

SRC PRESENTATION

INTEGRATING

IOT IN XR

CAMPUS MAP



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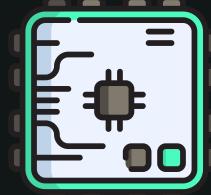
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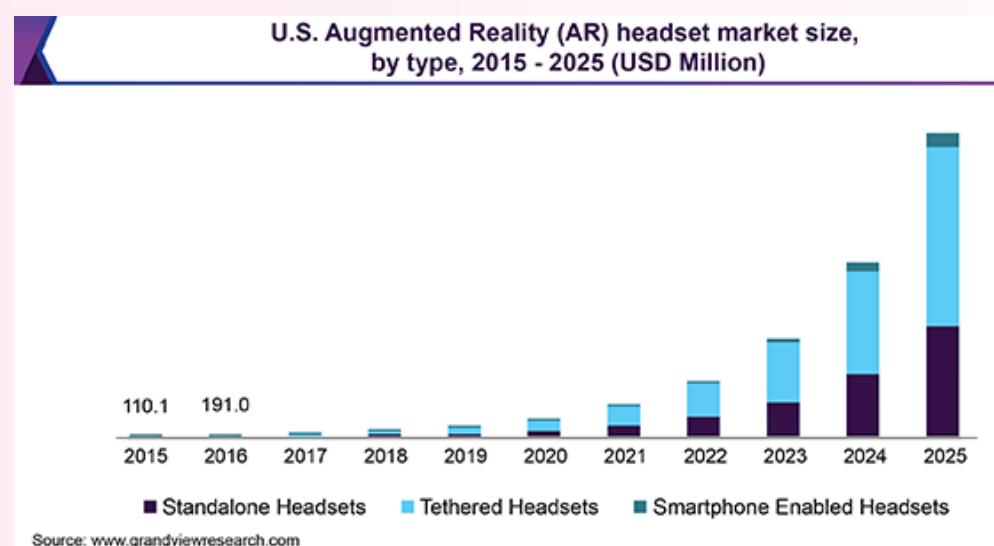
INTEGRATION

Integration of sensors

Introduction

Objective

With the rise of XR HMD devices (Oculus Quest Pro, Apple Vision Pro) having XR applications that integrate real time data would be beneficial for users.



