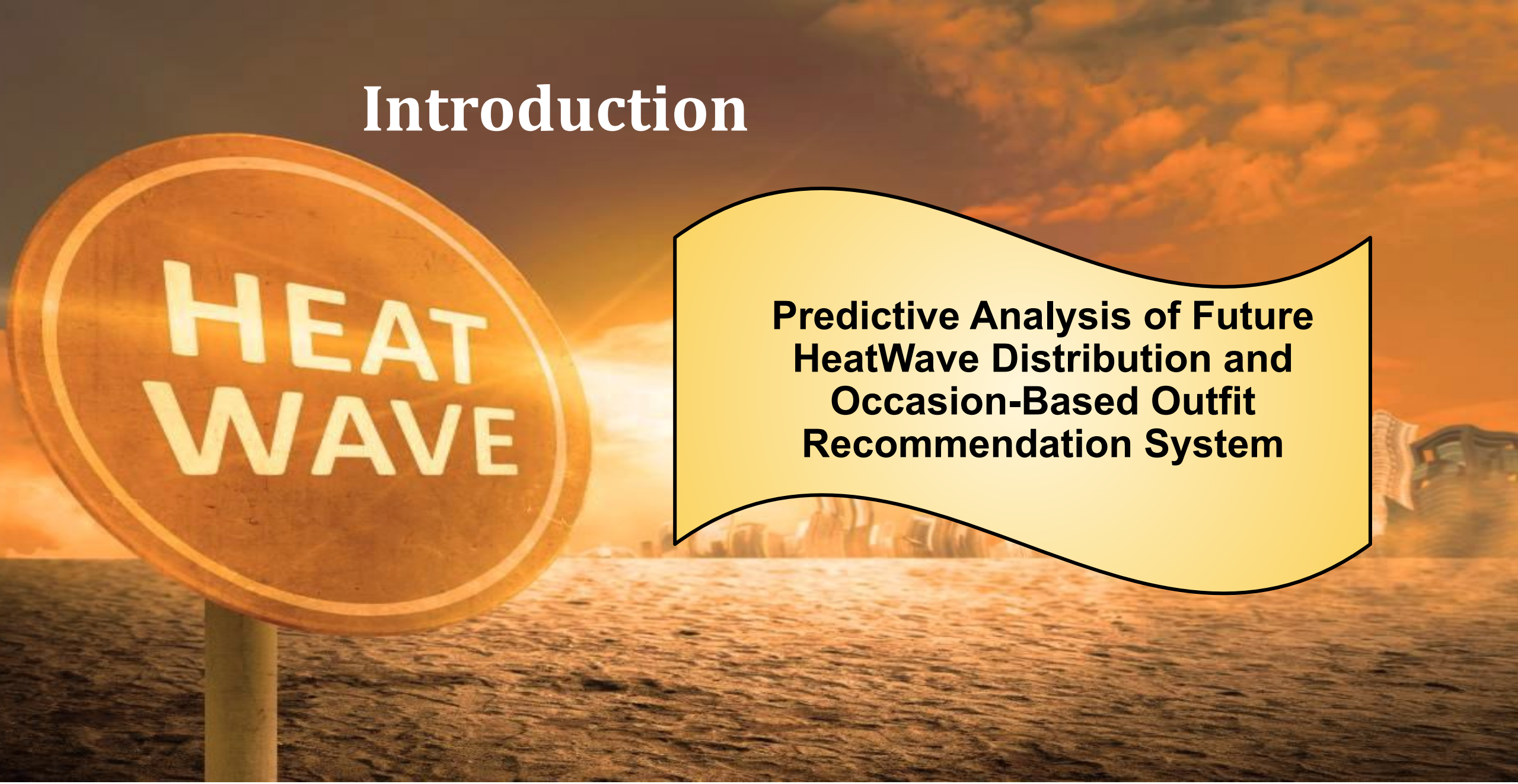
Introduction



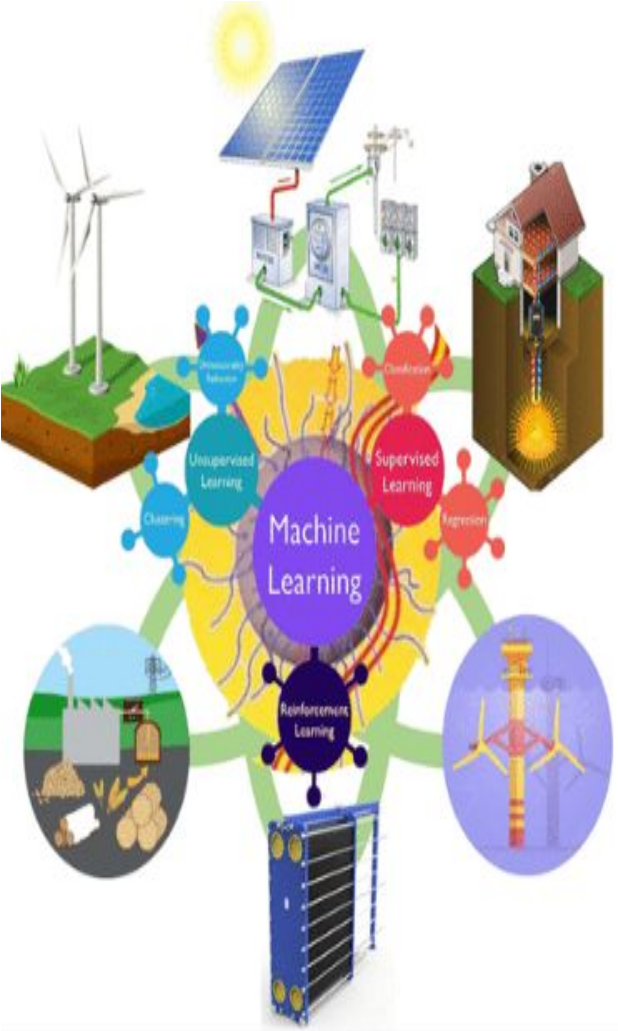
Predictive Analysis of Future HeatWave Distribution and Occasion-Based Outfit Recommendation System

Research Problem

Difficulty in choosing a daily outfit that suits people and includes clothing items that are appropriate for the weather of the day.

Research Gap

- Develop a recommendation system that suggests the most suitable outfit to minimize the impact of heatwaves by taking the occasion and future heatwave distribution data



References	{1}	{2}	{3}	{4}	{5}	{6}	Our System
recommender system for smart clasets.	✓	✗	✗	✗	✗	✗	✓
visual object reconition	✗	✓	✗	✗	✗	✗	✓
goal orientd fashion recommendation.	✗	✗	✓	✗	✗	✗	✓
identification and predication of heat response time.	✗	✗	✗	✓	✗	✗	✓
weather-oriented clothing recommendation.	✗	✗	✗	✗	✓	✗	✓
people's clothing behavior according to extenal weather and indoor environment.	✗	✗	✗	✗	✗	✓	✓

Benefits


Seek shade often
Drink plenty of water
Check on the elderly and those without A.C.
Don’t leave children or pets in your hot car.
Limit outdoor activity to mornings and evenings.
Know how to spot the signs of heat-related illness.

