Project Design Phase-II
Technology Stack (Architecture & Stack)

Date	14 May 2023
Team ID	NM2023TMID04258
Project Name	IOT Based Weather Adaptive Street Lighting System

Technical Architecture:

The Deliverable shall include the architectural diagram as below and the information as per the table1 & table 2

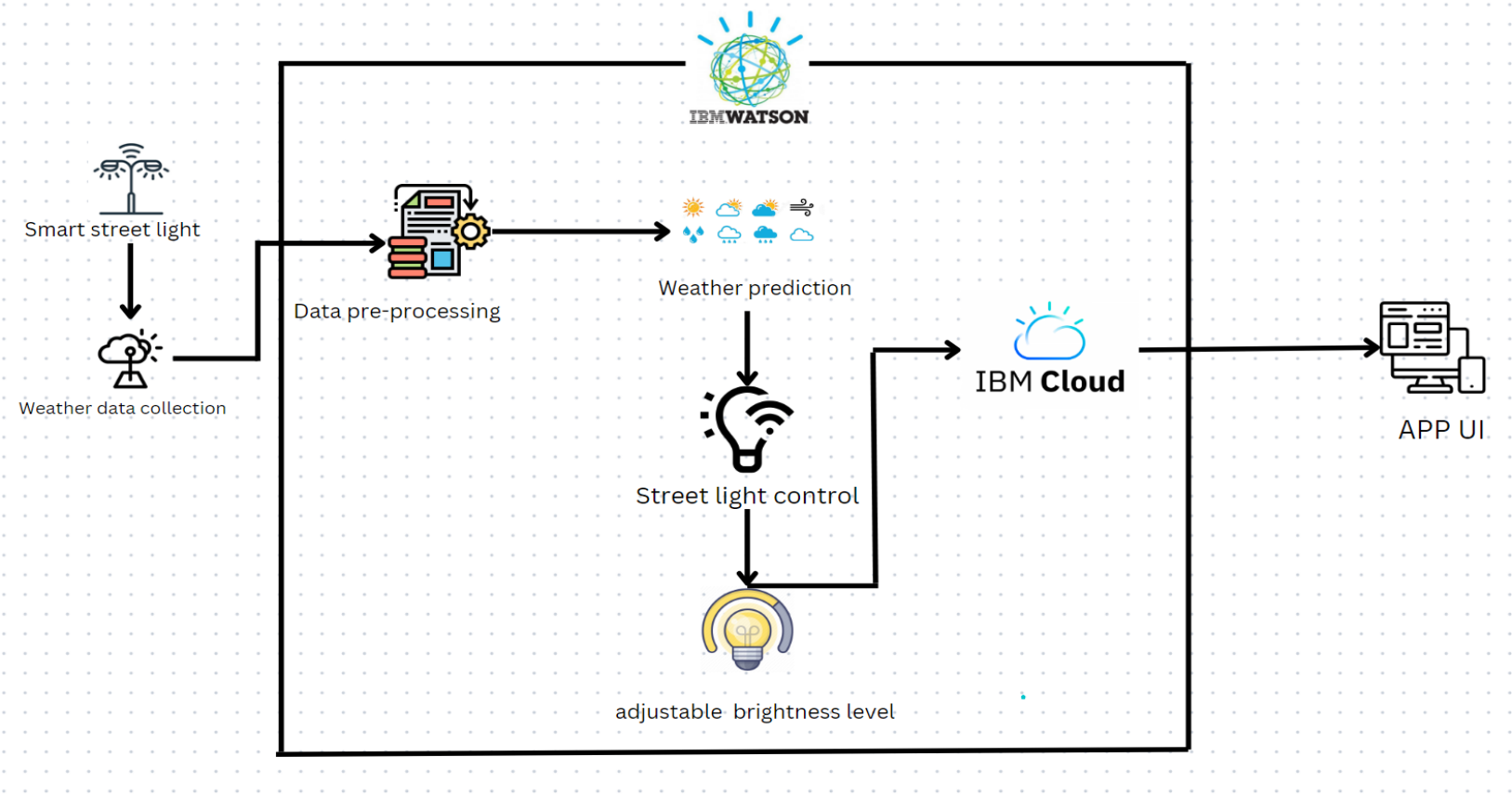

Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	HTML, CSS, JavaScript / Angular Js / React Js etc.	Web UI, Mobile App
2.	Application Logic-1	IoT sensors to measure weather conditions in real-time, such as temperature, humidity, and precipitation. Microcontrollers such as Arduino or Raspberry Pi to control the street lights and adjust their brightness.	Basic Weather Monitoring
3.	Application Logic-2	Machine learning algorithms such as decision trees, random forests, or neural networks to predict future weather conditions. Cloud services such as IBM or Google Cloud Platform to store and process large amounts of data.	Advanced Weather Prediction and Light Control
4.	Application Logic-3	Mobile applications to communicate with emergency services and city officials.	Emergency Response
5.	Database	Relational databases are suitable for structured data that require complex queries and transactions. NoSQL databases are suitable for unstructured or semi-structured data that require high scalability and availability.	MySQL, NoSQL, etc.
6.	Cloud Database	IBM also offers various database management tools and services, such as IBM Data Management Console for managing databases on IBM Cloud, IBM Cloud Pak for Data for data analytics and AI, and IBM Watson Studio for building and deploying machine learning models.	IBM DB2, IBM Cloudant etc.
7.	File Storage	You can store files on the local system of the device running the street light system. This can be a simple and low-cost option, but it may not be scalable and can pose a risk of data loss if the device fails. A NAS is a dedicated storage device that can be attached to the street light system over a network. NAS devices provide higher scalability and reliability than local file storage and can be accessed by multiple devices.	Network-attached storage (NAS) Local file storage Cloud storage
8.	External API-1	this API provides current and historical weather data, as well as 15-day weather forecasts. You can use this API to retrieve weather data for street light system and adjust the light settings accordingly. The API can also provide information about severe weather conditions and alerts, which can be used for emergency response.	IBM Weather API, etc.

9.	External API-2	This API allows you to connect and manage IoT devices, such as your street lights, and collect and analyze the data they generate. With the IoT Platform, you can set up rules and alerts based on sensor data, and trigger actions such as adjusting the light settings or sending notifications. You can also use the platform to visualize the data and monitor the performance of your street light system.	IBM IoT Platform