What is XR



AR



MR



VR

Digital content on top of real world

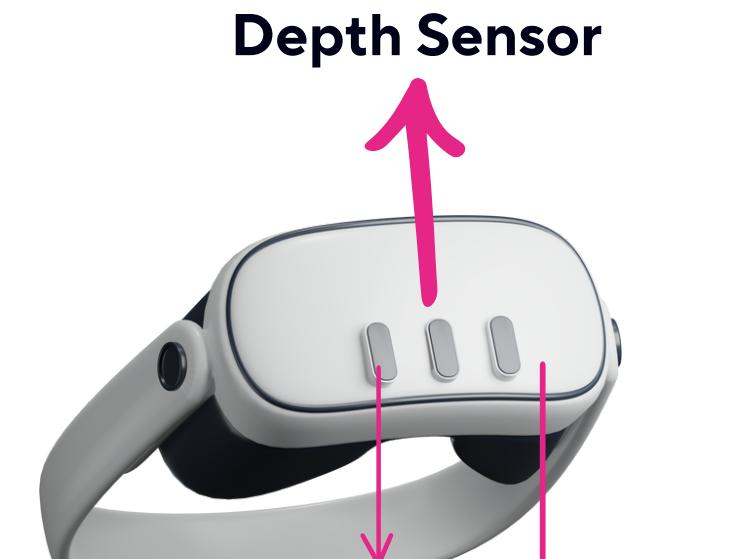
Digital interacts with real world

Digital environment that shut off real world

