Concordia Institute for Information Systems Engineering

INSE 6400 — Winter 2024

Principles of Systems Engineering

Course Project Presentation Slides: Due Date: April 8th, 2024

Final Course Project Report : Due Date: 1 Week after Final Exam

Purpose: The purpose of the INSE6400 term project is for students to apply concepts and methodologies that are discussed in class throughout the semester. The term project must be done by a team of maximum 5 members.

Instructions: You must submit your project presentation slides and report electronically in PDF format through MyConcordia Moodle system: https://my.concordia.ca

• Make sure to write your name and I D number on the first page of your presentation slides and report (otherwise, 5 marks will be deducted).
• E-mail submissions of the project will NOT be accepted.

Project Description:

For the project, you have the flexibility to select from among the following available options:

I. Project Title: "Smart Campus: A Systems Engineering Approach"

Project Overview:

This project involves designing a "Smart Campus" system where each student/team focuses on a specific subsystem or component of the campus. The objective is to integrate these subsystems into a cohesive, efficient, and sustainable campus environment. The project emphasizes the interdisciplinary nature of systems engineering, requiring collaboration, integration, and systems thinking.

Subsystems/Components (Examples for Individual Focus):

1. **Energy Management System**: Focus on designing a sustainable energy system for the campus, involving solar panels, wind turbines, and energy storage solutions.
2. **Smart Transportation System**: Develop a system for efficient campus transportation, including electric shuttles, bike-sharing programs, and pedestrian pathways.
3. **Waste Management System**: Design a waste management solution, focusing on recycling, composting, and waste reduction strategies.
4. **Water Resource Management**: Work on water conservation and management solutions, including rainwater harvesting and wastewater treatment.
5. **Building Automation System**: Focus on smart building technologies for energy efficiency, security, and comfort, using IoT devices and automation.

6. **Campus Safety and Security System**: Design a system for campus safety, incorporating surveillance, emergency response, and access control.
7. **Information and Communication System**: Develop a robust ICT system for the campus, ensuring reliable internet access, campus-wide Wi-Fi, and digital signage.
8. **Landscaping and Environmental Design**: Focus on sustainable landscaping, green spaces, and environmental impact mitigation.
9. **Campus Health Services System**: Develop a health monitoring system, including telemedicine services and health tracking for students and staff.
10. **Educational Technology System**: Design an advanced educational technology system, integrating virtual classrooms, e-learning platforms, and smart libraries.

Project Deliverables:

- **Individual Subsystem Design**: Each student/team presents a detailed design of their subsystem, including technical specifications, sustainability considerations, and integration aspects.
- **Integrated System Model**: Collaboratively develop a model showing how all subsystems integrate into the Smart Campus.
- **Feasibility Study**: Analyze the economic, environmental, and social feasibility of the proposed systems.
- **Presentation and Report**: Each student presents their subsystem, and a final report is compiled showcasing the integrated Smart Campus design.

II. Project Title: "Integrated Healthcare Monitoring and Management System"

Project Overview:

This project aims to design an Integrated Healthcare Monitoring and Management System, leveraging technology to enhance patient care and healthcare operations. The project requires students to work on different subsystems that combine to create a comprehensive, patient-centered, and efficient healthcare system. Each student will focus on a specific aspect, ensuring both depth in individual areas and breadth in understanding the overall integrated system.

Subsystems/Components (Examples for Individual Focus):

1. **Patient Health Monitoring System**: Develop a subsystem for continuous health monitoring using wearable devices and sensors to track vital signs and health metrics.
2. **Electronic Health Records (EHR) System**: Focus on creating a secure and efficient electronic health records system, enabling easy access and management of patient data.
3. **Telemedicine Services**: Design a telemedicine platform that facilitates remote consultations, diagnostics, and patient engagement.
4. **Pharmacy Management System**: Develop a system for efficient management of pharmacy services, including medication dispensing, inventory control, and drug interaction alerts.
5. **Diagnostic and Lab Information System**: Create a subsystem for managing laboratory and diagnostic services, ensuring accurate and timely processing of test results.
6. **Patient Scheduling and Administration System**: Design a system to streamline patient appointments, scheduling, and administrative tasks.
7. **Healthcare Analytics and Decision Support**: Implement a system for healthcare analytics, utilizing data from various subsystems to inform decision-making and improve patient outcomes.

8. **Emergency Response and Critical Care System**: Focus on a system for managing emergency services and critical care, including ambulance dispatch, triage protocols, and critical care monitoring.
9. **Mental Health and Wellness Platform**: Develop a platform dedicated to mental health, offering resources, support, and monitoring for mental wellness.
10. **Healthcare Staff Management and Training System**: Create a system for managing healthcare staff, including scheduling, training, and performance evaluation.
11. **Patient Feedback and Quality Improvement System**: Design a system for collecting and analyzing patient feedback, aimed at continuous quality improvement in healthcare services.

