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at Northeastern University

The role of IoT in Intelligence Campus

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Outline

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- Index Terms: Intelligence(Smart) Campus, Wireless Sensor, Big Data, Artificial Intelligence, IoT
- What we will talk:
  - Introduction
  - Focused Areas of Smart Campus
  - Layers of Smart Campus
  - Working Modules
  - Case Studies
  - Low Power Wide Area IoT
  - Conclusions

Introduction

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- Motivation
  - **Traditional Teaching falls behind with society's development:**
    - COVID-19 show us society is still vulnerable
      - It changes the way people interact, communicate, learn and work
    - Intelligence Campus improves education in various way
      - It provides both a comprehensive environment and information service platform to both students and teachers
    - According to "Schools and Society" by Dewey[1]
      - Intelligence campus leverages devices and apps to create new experiences or services and promote operational efficiency

What Smart Campus Can Do…

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- **Sustainability**
  - **Energy**
    - Focus on reducing energy consumption to improve greenhouse gases impact
  - **Water**
    - Focus on campus water reusage and sustainability
  - **Waste Management**
    - Structured Process, aiming to manage generated waste
  - **Emissions**
    - By reducing Greenhouse Gases, aiming to become carbon neutral

What Smart Campus Can Do…

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- **Infrastructure**
  - Data Centers satisfy IT needs
  - Cloud based infrastructure
  - Building Management Systems
  - Unified Communication system
  - Automated Campus Parking
  - Smart Transportation System
  - Installation of Sensors and the collection of Big Data

What Smart Campus Can Do…

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- **End User Utility and Experience**
  - Smart Cafeteria
  - Health and Wellness App
  - Intelligent Access Control
  - Smart Indoor Navigation
  - Visitor Management
  - Safety and Security applications
  - Room Reserving
  - Smart Seat Allocation System