XR



Apple Vision Pro



Positional tracking, MR passthrough

Meta Quest Pro



Architecture Diagram

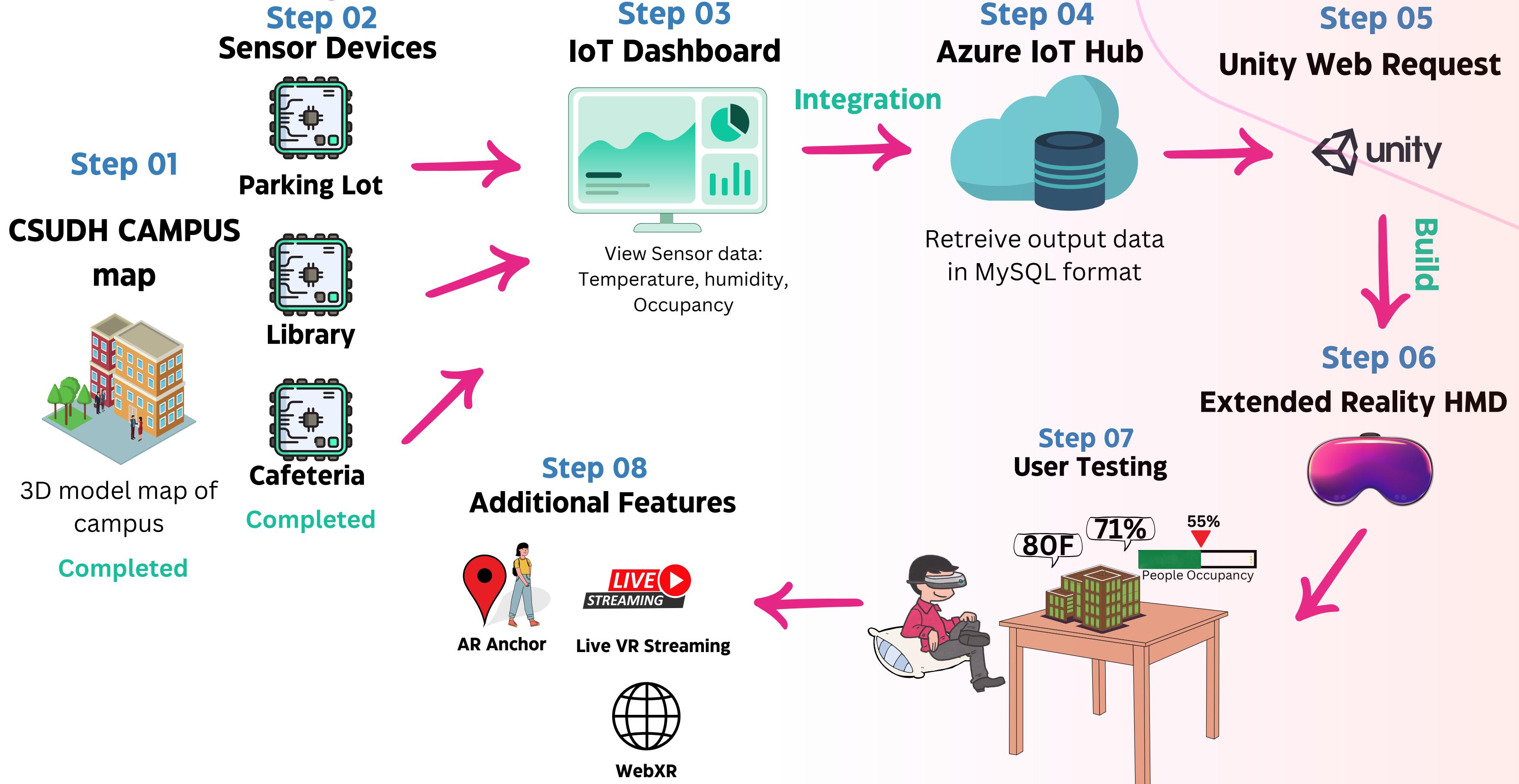
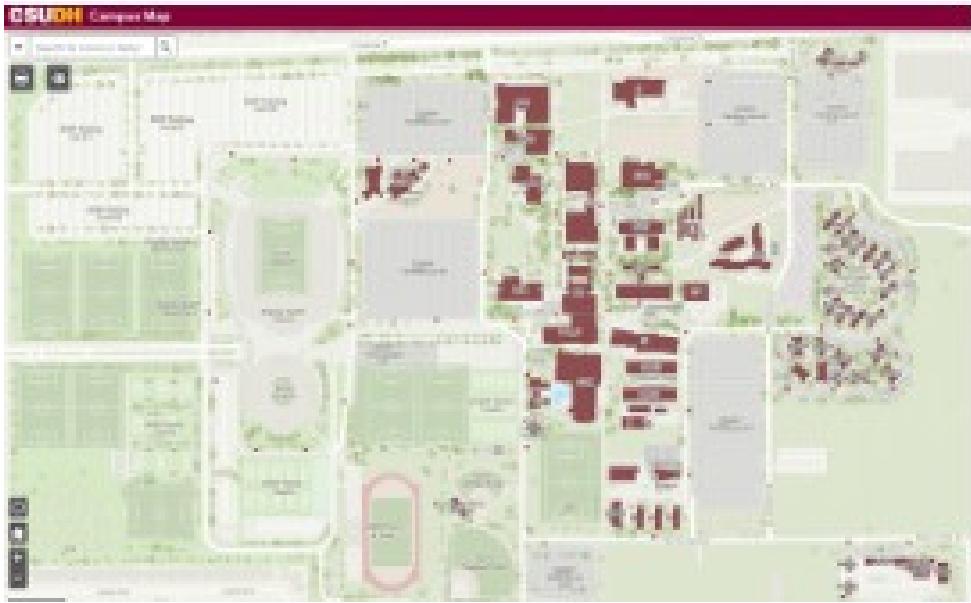


