

Personal Activity Recommendation System based on Real-Time Streaming Weather Data

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Outline

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Motivation

- **Challenges in Daily Activity Planning.**
- **Limitations of Traditional Forecasting.**
- **Need for Innovation.**
- **Technological Advancement.**
- **Broader Impact.**



Problem Statement

- **Challenges in Daily Activity Planning:**
- **Unpredictable Weather:**
 - Rapid weather changes disrupt outdoor activities.
 - Limited real-time access to tailored weather data.
- **Lack of Personalization:**
 - Generic weather forecasts fail to cater to individual preferences.
- **Health and Safety Concerns:**
 - Engaging in activities unsuitable for current conditions can lead to discomfort or risks.



Challenge In Construction Project

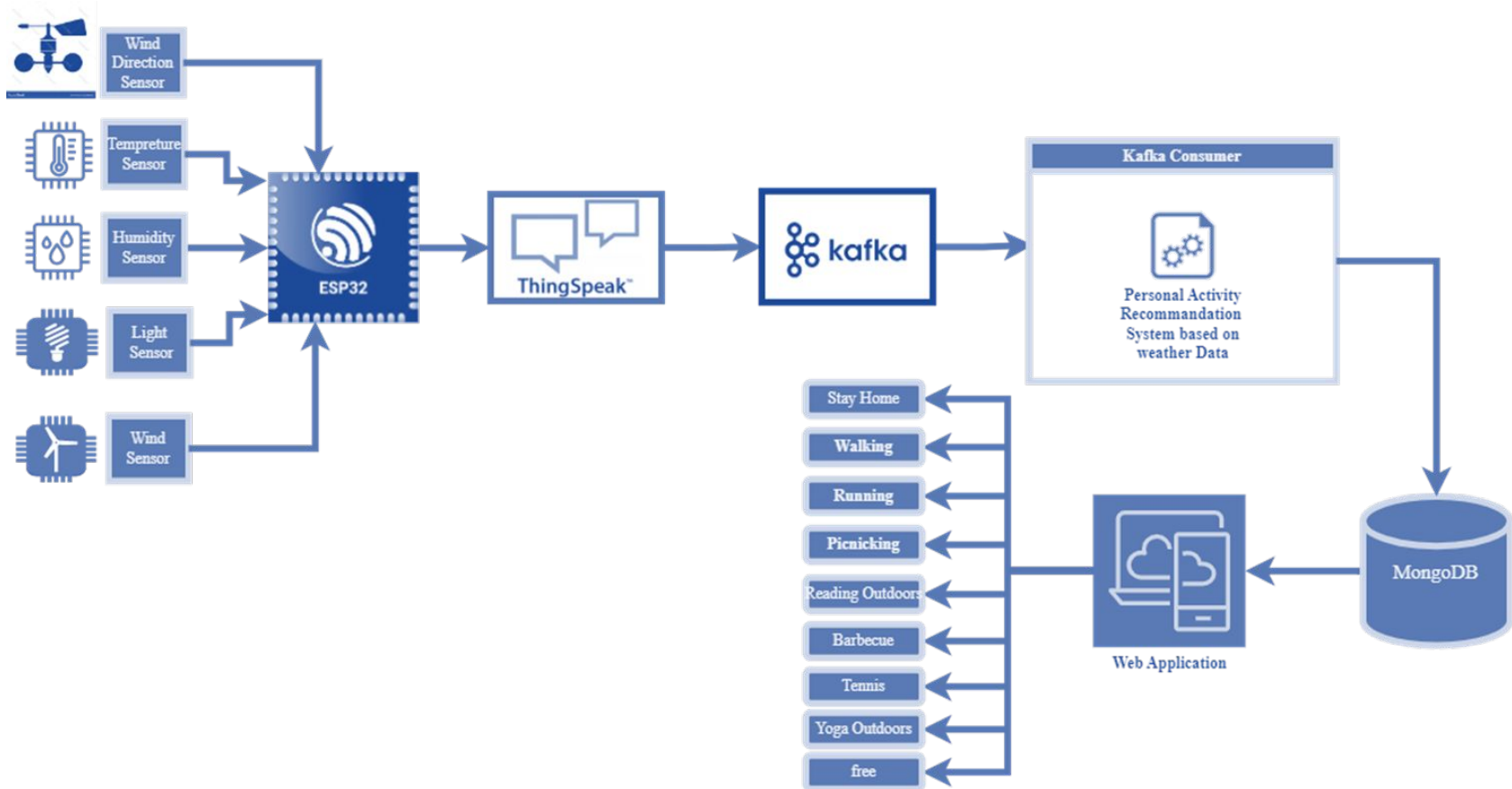
1. Weather data streaming from thingspeak.
2. ML algorithm selection, Pipeline building and saving
3. Kafka related problems
4. Consumer streams with Mongoddb and web server
5. Web application construction



