ProjektIT Spring 2011 – 30hp (weeks 03-22)

ProjektIT focuses on researching, designing, and implementing a distributed software system in the context of a large team. In this course you will get a chance to use the skills you have learned during your IT education, extend them into new areas such as image processing, planning, mapping, and AI, and learn how to leverage them in the context of project design, integration, and testing. In addition to technical knowledge, this course will help you develop your team management and leadership skills and hone your presentation and communication skills.

The Project

The project for Spring 2011 is a distributed robot system. You will have robots with on-board computers, sensors, and actuators to explore, map, and navigate an arena. The arena will consist of a maze-like area with energy sources spread throughout it. Your goal is to detect and collect as much energy as possible during the allotted time, but there’s a catch: just like in the real world, everything you do (sense, compute, or move) consumes energy, so if you’re not careful you may end up with a dead battery right next to a glowing red source.

To accomplish this goal we’ll give you a big bucket of parts. You’ll get two Roombas with on-board computers, a bunch of video cameras, two Mindstorm kits, an infrared communications device, and an arena you can configure for testing. As this is a software course you won’t be building your own electronics, but you will get to assemble your system and extend it with the Mindstorm kit. To help you keep on track we’ll provide a few milestones for your demos, but it’s up to you to figure out how to coordinate and optimize the performance…for both the system and the team.

Expectations

ProjektIT is a 30hp course and students are generally expected to be present during normal business hours each day during the course. Everyone is expected to contribute to the project and participate in the team-building and evaluation exercises.

Schedule

The course is divided up into 6 sections:
- Mini Project (2 weeks) – getting started and learning the hard way
- Research (2 weeks) – background information and technologies
- Phase 1 (4 weeks) – management approach 1
- Phase 2 (4 weeks) – management approach 2
- Phase 3 (6 weeks) – your choice of management style
- Final Demonstration and Report (1 week)

Each week there will be two regular meetings with the teaching staff. At these meetings 5 students will each give 5-minute presentations as to the status of their area of the project, followed by questions. The presentations will be recorded and the students will then review their performance with the teaching staff to receive feedback and an evaluation of their presentation. Once a week the teaching staff will meet with the team leaders to discuss management issues.
Throughout the course there will be periodic demos, team and individual reviews, external project review panels, and multiple course feedback sessions. We will explicitly rotate students through management positions to make sure everyone gets a chance to manage and be managed. The goal is to provide you with a large group development experience and a structured way to reflect on how the project is working, what is functioning well, and where you can improve.

**Evaluation**

To pass this course you must demonstrate proficiency in the following three areas: technical, leadership, and communications. Technical competency consists of demonstrating that you have successfully implemented a non-trivial technical component of the system from research through design and testing, and are aware of its role within the larger system. Leadership competency requires that you have demonstrated experience managing other members of the group and have shown that you understand the problems you may have encountered. Communications competency consists of demonstrating the ability to regularly deliver high-quality presentations and written documents.

**Technical Opportunities**

Not everyone will get to do everything, but here are some of the areas where the group will have to develop expertise to accomplish the project.

- **Image Processing**
  - Feature recognition
  - Camera calibration
  - Stereo vision
  - Structure from depth and motion

- **Control**
  - Optimal energy control
  - Waypoint driving
  - Targeting
  - Distributed control

- **Machine Learning and AI**
  - Image recognition
  - System identification
  - Strategy
  - Power minimization

- **Path Planning**
  - Energy minimization
  - Expected utilization maximization
  - Distributed exploration

- **Communications**
  - Protocols
  - Error correcting and recovery
  - Energy/value tradeoffs

- **System Integration** (everyone gets to do these…)
  - Testing
  - Debugging
  - Optimization

- **Mapping**
  - Geometry from vision
  - Position estimation
  - Landmark identification
  - Statistical map generation

**Requirements**

- 150 hp in Data/Teknik.
- Programming competence, willingness to learn new computer languages and systems.
- Sufficient background in other areas to research and implement algorithms for image processing, mapping, path planning, and AI. (I.e., you can get the book, read up on them, and figure them out.)

Please note this is a new project for this course and as such the project description and course schedule are subject to change.