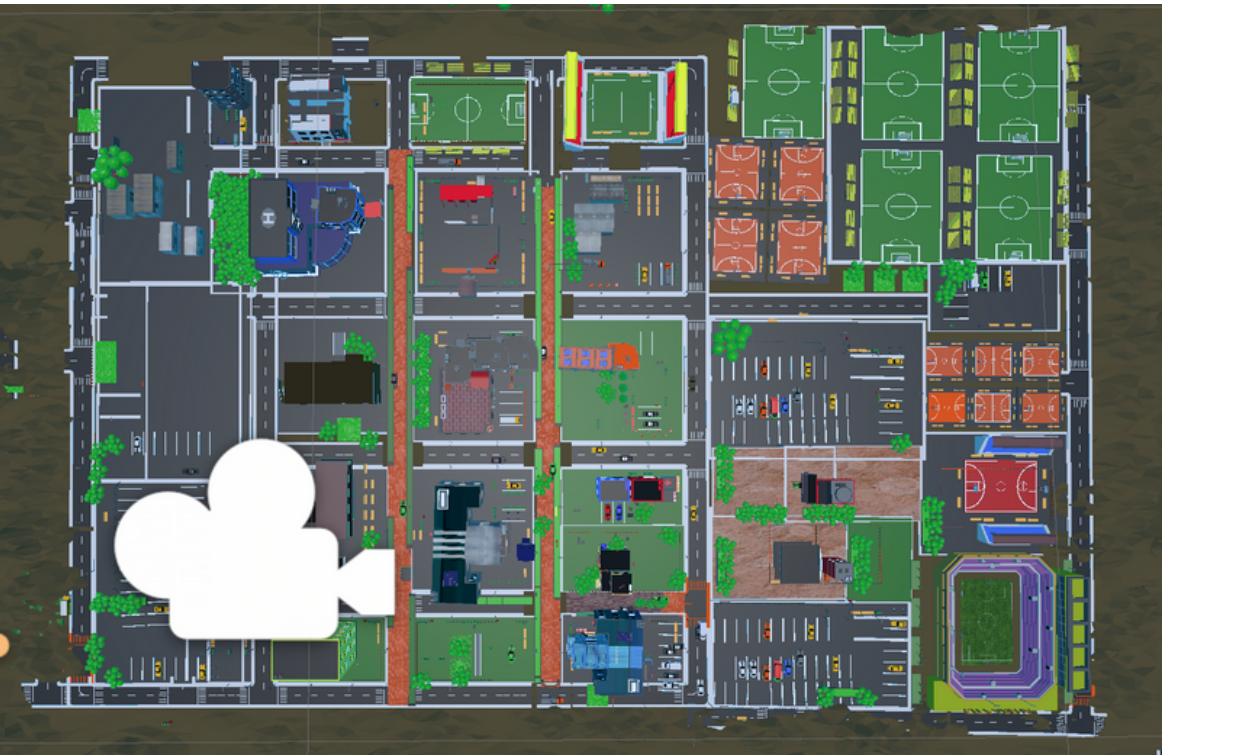
Table 1: Comparison of realistic 3D campus with Unity 3D