Boston Weather Station



System Overview & Pipeline Diagram



Data Collection with IoT Sensors

- **Innovative Features:**

- **Sensors Used:**

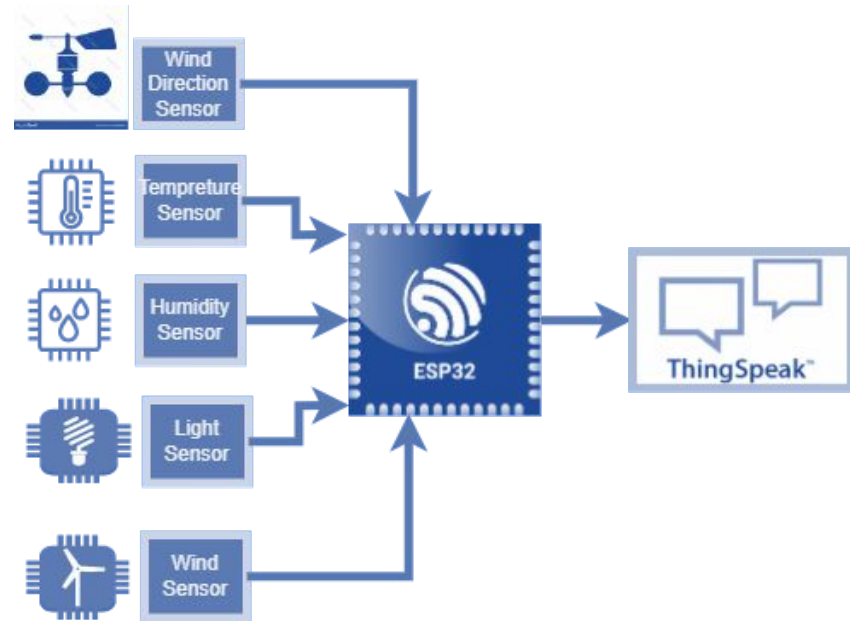
- Temperature
- Humidity
- Wind Speed/Direction
- Light Intensity

