

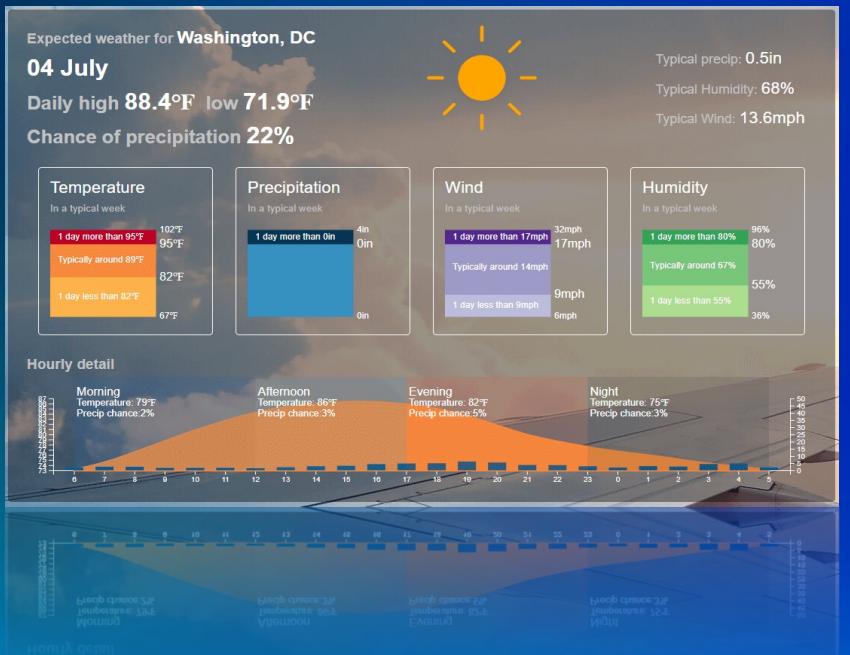
APPLICATION OF IOT IN SMART CITIES: UTILIZING STREETLIGHT-INTEGRATED DRONES FOR PRECISION WEATHER MONITORING AND REAL-TIME CROWD TRACKING

NTU IOT PROJECT 2024

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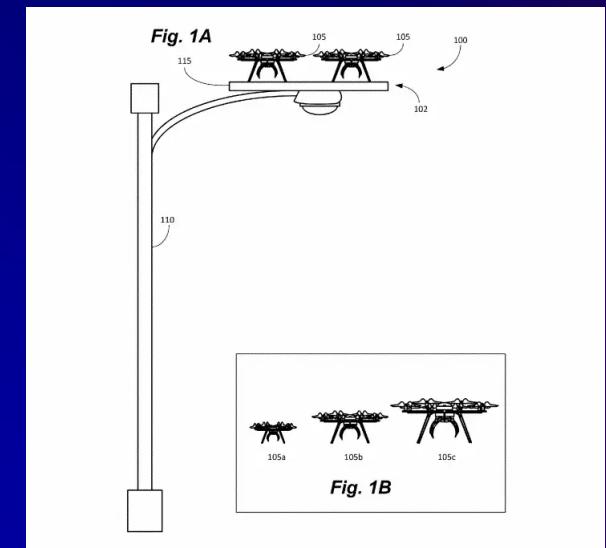
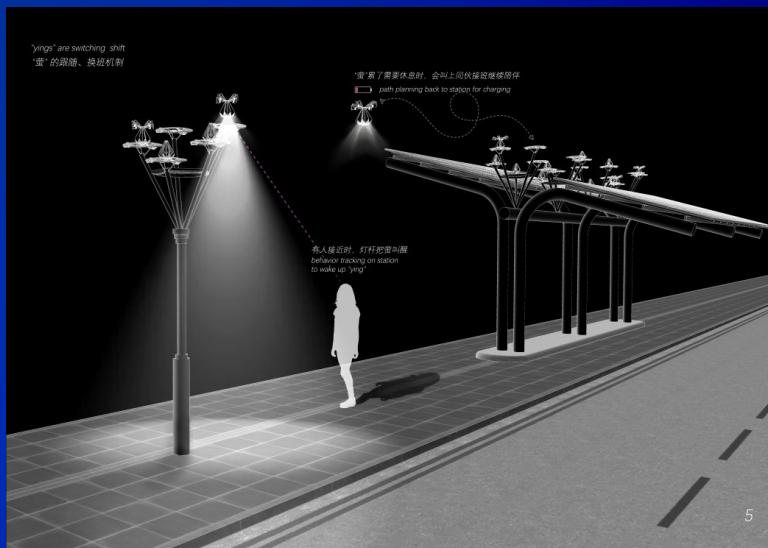
MOTIVATION

- Urbanization Challenges:
 - *Increasing population density*
 - *Need for efficient city management*



- Current Limitations:
 - *Lack of localized weather data*
 - *Inefficient real-time crowd management*

MOTIVATION



MOTIVATION

TECH

Amazon has a radical idea to turn street lights and church steeples into refueling stations for its drones

