Course Curriculum: Applied Engineering Technology PHY 320

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Course Description

This upper-level undergraduate course delves into the field of engineering technology with an emphasis on the development of an engineering product through the integration of hardware components and sensors using Raspberry Pi, project management strategies, modular design models, and budget constraint requirements.

Course Goals

1. Develop a deep understanding of applied engineering principles.
2. Explore modular design concepts and systems integration for complex projects.
3. Demonstrate effective project management within budget constraints.
4. Master the application of micro-controllers (Raspberry Pi) in platform-independent engineering project development.
5. Gain proficiency in selecting, integrating, and troubleshooting sensors and hardware components.
6. Acquire high-level programming language skills for microcontrollers and robotic systems.
7. Showcase a final project presentation aligned with NASA's engineering standards.

Course Outline

0.1 Introduction: 8 weeks (Module I)

1. **Week 1-2: Fundamentals of Applied Engineering Technology**
   - Overview of applied engineering technology and engineering products.
   - What are micro-controllers? In-depth study of Raspberry Pi.
   - Defining complex problem statements and project objectives.
2. **Week 3-4: Systems Integration and Modularity in System Design**
   - Advanced systems integration techniques for complex physical systems.
   - Designing modular system architectures for scalability and maintainability.

- Ensuring platform independence in engineering designs.

3. **Week 5: Project Management and Budgeting**
   - Project management strategies for engineering projects.
   - Budget allocation and cost-effective component selection.
     Budget Constraints: 1000 Dollars.
   - Time management and milestone tracking.

4. **Week 6-9: Multi-Sensor Integration and Data Fusion**
   - In-depth exploration of advanced sensors: LIDAR, cameras, inertial measurement units (IMUs), temperature sensor, pressure sensor, and GPS.
   - Sensors include the following:

     Navigation Sensors: Inertial Measurement Unit(IMU), Global Navigational Satellite System(GNSS) or Global Positioning Systems(GPS), Magnetometers, LIDAR, Radar.

     Thermal Sensors: Temperature Gradient Measurement.

     Environmental Sensors: Atmospheric measurements - Gases such as O2, CO2, N2.

     Audio and Visual Display: LED, LCD, Buzzer, Speaker Systems
   - Strategies for data fusion and sensor synchronization.
   - Real-world data processing and analysis.

0.2 BUILD, TEST, AND PRESENTATION: 8 weeks (Module II)

1. **Week 8-10: Preliminary Design Architecture Submission: 1-page paper**
   - Student-led design project.

2. **Week 11-14: Critical Design Review: Initial Assessment of hardware, sensors, integration**
   - Student-led project activities.

3. **Week 14-15: Final Design Review: Final Assessment of designed product**
   - Students prepare a poster presentation as their final project.

Assessment

- Assessment of Model-based system design architecture.
- Poster quality contents.
- Final project presentation and symposium participation, assessed against industrial engineering standards.

Conclusion

The Applied Engineering Technology course (PHY 320) offers upper-level undergraduate students an immersive and comprehensive journey into the dynamic world of engineering innovation. Through a meticulously designed curriculum, students will delve into the intricate realm of hardware integration, modular design, and project management, equipping themselves with invaluable skills to navigate complex engineering challenges. Moreover, the course empowers students with essential project management strategies, emphasizing budget-conscious decision-making and milestone tracking. By engaging in real-world scenarios, students will learn to balance project requirements with financial constraints, honing their ability to drive successful engineering projects from inception to completion.