- **Processing Unit:**

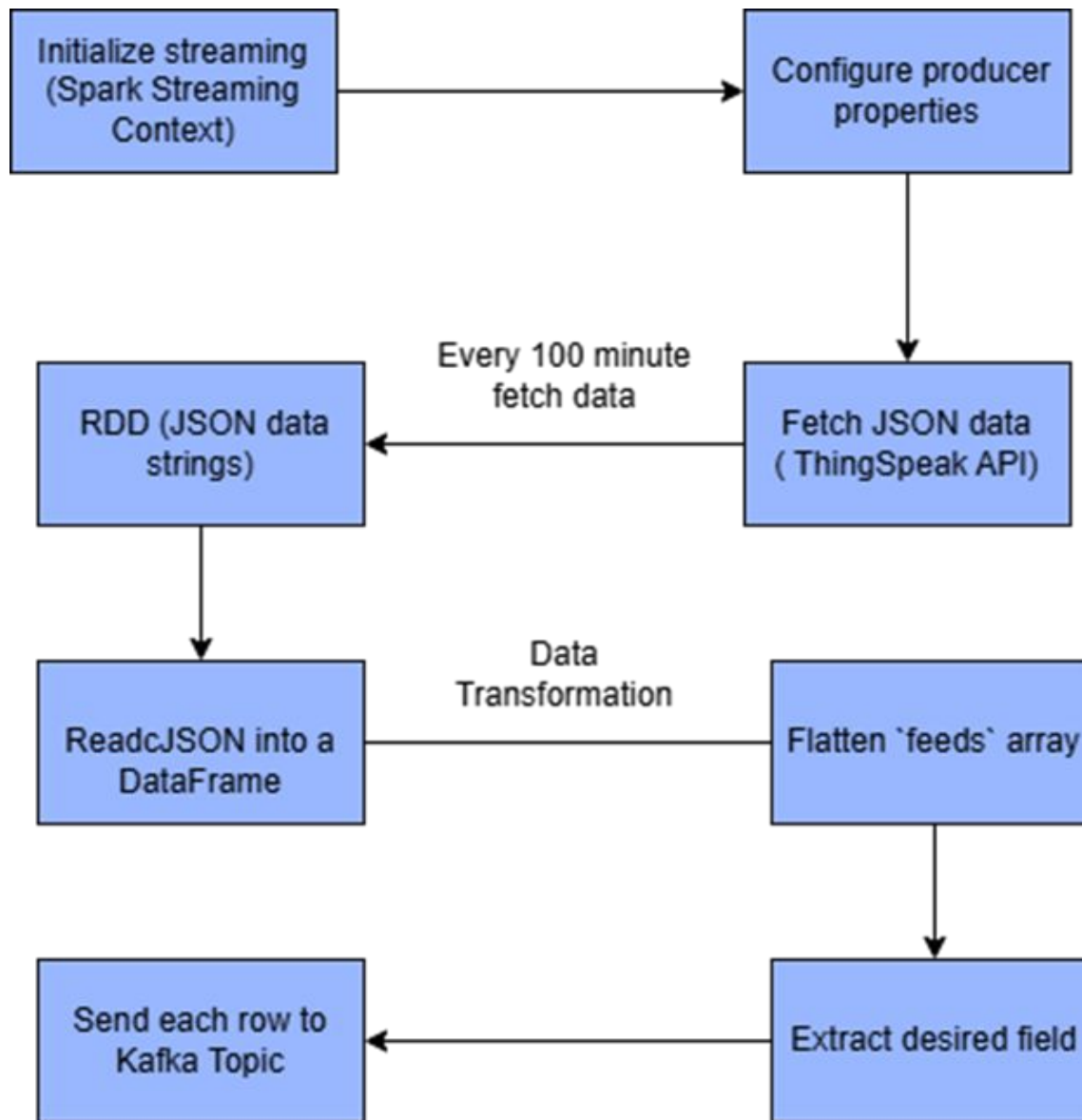
- ESP32 microcontroller for low-cost and efficient data handling.