Project Deliverables:

- **Individual Subsystem Design and Report**: Each student presents a detailed report on their subsystem, addressing design considerations, functionality, and integration with other subsystems.
- **Integrated System Model**: Collaboration to develop a comprehensive model demonstrating how all subsystems work together in a unified healthcare system.
- **Implementation Plan and Feasibility Study**: Create a plan for the implementation of the system, including a feasibility study covering technical, financial, and regulatory aspects.
- **Final Presentation and Demonstration**: Each student presents their subsystem, culminating in a demonstration of how the integrated system operates in a healthcare setting.

III. Project Title: "Smart City Integration and Management System"

Project Overview:

This project involves designing a Smart City Integration and Management System that leverages technology to enhance urban living. The goal is to create a city that is efficient, sustainable, and responsive to the needs of its residents. Students will focus on different subsystems or components, each addressing a specific aspect of the smart city, and work towards integrating these into a cohesive whole.

Subsystems/Components (Examples for Individual Focus):

1. **Smart Transportation System**: Develop a system for optimizing traffic flow, public transportation, and pedestrian safety using smart technologies like IoT sensors and AI traffic analysis.
2. **Energy Management System**: Design a sustainable urban energy system, incorporating renewable energy sources, smart grid technology, and energy-efficient buildings.
3. **Waste Management and Recycling System**: Create a system for efficient waste collection and recycling, utilizing smart bins and waste processing technologies.
4. **Water Supply and Management System**: Develop a water management system focused on conservation, leak detection, and efficient distribution.
5. **Public Safety and Emergency Response System**: Design a system for enhancing public safety, including smart surveillance, emergency response coordination, and disaster management technologies.
6. **Environmental Monitoring System**: Implement a system for monitoring air quality, noise levels, and other environmental parameters to ensure a healthy urban environment.

7. **Urban Infrastructure Maintenance System**: Focus on the maintenance of urban infrastructure using predictive analytics and automated repair systems.
8. **Smart Healthcare Services**: Develop an integrated healthcare system for the city, incorporating telemedicine, health tracking, and efficient hospital management.
9. **E-Government Services**: Create a digital platform for municipal services, enhancing citizen engagement, and streamlining government operations.
10. **Education and Smart Learning Systems**: Design advanced educational technology systems, integrating digital classrooms, online resources, and interactive learning environments.
11. **Community Engagement and Social Services**: Develop systems for community engagement, social services, and cultural promotion, using digital platforms to foster a sense of community.

Project Deliverables:

- **Individual Subsystem Design**: Each student is responsible for a comprehensive design and analysis of their assigned subsystem.
- **Integrated System Framework**: Collaboratively develop a framework that shows the integration of all subsystems within the smart city.
- **Sustainability and Impact Assessment**: Conduct an assessment on the environmental, social, and economic sustainability of the smart city system.
- **Final Presentation and Compilation Report**: Each student presents their subsystem, and a final report is compiled detailing the integrated smart city system.

IV. Project Title: "Advanced Smart Home System"

Project Overview:

This project involves designing an Advanced Smart Home System, focusing on creating a comfortable, efficient, and technologically integrated living environment. The goal is to develop a smart home that not only automates routine tasks but also ensures sustainability, security, and ease of living. Each student will concentrate on a specific subsystem or technology, contributing to the overall functionality and innovation of the smart home.

Subsystems/Components (Examples for Individual Focus):

1. **Home Automation and Control System**: Design a central control system for managing lighting, temperature, appliances, and multimedia systems through voice commands, mobile devices, or AI assistants.
2. **Energy Management and Sustainability System**: Develop a system for optimizing energy usage, integrating renewable energy sources like solar panels, and employing battery storage and smart meters.
3. **Security and Surveillance System**: Focus on advanced security features, including smart locks, surveillance cameras, motion detectors, and integrated alarm systems.
4. **Climate Control and HVAC System**: Design an efficient heating, ventilation, and air conditioning system that adjusts automatically to maintain optimal indoor conditions.
5. **Smart Kitchen and Appliances**: Develop a smart kitchen system with internet-connected appliances like refrigerators, ovens, and dishwashers that can be monitored and controlled remotely.
6. **Home Entertainment and Multimedia System**: Create an integrated home entertainment system, including smart TVs, audio systems, and gaming setups, controllable through a unified interface.

7. **Health and Wellness Monitoring System**: Implement a system for health monitoring, including air quality sensors, water quality monitoring, and fitness equipment integration.
8. **Gardening and Plant Care System**: Develop an automated system for garden maintenance, including irrigation, fertilization, and sunlight exposure control.
9. **Smart Lighting System**: Design an intelligent lighting system that adjusts based on time of day, occupancy, and user preferences.
10. **Voice and Gesture Control Integration**: Focus on integrating voice and gesture recognition technologies to enhance the ease of controlling various smart home systems.
11. **Network and Connectivity System**: Ensure robust and secure home networking for seamless connectivity among all smart home devices.

Project Deliverables:

- **Individual Subsystem Design Report**: Each student presents a detailed report on the design and functionality of their subsystem.
- **Integrated Smart Home Model**: Collaboratively create a model demonstrating how each subsystem integrates into the smart home framework.
- **Technology and Innovation Analysis**: Analyze the latest technologies used in the project and their innovative aspects.
- **Presentation and Demonstration**: Each student presents their subsystem, followed by a simulated demonstration of the integrated smart home system.