Eugene Kim Jul 20, 2016, 6:18 AM GMT+8

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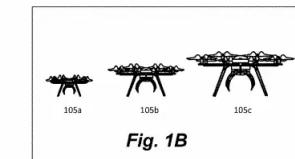
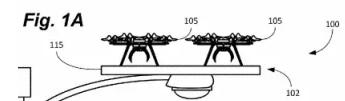


Fig. 1B



OBJECTIVE

- **Main Goal:**
 - *Integrate IoT and drone technology into streetlights*
- **Specific Objectives:**
 - *Provide real-time, localized weather data*
 - *Enable real-time crowd density monitoring*
 - *Improve decision-making for residents and city planners*

SCOPE OF WORKS



想象一下，在一个炎热的夏日，你正在繁忙的城市公园中漫步。你打开智能手机上的应用程序，查看当地的天气状况。该应用程序连接到安装在公园各处路灯上的无人机，提供实时的温度、湿度和空气质量数据。你注意到空气质量开始恶化，可能是由于人群密度增加所致。

SCOPE OF WORKS



想象一下，在一个炎热的夏日，你正在迪士尼乐园游玩，人流拥挤。你打开智能手机上的应用程序，查看各个游玩项目的排队情况。该应用程序连接到安装在公园各处路灯上的无人机，提供实时的各个项目的排队状况图像。

SCOPE OF WORKS

- **Project Scope:**

- *Development of an app with weather and crowd monitoring features*
- *Installation of drones with sensors on streetlights*

- **Key Components:**

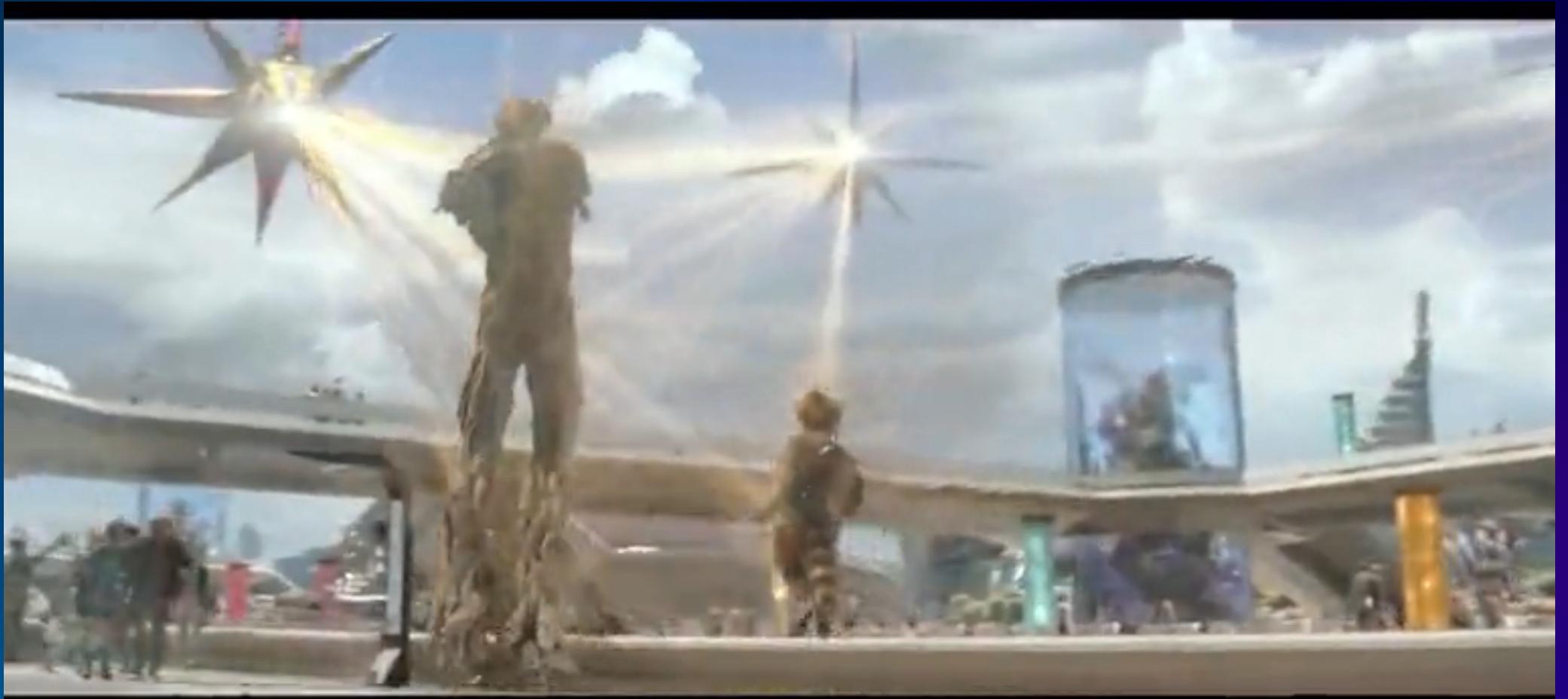
- *Temperature, air quality and humidity sensors for weather monitoring*
- *Camera sensors for crowd tracking*
- *Data privacy, transmission and processing infrastructure*

