CSE321   Realtime and Embedded Operating Systems   Fall2016
Due date: Package Submission online: 11/30
Demo deadline: 12/1-12/7 (hard deadline)

 Goals: To apply the embedded and real-time systems concepts learned in the course. These are:

1. Ability to design and construct a complex hardware and software system, component, or process to meet desired needs using relevant software engineering principles, within realistic constraints such as economic, environmental, social, political, ethical, health & safety, manufacturability, and sustainability.

2. Ability to identify, formulate, and solve hardware and software computer engineering problems using sound computer engineering principles.

3. Ability to effectively communicate technical information in speech, presentation, and in writing.

4. Continue the learning in the course to engage in lifelong learning.

5. Ability to understand contemporary issues in this area.

Objectives: We plan to address the goals stated above using a hands-on project that will involve original design, and implementation, demonstration and presentation of embedded/realtime system. This is a demonstration project that includes a presentation of your completed project. For this project you will work in **groups of one or two**, no more.

Problem Statement: Choose a concept/idea after discussion with your team mate, TA and your instructor. The idea has to be approved by either the TA or the instructor. The scope of the project should be implementable within the time and the resources available.
1. Choose/Identify an idea that has economic, environmental, social, ethical, health and safety, manufacturing and sustainability (say, in energy) impact.

2. Formulate the solution for the problem identified using best practices learned in the course.

3. Implement and test the solution. Prepare for the demo and presentation.

New this semester are the drones: DJI Pahtom3 (https://developer.dji.com/mobile-sdk/) and (Parrot dronehttp://developer.parrot.com/) platforms are available for you work with.

You can also work with Adruino (www.arduino.cc) Uno hardware as the primary base hardware. You can use other similar small embedded system such as Rasberry PI (http://www.raspberrypi.org/), Maple (http://leaflabs.com/devices/maple/) or Parrot drone or Phantom 3. The discussion below is equally applicable to any of the platforms.

Arduino itself has many variations such as Arduino Zero, Mega, Arduino Duo etc. Arduino is a very popular hardware used in many modern/contemporary systems. Ford OpenXC is ardunio compatatible, for example. "The OpenXC kit includes a vehicle interface module based on the popular Arduino platform developers can use to read data from the vehicle's internal communications network. The hardware module provides real-time access to parameters like the vehicle sensors, GPS receiver and vehicle speed. The hardware module is connected to a smartphone or tablet on which apps can be written to consume and use these data. See http://openxcplatform.com/
How about Google's driverless car? Apple's? How about the drones for various purposes?

How to choose a project idea? Think about the keyword "automation" and automating something really useful for you and your peers. Think about an innovative idea that can be presented at a "startup weekend" or at such competitions.

What to do? This is for Arduino.
1. Choose your group members. You are allowed at most two in a group.

2. We will be using Arduino Uno hardware; For Arduino details look at the link:
http://arduino.cc/en/Main/Software

This page has download details and also details of many examples. Go through the examples before deciding on your problem. (For example, do not repeat "blinking LED" as your project.)
3. You will have to get approval for your project idea either from any of the TA or me. I want the ideas finalized by this Friday (10/30) class time. All TAs will help with project ideas. Talk to them during recitation or office hours.
4. Once the idea is approved you will work on the project design, implementation and presentation and the documentation (in the form of Report).
5. You will submit the presentation and the report online for grading.
6. Your presentation should include a diagram of how you divided the responsibilities of your project among the team members.
7. Your report should include a Use Case diagram and a class diagram explaining the design of your application.
8. Your grade will be based on completion of your project, presentation, and your report.
9. Also part of your project 3 grade will include grade for presentation.
11. Finally, the due date for the submission of the Report and presentation online is: 11/30/2016.

What to do with Arduino?
1. Once the Arduino development Env. is installed, go to Getting Started in the Help menu, to upload and run a sample program, "LED Blink"; observe the setup and loop functions. Setup function is used to initialize the conditions and loop function is the cyclic executive.
2. Understand the Arduino Uno hardware on the board.
See http://docs-asia.electrocomponents.com/webdocs/0e8b/0900766b80e8ba21.pdf
3. Look at File the examples and run the many examples that are provided with the IDE.
4. Understand the Sketchbook concept and also sketches.
5. Arduino Uno (R3) is connected via USB port and the File Upload is used to load the "Sketch" into the board.
Arduino Hints:
Here are some links for Arduino:
1. http://arduino.cc/en/Guide/HomePage
2. http://arduino.cc/en/Main/Software (get the Arduino IDE software from here)
3. http://mattters.com/science-projects/news/tft01-arduino-lcd-shield-in-stock
4. http://www.meetup.com/buffalolab/members/1627521/
5. http://arduino.cc/en/Reference/HomePage
7. http://docs-asia.electrocomponents.com/webdocs/0e8b/0900766b80e8ba21.pdf
9. http://www.ladyada.net/library/arduino/unofaq.html
10. http://randommusicdesign.blogspot.com/

CSE321 Term Project Report Details Fall2016

0. Cover Page

<div align="center">

<appropriate title> <LOGO>
<logo>
<authors>
<affiliation: course, school, email contact>

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1. Executive Summary

What is it? Define the project in one or two sentences. Major contributions? Innovative ideas?
Why are you undertaking this project? What advantages?
Where? And for whom will this application help?
How to you plan to design and implement it?
Who will be users of this system?