- **Data Integration Platform:**

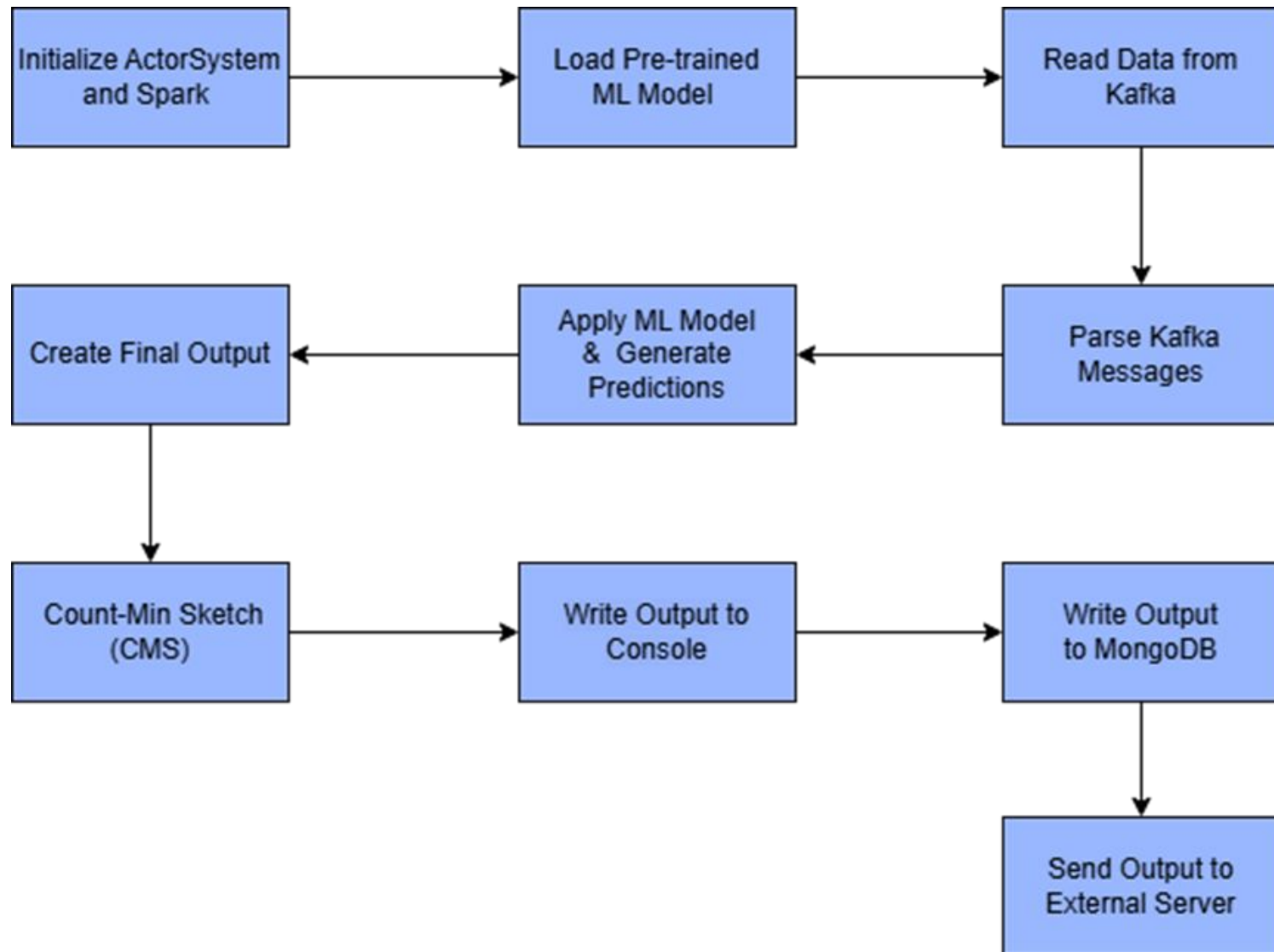
- ThingSpeak for real-time weather data access, retrieval and logging .



Kafka Producer Pipeline



Consumer Pipeline



ML Recommendation System

- **Machine Learning Algorithms:**
 - Model trained on historical weather and activity preference data.
- **Example Predictions:**
 - Sunny day: Outdoor activities like running, cycling.
 - Light Rainy day: Outdoor activities like yoga, reading.