SCOPE OF WORKS *Future Vision*



Traffic light in CyberPunk2077

SCOPE OF WORKS *Future Vision*



Getting Caught on Xandar(Marvel: Guradians of the Galaxy)

Description of Solution

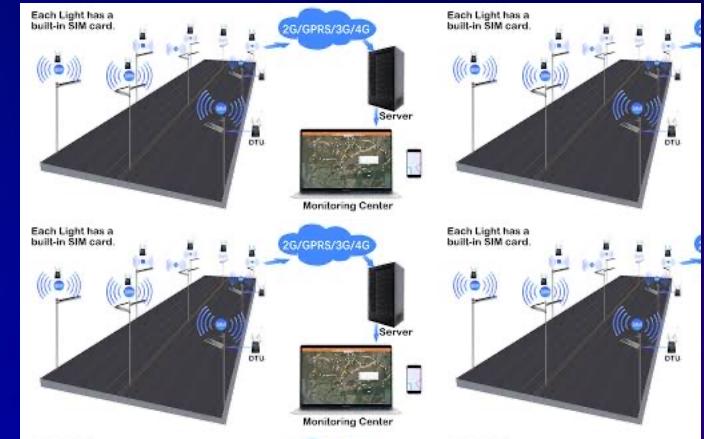
Precision Weather Monitoring:



Equip drones with temperature and humidity sensors.



Collect real-time data at various altitudes within the urban environment.



Broadcast this data through streetlight-based signals to an app, providing users with precise local weather information.

Description of Solution

Real-Time Crowd Tracking:

- *Use drones with camera sensors to capture real-time images of public spaces.*
- *Apply visual recognition technologies to analyze crowd density.*
- *Stream processed data to an app, helping users make informed decisions about navigating crowded areas.*



Drones with camera sensors



Analyze the crowd density

Description of Solution

Air Quality Monitoring:

- *Air quality sensors such as PM2.5, CO2 sensors.*
- *Providing more comprehensive environmental data.*
- *CO2 sensors will monitor carbon dioxide concentrations, offering insights into urban air quality and helping to identify pollution sources.*



CO2 sensors

A literature survey

The review of existing literature has revealed some gaps in existing smart city technologies:

- Weather monitoring
- Crowd management
- Traffic management
- Energy management
- Environmental monitoring
- Public services
- Safety and emergency response

Description of Solution

Emergency Response Features:

- *Integrate emergency response capabilities into drones.*

drones can automatically fly to the site and transmit real-time data to emergency teams when anomalies are detected.



Drones can automatically fly to the anomalies site

Implementation and Results

App Development



We developed an intuitive app that offers precise weather data and real-time crowd monitoring. The user interface was designed to be user-friendly, ensuring ease of navigation and access to critical information.

The app's design focused on user experience, ensuring that the information provided is easily accessible and actionable.

Key features of the app include:

Weather Data: Real-time updates on temperature, humidity, and air quality.

Crowd Monitoring: Live images and density analysis of public spaces, helping users to avoid crowded areas.

Implementation and Results

Sensor Integration

The installation process included:

We equipped drones with advanced sensors for weather and crowd monitoring.

Improved Urban Living: Residents benefit from accurate weather information and real-time crowd data, enabling better planning and decision-making.

Enhanced City Management: City planners can utilize the data for more efficient resource allocation and management.

Monetization Opportunities: The system opens avenues for monetization through targeted advertising and special event services.

Overall, the project demonstrated the potential of IoT and drone technology in creating smarter cities, offering practical benefits to both residents and city planners.

Implementation and Results

Results

Improved Urban Living: Residents benefit from accurate weather information and real-time crowd data, enabling better planning and decision-making.

Enhanced City Management: City planners can utilize the data for more efficient resource allocation and management.

Monetization Opportunities: The system opens avenues for monetization through targeted advertising and special event services.

Explore Advanced Technologies: Incorporate more sophisticated sensors and data analysis techniques.

Expand Coverage: Extend the system to cover more urban areas.

Continuous Improvement: Gather user feedback and make iterative improvements to the system.

Future Work

Conclusion

- **Summary:**

- Innovative use of IoT and drones for smart cities
- Significant improvements in weather and crowd data accuracy
- Practical benefits for residents and city planners

- **Future Work:**

- Explore more advanced technologies
- Expand the system to cover more urban areas
- Continuous improvement based on user feedback

Conclusion

Innovation in Urban Infrastructure

- Maximizing urban assets
- Providing real-time environmental data
- Enhancing quality of urban living



Conclusion

Impact and Outcomes

- Improved decision-making
- Enhanced public safety
- Optimized traffic flow



Conclusion

Future Prospects

- Upgrading to advanced drones
- Expanding system capabilities
- Anticipating future urban challenges



Conclusion

Call to Action and Community Engagement

- Encouraging community feedback
- Promoting data sharing
- Fostering a sense of shared responsibility



THANK YOU!