2. Project objectives

This is like the requirements document that specifies both the functional and non-functional aspects; it also specifies hardware, software and human factors requirements.

<project1 title> project will meet the following objectives:

<Example:

- Provide data entry facility for production data entry and incident reporting.
- Automatically prompt users to carry out certain processes such as incident reporting based on the production data entered.
- Send reminders (email) for respective users for completing the other processes in the workflow generated by an incident report.
- Provide simple text-based report generation facility and graphical comparison charts.
- Provide intranet accessibility to information recorded and the computed values.
- Provide basic authentication by user login feature**.>**

3. Project Approach

<Example: We will develop the application in phases in order to rapid prototype the application and to test it before working on its extensions. A software prototype will be designed and developed for a single location of the company. The project will be written as an intranet-enabled application. Application will be modeled using client/server architecture with the server controlling the number of clients that can access it. The programming language for development, the platform for deployment and the relational database will be used for storing the information are …>

4. Project Description (Sample)

Clients

ProductionDataClient   IncidentClient   AccountingClient

Business

Processes

ProductiondataProcess   IncidentProcess

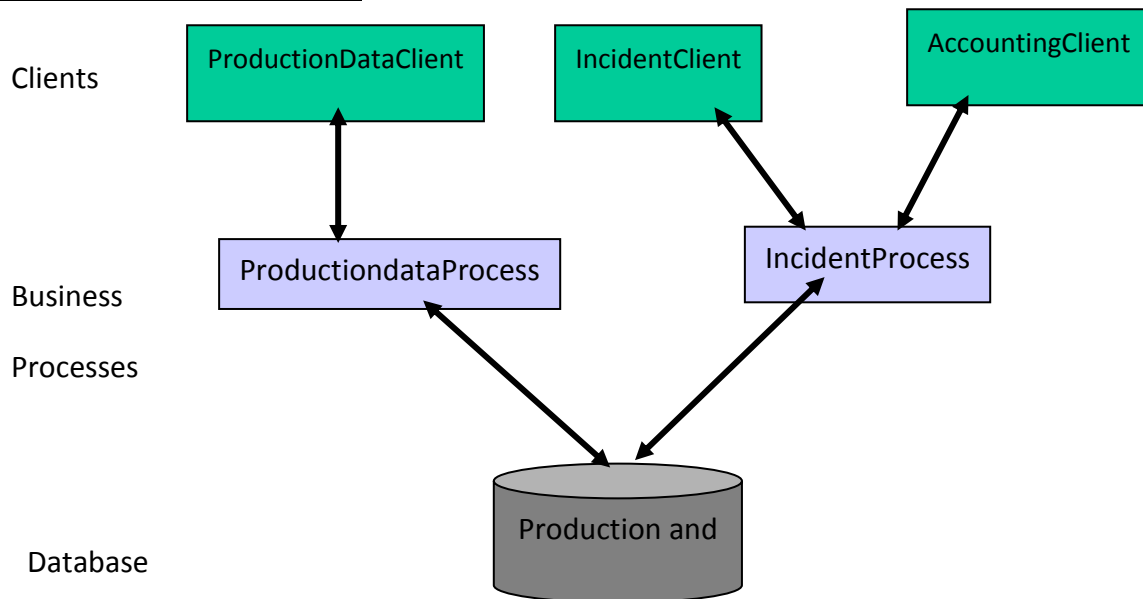Database

Production and

Figure 1: <project title> Architecture for a Three-tier Client/Server System
<example The three-tier (client, business process, database) architecture of IncidentWeb is presented in the Figure 1. The data tier is made up of the various databases: production data, availability data, incident reports and description, and other associated data. Business object layer consists of processes that analyze the production and availability data along with the incident report and generate the various reports and charts. ..The historical data stored can be viewed/ accessed from any of these clients. …>

5. Design Details
Tools and technologies used; Block diagram or any UML diagram will help.

6. User's Manual
This provides instructions for anybody who wants to use the application/ you have deployed, for example, the customer who will interact with the system. You may provide some relevant screen shots that explains the operations.

7. Programmer's Manual
This provides the information about the modules, installation details, configuration details and deployment details. For your project, provide items list, steps in assembling and programming and photographs of the various stages, videos of it working.

8. References: Provide a list of references you used.

9. Project Presentation Details: (5 minutes) Demo of the project developed to the TA.