Layers of Smart Campus

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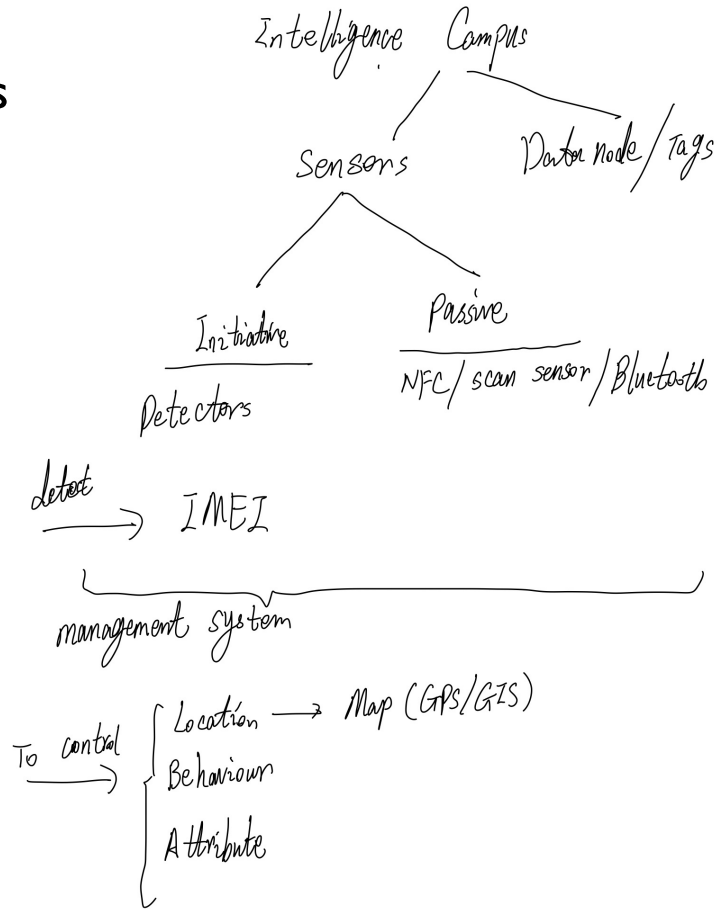
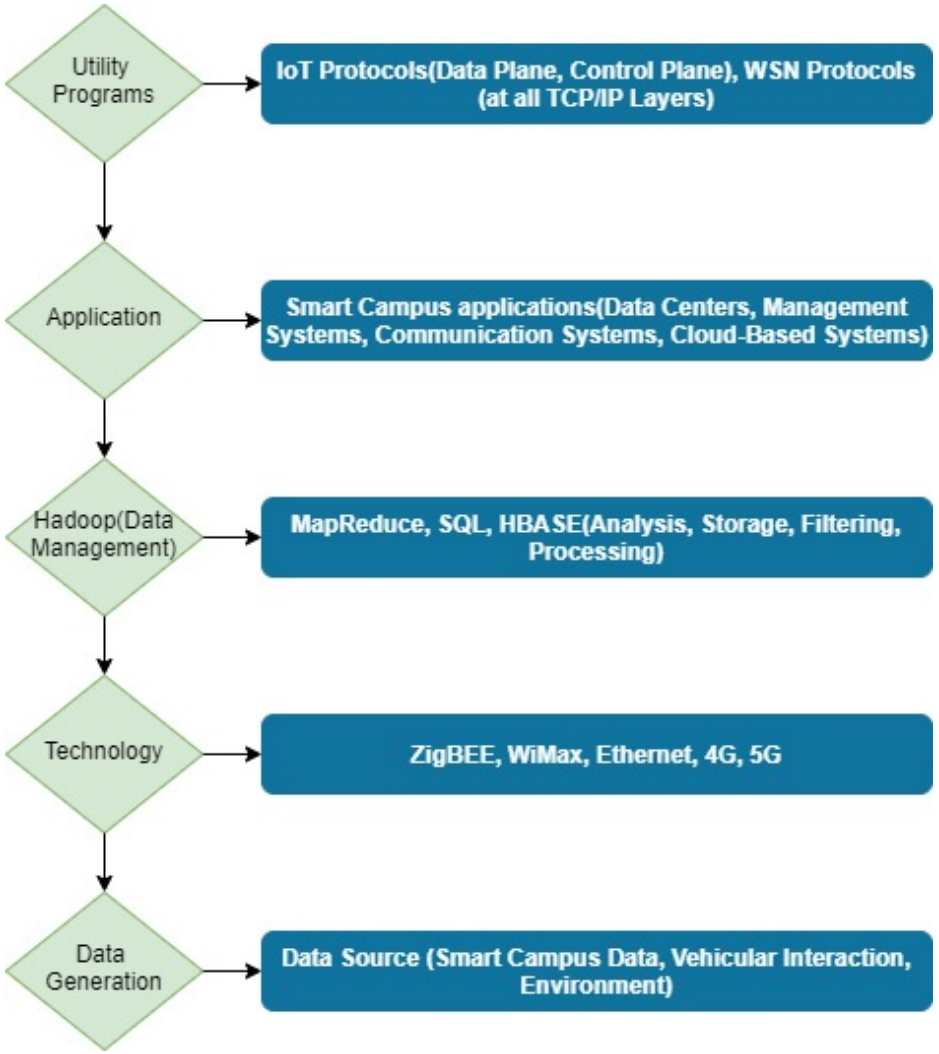
- Structure of Intelligence Campus Big Data Analytics