DESIGN OF CAMPUS MAP



Top View of CSUDH Campus Map [1]



Top View of CSUDH Campus Map from Unity application

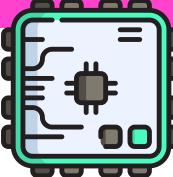


Perspective View of CSUDH Campus Map [1]



Perspective View of CSUDH Campus Map from Unity application

Building Name	Realistic 3D model	Unity 3D Model
I&I		
Welch Hall		
LSU		
Library		
Parking		
Stadium		
Dignity		



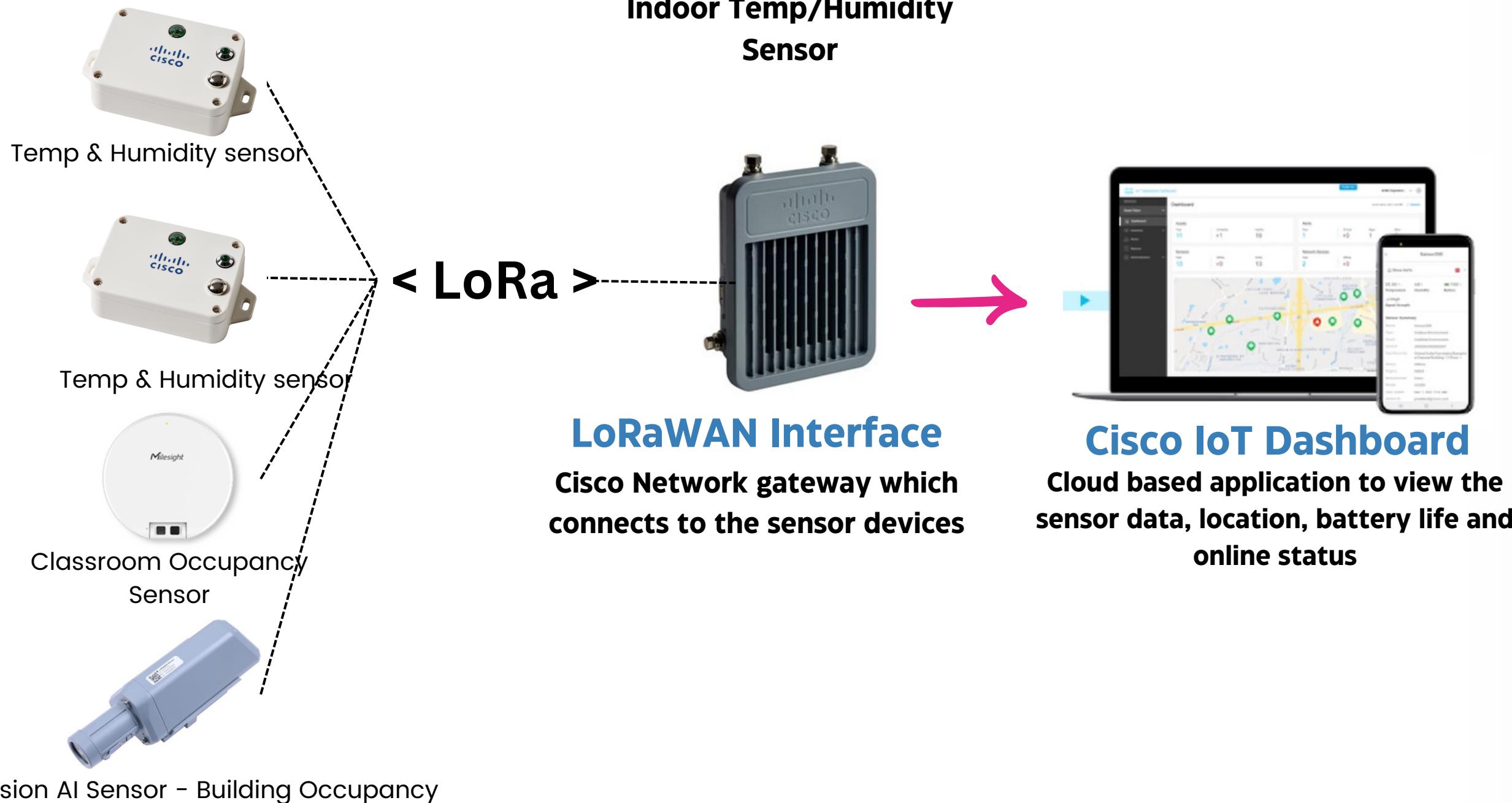
Integration of Sensors

LORAWAN

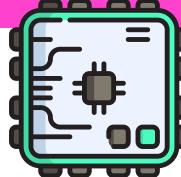
LoRaWAN (Long Range Wide Area Network) network device, often used for connecting sensors in a wide-range IoT (Internet of Things) setup.

Sensor Architecture Diagram

LoRaWAN Sensor Devices



This technology was chosen for its long-range connectivity (up to 10km) and low power consumption (5-year battery life), which is ideal for the extensive campus setting such as CSUDH.



Dashboard



Name	Org Hierarchy
tempsensor1	Global
tempsensor2	Global
Data Summary Feb 9, 2024 - Feb 15, 2024 X	
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>Humidity</p> <p>57.82 %</p> <p>tempsensor1</p> </div> <div style="width: 45%;"> <p>Temperature</p> <p>70.09 °F</p> <p>tempsensor1</p> </div> </div>	
Name Org Hierarchy	
LoRaWAN	Global



Cloud Integration

After successfully accessing the real-time temperature and humidity data on the IoT Dashboard. The next step is to integrate this data to the Azure Cloud.

Add Integration

Select Integration Type

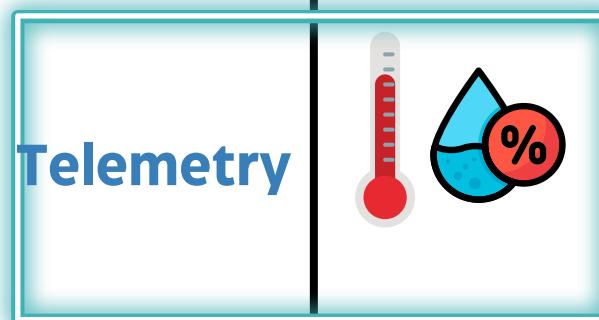
 MQTT Server	 Microsoft Azure IoT
-----------------	-------------------------

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MrY=
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INTEGRATION OF SENSORS