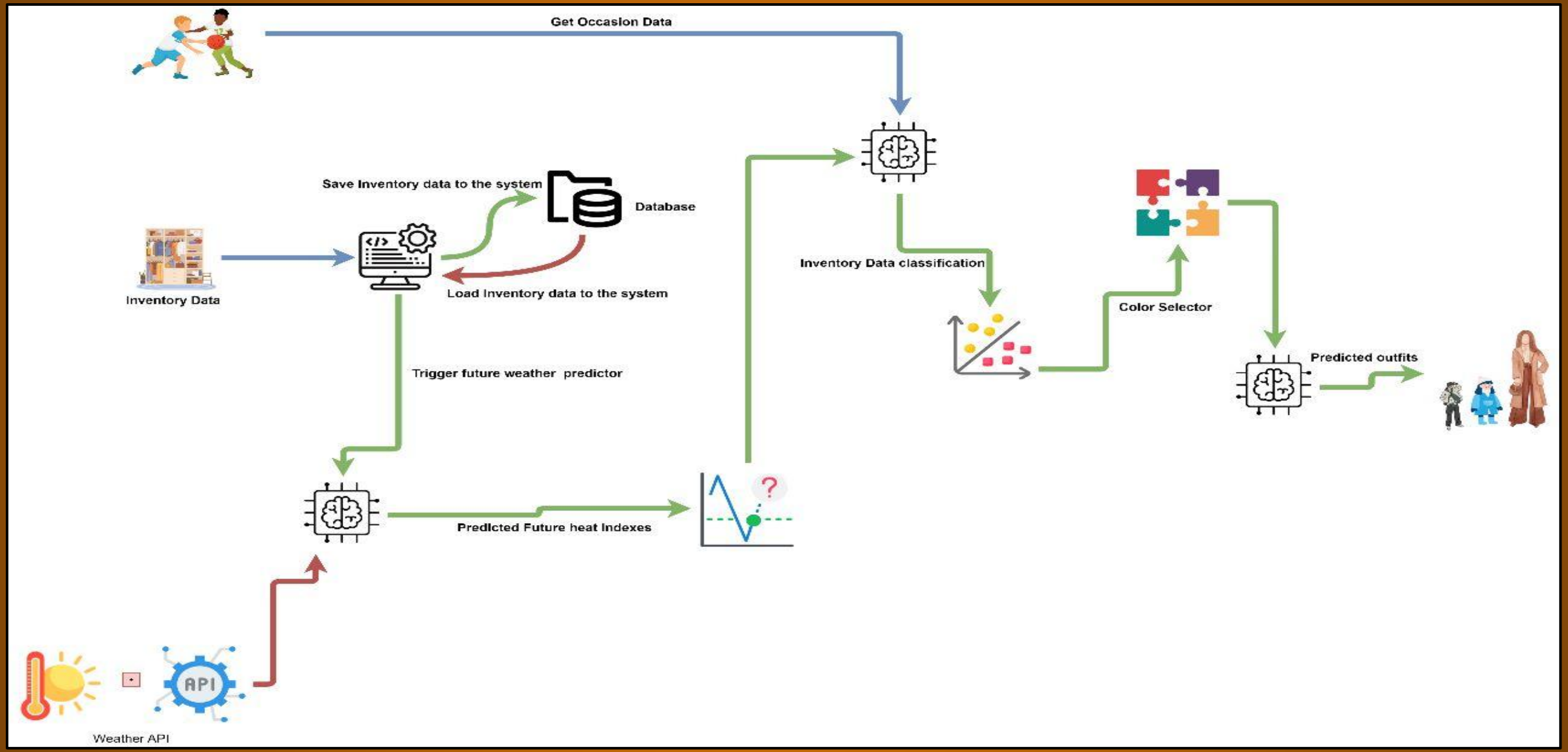
Main Objective

Develop a recommendation system that suggests the most suitable outfit to minimize the impact of heatwaves.

Sub Objectives

- Visual object storing
- Heat Index Prediction
- Occasion Analysis
- Color Palette Selection
- Outfit Recommendation

Diagram


Get Occasion Data
Save Inventory data to the system
Database
Inventory Data
Load Inventory data to the system
Inventory Data classification
Color Selector
Predicted outfits
Trigger future weather predictor
Predicted Future heat Indexes
API
Weather API

Reference

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[6]https://www.researchgate.net/publication/223936659_People's_clothing_behaviour_according_to_external_weather_and_indoor_environment

Commercialization

- **Add outfit limitation after 5 free trials.**
- **Play store subscription.**

❖ **End.**