Working Modules

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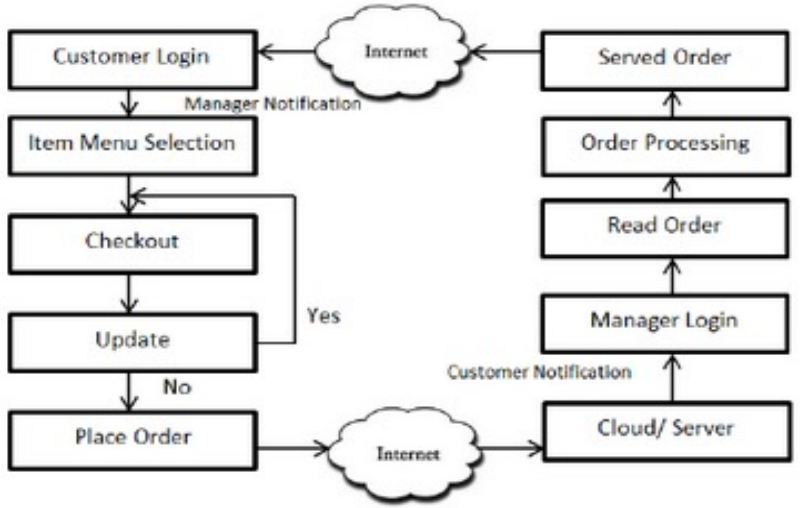
- **Intelligence Campus Working Module**
  - **Developed by team of Hossain, 2019[2]**
  - Conceptual working models for :
    - an innovative environment monitoring system (Figure a.)
    - an intelligent car parking system (Figure b.)
    - an intelligent canteen management system (Figure c.)



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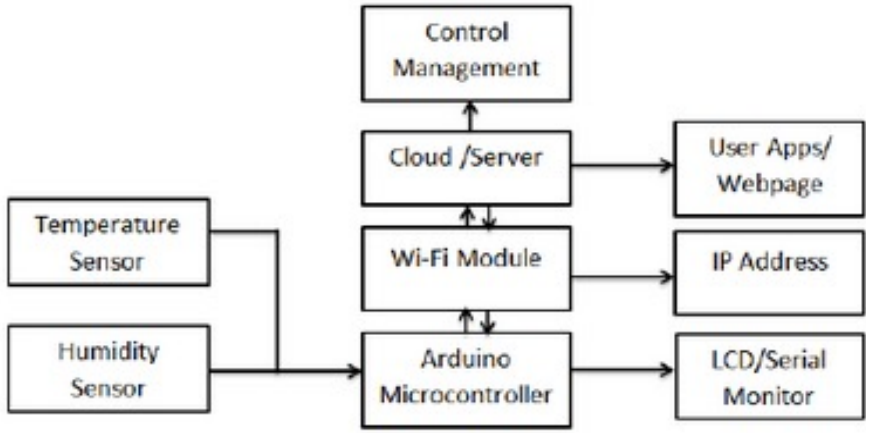
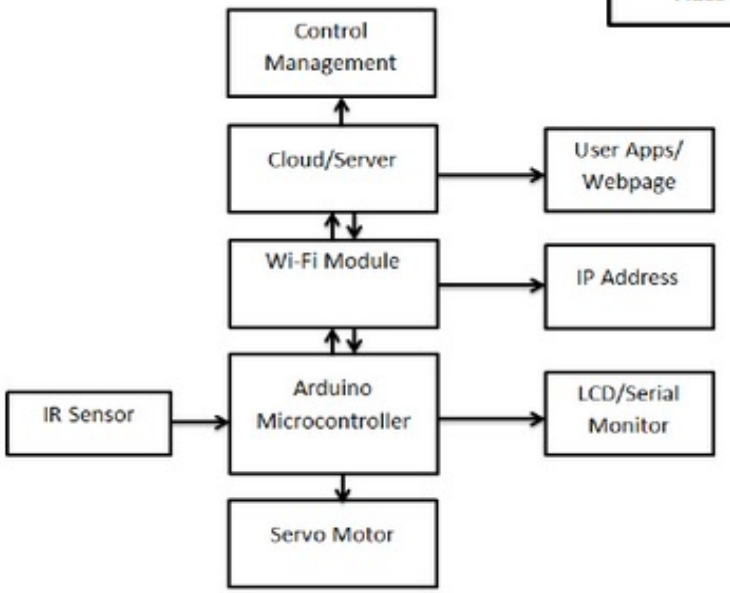


(a)



(b)