IoT Edge Device



Integration



Ingest

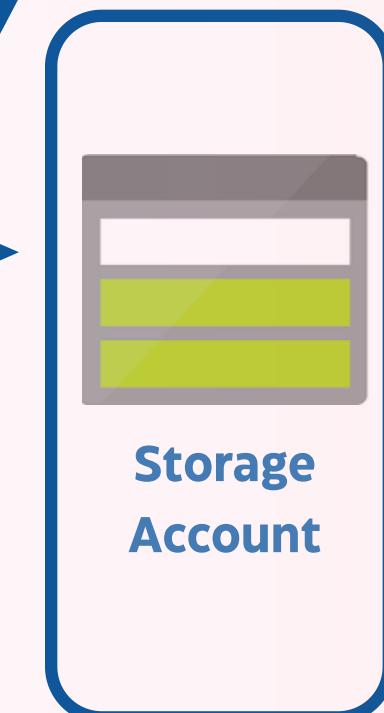


Output



Temperature	Humidity:
22C	62%
21.5C	62.5%
23C	64%

Analyze



Json format

Humidity: 71%
Temperature: 22C



```
SELECT TOP (1000)
DATEADD(SECOND, CAST(timestamp AS BIGINT)/1000,
'1970-01-01') AS readable_timestamp,
JSON_VALUE(telemetry, '$.temperature.value') AS
temperature,
JSON_VALUE(telemetry, '$.humidity.value') AS humidity
FROM
[dbo].[sensordata]
ORDER BY
readable_timestamp DESC;
```

readable_timestamp	temperature	humidity
2024-02-10T08:39:29.0000000	21.98	57.37
2024-02-10T08:32:35.0000000	22	56.19
2024-02-10T08:24:28.0000000	22.15	56.99
2024-02-10T08:17:34.0000000	21.9	56.13

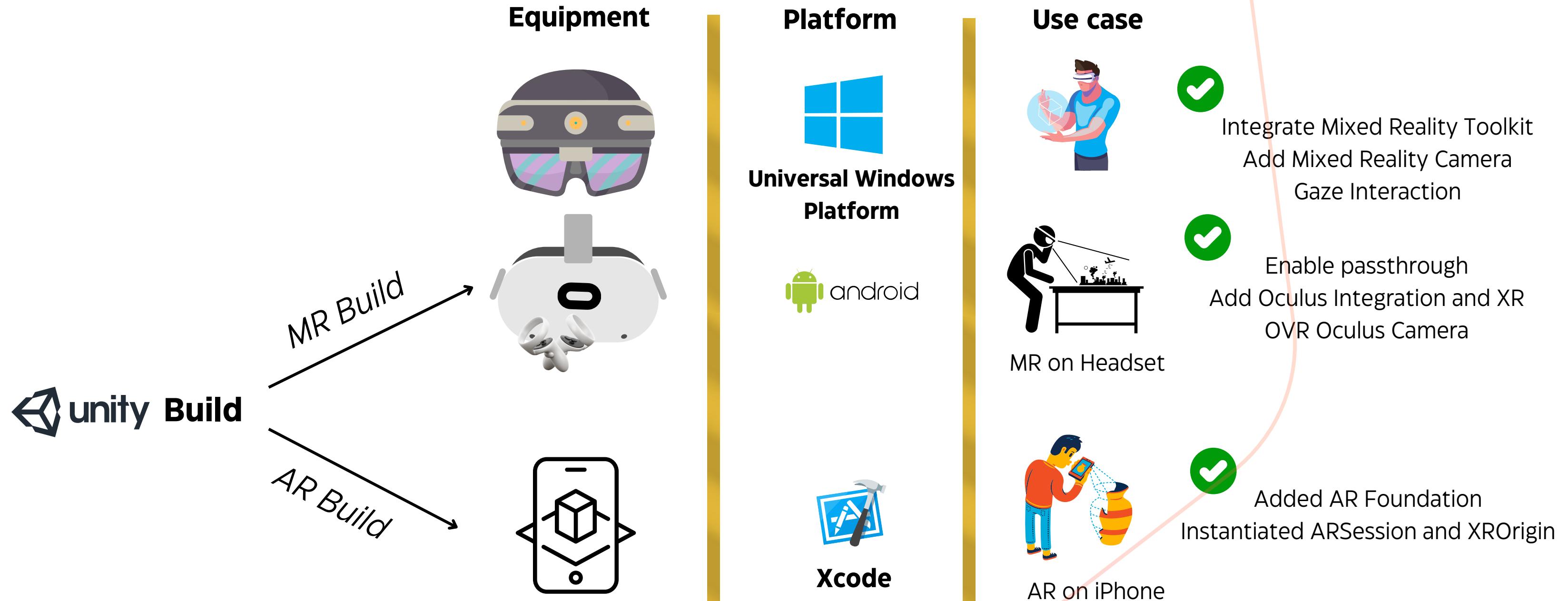


```
public class AzureSQLConnector : MonoBehaviour
{
    private string connectionString = "Server=tcp:ciscoiotssensorserver.database.windows.net,1433;Initial Catalog=IoTsensordata;;";
    void Start()
    {
        ConnectAndQueryDatabase();
    }

    using (SqlCommand command = new SqlCommand())
    {
        command.Connection = connection;
        command.CommandType = CommandType.Text;
        // Updated SQL command text with timezone conversion
        command.CommandText = @"

        using (SqlDataReader reader = command.ExecuteReader())
        {
            while (reader.Read())
            {
                Debug.Log("Timestamp: " + reader["readable_timestamp"].ToString() + ", Temperature: "
reader["temperature"].ToString() + ", Humidity: " + reader["humidity"].ToString());
            }
        }
    }
}
```

