

# ECET/CPET 491 Senior Design Project II

## Project Management Guideline

Spring 2017

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### **Recommended Sections and Info for the Project Activities.**

#### **1. Introduction**

#### **2. System Specifications**

- System Description
- System Operating Environment
- System Structure: physical decomposition and information flow (module chart, component charts)
- System Behavior: temporal and control relations (state chart, sequence diagram)
- System Functionality: functional decomposition and information flow (activity charts)

#### **3. System Design**

- Requirements Specification
- Implementation Definition

##### 3.1 System Requirements

- Functional Requirements
  - System response time
  - Quality requirements
  - Performance requirements
  - Efficiency requirements
- Non-Functional Requirement
  - System running environment, platform
  - Reliability requirements
  - Safety requirement
- Hardware/software distribution
  - Software/hardware interfaces

##### 3.2 Constraints

- Memory size
- Real-time constraints: 0.1% time precision
- Hardware constraints: motor inertial time 50 ms
- Speed precision: 10 rpm
- Response time
- Technological constraints

##### 3.3 Verification of System Requirements

- 3.4 System Requirement Analysis
  - 3.4.1 Scenarios
  - 3.4.2 Sequence Diagrams
  - 3.4.3 Capturing Time and Timelines
  - 3.4.4 State Transition Charts and Use Cases

## **4. Hardware System Design**

- 4.1 Requirements
  - Operating environments, temperature, frequency, voltage, current, noise, system clock, power consumption, etc
- 4.2 Hardware Architecture Design
- 4.3 Electrical/Electronics Analog Circuit and Interface
  - Modeling – mathematical model, behavior modeling
  - Simulation
  - Prototype Testing
  - Hardware Description
- 4.4 Digital Circuit and Interface
  - Modeling – mathematical model, behavior modeling
  - Simulation
  - Prototype Testing
  - Hardware Description
  - Timing Requirements
- 4.5 Microcontroller/Microprocessor
  - Block Diagrams
  - Timing Sequence of Interrupt Handling
- 4.6 Other System Hardware
- 4.7 Verification of Hardware Design and Requirement for Implementation

## **5. Software System Design**

- 5.1 Requirements
- 5.2 Software Architecture Design
  - Data Flow Diagrams
  - Flow Charts
  - State Transition Diagrams
  - Tasks
- 5.3 Development Tools and Program Languages
- 5.4 Data Structure Design
  - Parameters
  - Variables/Data structures/Descriptions
  - Specifications
- A Sensor Example
  - Attributes (data): Linear value, rate of change
  - Behavior (operation method): Acquire, report, reset, zero, enable, disable
  - State (memory): Last value, last rate-of-change
  - Identity: an instance of some temp reading

- Responsibility: provide x info for  
An Airline Flight
- Attribute: Flight number, departure time, arrival time, flight plan
- Behavior: Depart, arrive, adjust course
- State: current location (x, y, z, t)
- Identity: NW100 to Ft Wayne
- Responsibility: Transfer luggage and passengers to destination; file flight plan, adhere to flight plan

#### 5.5 Events, Conditions, Observations Modeling

- Timing analysis
- Activation
- Messaging: an interrupt, a function call, etc

Examples:

- The States of A/D Converter: Enabled, Sampling, Holding, Disabled
- Actuators
- On
- Off

#### 5.6 Function Design

- Inputs/outputs
- Variable sharing model/relation
- Function behaviors/descriptions/specification
- Function/module synchronization
- Function modeling

#### 5.7 HMI & Command Design

- User Interface
- Regulator activation
- Start
- Stop
- Acceleration
- Return
- Add ?
- Remove?
- Read

#### 5.8 Other System Software/Firmware

#### 5.9 Verification of Software Design and Requirements for Implementation

### **6. System Integration and Testing**

#### 6.1 Hardware Integration

##### 6.1.1 Prototyping

##### 6.1.2 Filter Sub-circuit

##### 6.1.3 Signal Conditioning Sub-circuit

##### 6.1.4

#### 6.2 Software Integration

##### 6.2.1 Software Modules

- 6.2.2 Software Coding
- 6.2.3 Software Debugging
- 6.2.4 Testing Cases and Validation
- 6.2.5 Software Integration Testing Reports
  
- 6.3 Software/Hardware Integration and Testing
  - 6.3.1 System Performance Analysis
    - Propagation delay
    - System timing
    - Memory requirements
    - Interrupt latency
    - Loading
    - Current, voltage, power, harmonics
  - 6.3.2 System Tuning and Optimization

## REFERENCES

(Last page of the report; in IEEE Format with examples for reference to data sheet, user manual, technical specification, technical documentation, books, conference papers, and papers)

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## **APPENDICES**

**Appendix A:** Bosch CAN

**Appendix B:** Parts List for Prototype

**Appendix C:** Software Programs and Routines

**Appendix D:** Technical Support & Communications