10.	Machine Learning Model	By training a machine learning model on historical weather data and other factors such as location, time of day, and season, you can predict the likely weather conditions for a given time and location. This information can be used to adjust the light settings, for example, to increase brightness in case of rain or fog. By training a machine learning model on images or video feeds from the street light system, you can recognize objects such as vehicles, pedestrians, or animals. This information can be used to adjust the light settings, for example, to increase brightness in areas with high pedestrian traffic or to dim the lights in areas with low activity.	Object Recognition Model, Weather prediction ,etc.

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	TensorFlow can be used for a variety of machine learning tasks, including weather prediction and object recognition. TensorFlow can run on a variety of platforms, including IBM's PowerAI platform, which is optimized for deep learning workloads. This is an open-source framework for deploying and managing machine learning workflows on Kubernetes, a popular container orchestration platform. This is an open-source computer vision library that can be used for tasks such as object detection, tracking, and recognition.	TensorFlow,KubeFlow,OpenCV.
2.	Security Implementations	Encrypting the data in transit and at rest can prevent unauthorized access and data breaches. You can use encryption protocols such as SSL/TLS for data in transit and AES encryption for data at rest. Implementing access control measures such as user authentication, authorization, and role-based access control can ensure that only authorized personnel have access to the system and its data.	Encryptions, AcessControls, etc.
3.	Scalable Architecture	These tools can help you deploy and manage your application across multiple nodes, and scale up or down as needed. Another way to achieve scalability is by using cloud-based services such as IBM's Cloud Functions, which allows you to run serverless functions that can automatically scale up or down based on demand.	IBM's Cloud Functions, Docker and Kubernetes.
4.	Availability	Load balancing can distribute incoming traffic across multiple servers, while failover can automatically switch to a backup server in case of a failure. Disaster recovery can help you recover from catastrophic events such as natural disasters or cyber-attacks. IBM's Cloud Load Balancer and Cloud Resiliency Orchestration are some tools that can help you achieve high availability.	Loadbalancing,disasterrecovery.
5.	Performance	Caching can store frequently accessed data in memory, which can reduce the response time and improve performance. Indexing can optimize database queries by creating indexes on frequently accessed columns, while compression can reduce the size of data in transit and at rest, which can improve network and storage performance.	caching, indexing, and compression.