Build Process



Meta Quest View



Mobile AR View



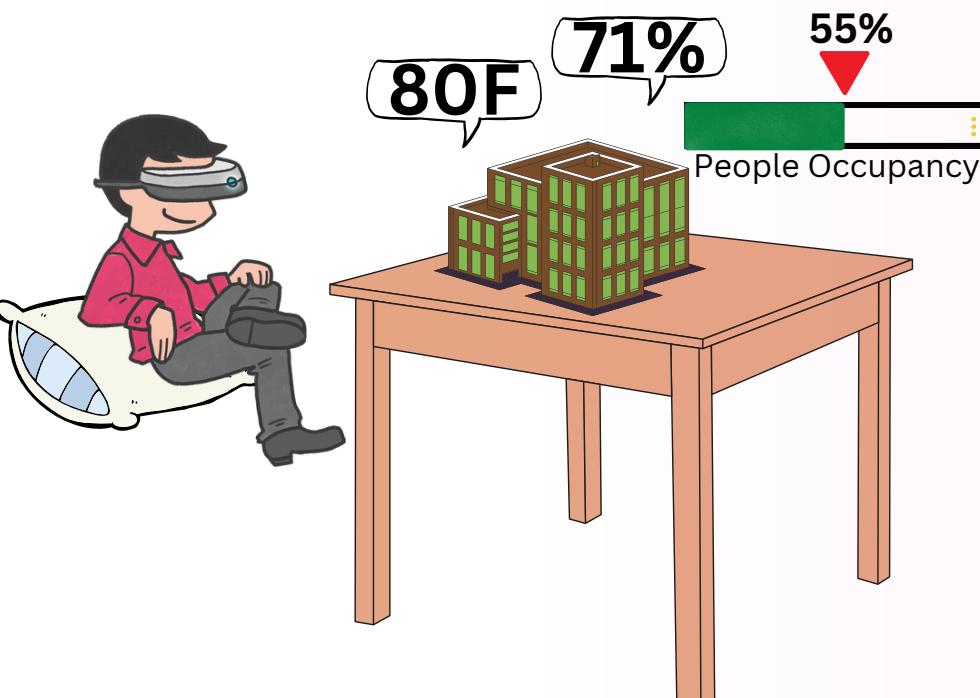
Summary & Future Work

Back End

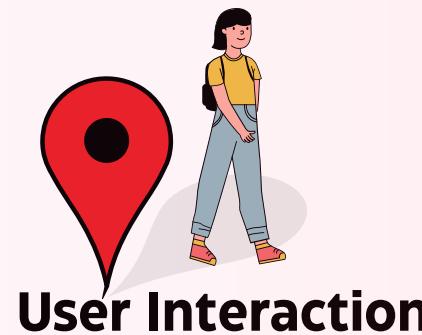
People Occupancy Data



User Testing



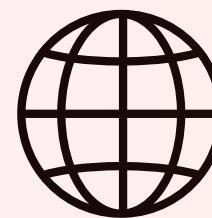
Front End



User Interaction



Apple Vision Pro



WebXR