Case Study

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- **Google**
  - Focus on sustainable workplaces such as LEED-certified workspaces
- **Microsoft**
  - Modernize the Redmond campus, use it as an innovative living laboratory
- **Amazon**
  - Focus on sustainability, energy conservation, and resource allocation in Seattle campus
- **Infosys**
  - Test LEED-certified offices in India, energy declined by 55% from 2008 to 2019
- **Arizona State University**
  - Use connected stadium that utilize real-time data from sensors to achieve a Smart Campus

- **LEED: Leadership in Energy and Environmental Design**
- **References [3][4][5][6][7]**

IoT Based Framework – New Cases

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- **Agarwal team's five-tier framework described in Table-I to implement the Smart Campus case[8]**

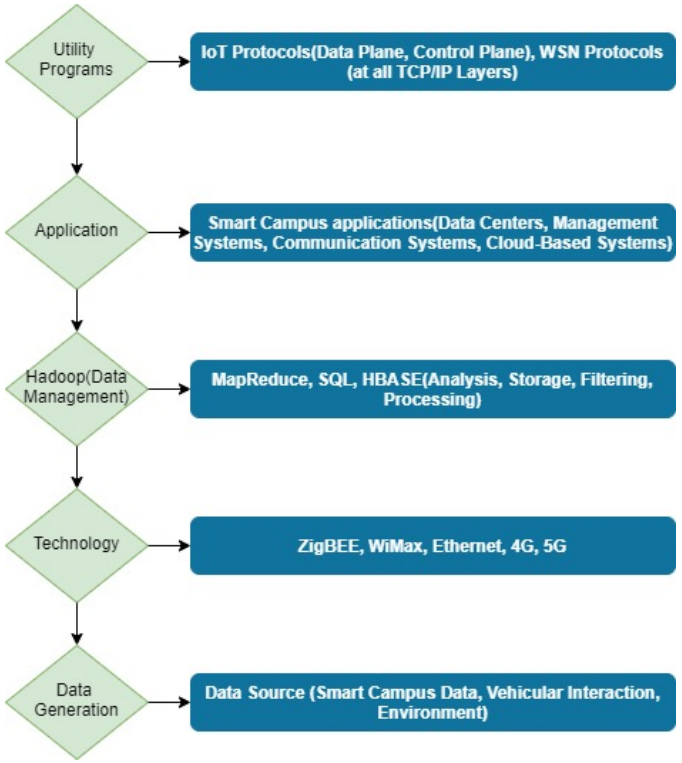

Table 1: Integrating new use case with 5 layered IoT Framework

Monitoring Layer and Alerts	Dashboard for Covid-19 to track the overall status
Application Layer	Mobile App or browser-based access Admin to track info based on business rules Individual User to get related information
Platform Layer	Integrate with backend IT systems Provide user specific details and define business rules for alert generation
Compute and Infra layer	Gather data from below layer and send to backend server or cloud Video Feed and Edge Analytics
Sensors and Data Acquisition layer	Camera feed for Video and Image analytics Entrance turnstile to monitor the recording Temperature check and health status declaration

Low Power Wide Area IoT Implementation

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1. Use RFID scheme, improving the efficiency of management and the collection of data analysis

2. RFID tag can be applied in asset entry and device control

3. Low Power Wide Area IoT can be applied in scientific experiment not only in Universities but also in Research Institutions

Application of L-P W-A IoT in campus

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- **IoT has great advantages especially in indoor areas, realizes general user applications in areas such as dormitories, dining halls, buildings and public campus areas.**
- **Such scheme deployment has simple remote monitoring system and convenient maintenance and low deployment cost.**
- **Combining with 3G/4G service security monitoring, it can handle vehicle management.**
- **It can also realize indoor safety management.**
- **IoT and AI devices further enhance the intelligent campus construction effect and level's comprehensive management.**

Conclusion

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- Intelligence campus construction is a complicated, intricate system project;
- Therefore, its structure needs a scientific and reasonable top-level design from the government and education sectors.

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- Thanks for watching