1	created_at	Wind Direction	Wind Speed (mph)	% Humidity	Temperature (F)	Rain (Inches/minute)	Pressure (Hg)	Light Intensity	recommended_activity
2	2024-11-06T17:06:34.000+02:00	90	3.3	45	49.5	0.0	30.21	0	Stay Home
3	2024-11-06T17:07:34.000+02:00	76	0.9	64	70.1	0.0	29.92	0	Stay Home
4	2024-11-06T17:08:34.000+02:00	55	0.1	37	52.1	0.0	30.2	1054	Walking
5	2024-11-06T17:08:34.000+02:00	65	0.6	46	44.9	0.5	29.78	0	Stay Home
6	2024-11-06T17:08:34.000+02:00	66	1.2	63	70.2	0.0	29.92	0	Stay Home
7	2024-11-06T17:08:34.000+02:00	113	4.2	74	70.2	0.5	29.73	0	Stay Home
8	2024-11-06T17:09:34.000+02:00	51	0.3	61	72.4	0.0	29.87	800	Running
9	2024-11-06T17:11:34.000+02:00	59	0.9	46	48.8	0.0	30.2	0	Stay Home
10	2024-11-06T17:11:34.000+02:00	73	0.5	61	72.6	0.0	29.87	800	Running
11	2024-11-06T17:12:34.000+02:00	46	0.0	40	48.3	0.0	30.22	306	Walking

Recommendation System Threshold

Temperature (F)	Rain (Inches/minute)	Wind Speed (mph)	Light Intensity	Recommended Activity
> 75	≤ 0.4	< 15	> 500	Running
≤ 75 and ≥ 60	$== 0$	< 10	> 300	Picnicking
≤ 50	≤ 0.4	> 15	> 200	Walking
Any	> 0.5	Any	Any	Stay Home
≤ 45 OR Any	Any	> 25 OR Any	< 100	Stay Home
≥ 60 and ≤ 85	≤ 0.4	< 10	> 500	Reading Outdoors
≥ 65 and ≤ 80	≤ 0.4	< 10	> 300	Barbecue
≥ 70 and ≤ 85	≤ 0.4	< 5	> 500	Tennis
≥ 60 and ≤ 75	≤ 0.2	< 5	> 200	Yoga Outdoors
Any	Any	Any	Any	You are free

Evaluation of Recommendation System Model

F1 Score = 98.56%

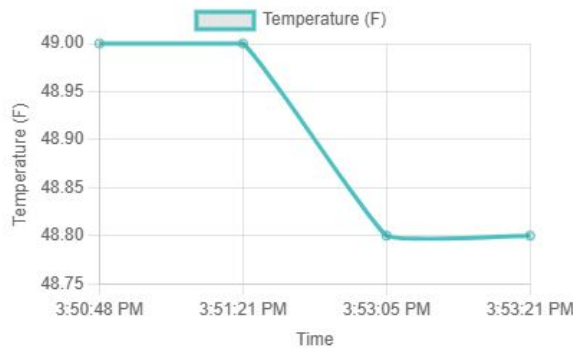
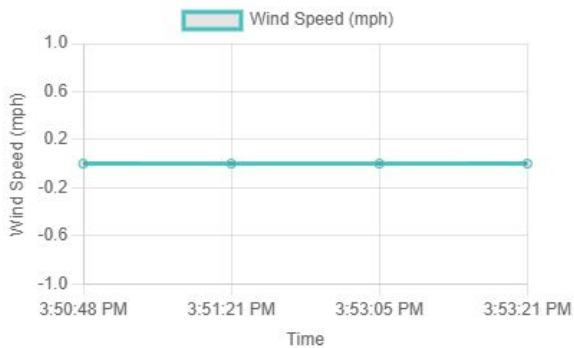
Precision = 98.61%

Recall = 98.59%

Web Application

Weather Recommendation Activity System

Time	Wind Direction	Wind Speed (mph)	% Humidity	Temperature (F)	Rain (Inches/minute)	Pressure (Hg)	Light Intensity	Recommended Activity	Activity Count Appearance
2024-11-22 23:07:27.0	46.0	0.0	63.0	48.8	0.0	29.24	108.0	Walking	3



Future Work

- Alerts for sudden weather changes with updated recommendations.
- Enhance the Recommendation system conditions “Threshold”.
- Adaptive learning to refine recommendations based on user feedback.
- Modify web app to be interactive to have to an easy-to-use interface for browsing and selecting activities