ECE 682 Winter 2011
Project Overview

ECE582 Autumn 2011

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What is ECE682?

Students encounter a

- *realistic team-based design experience*

that allows them to integrate and apply the fundamental material they have previously learned to

- *design and develop*
- *prototype*
- *evaluate and test*

a new product or device.

Personal Introduction

- My specific areas of interest:
  - Autonomous systems (vehicles, ground robots, aerial vehicles) – including DARPA challenges
  - Intelligent transportation systems and traffic systems
  - Control systems, embedded systems, and mechatronics
  - Sensor systems (GPS, IMU, LiDAR, image processing)
  - Wireless communication and DSRC
  - Virtual environment and simulation

Project 1 – Medical Monitoring

Goal: develop a small, lightweight, unobtrusive, wearable device that can measure and record human physiological variables over a significant period (days at least) of time.

Each team, in conjunction with the advisor, will develop the final specifications.

Functional Requirements

- Battery powered and rechargeable
- Long battery life – so low power
- Potential sensed vitals- pulse/heartbeat, breathing, blood pressure, skin conductance, ECG/EKG (heart), EEG (brain/neural activity), physical activity, temperature, …

  You tell me what can be done
- Data collection- sample at a prescribed interval
- Data storage- store onboard
- Data protected- from loss of power or other device failures
- Communications- reliable, verified automated data dump to a “base station” when in range. Device data only deleted after verification.

Project 2 – Position Localization

Goal: develop a system for that will allow a mobile unit to determine its position in an {indoor, outdoor} environment. The system might be mounted on a robot or vehicle or carried by a person.

The technology deployed is up to you.

Each team, in conjunction with the advisor, will determine the desired operating conditions and complete specifications.

GPS

- GPS basics:
  - Many satellites in orbit with known positions
  - Measure distances from ground receiver to satellites (by measuring time of flight)
  - Triangulate
- GPS is great, when it works…
  - Outdoors
  - Fairly good view of the sky
- What about non-GPS options?

Known Possibilities

- Outdoors
  - Cell tower signal strength or time of flight
  - Radio/TV station signal strength
  - Wifi hotspots
  - ?
- Indoors
  - Wifi basestations
  - Specialized beacons (light, sound, RF)
  - Query and response beacons
  - Image/sensor processing of tags or environmental features

Other Options

- Propose your own project
  - ECE 683
  - Within the context of ECE 682
- General ideas of interest
  - Automated fork lifts for warehouses
  - ION Robotic Lawn Mower Competition http://www.ion.org/satdiv/alc
  - LEO satellite tracking antenna and receiver
    - Rough initial estimate and then closed loop track
    - Orbital model position and then fine tune tracking
  - AFRL Student Challenges
  - Autonomous indoor aerial vehicles
  - Software defined radio

AFRL Student Challenges
http://www.afrlstudentchallenge.org

- Autonomous Airborne Monitoring System
- Autonomous Target Tracking Robot
- Detection and Characterization Of Human Vital Signs Using RF Sensor Nodes
- Flapping Wing Micro Air Vehicle Actuator
- Laser Detection and Ranging (LADAR) Viewer
- Motion-Capture For Runners
- Robotic Metal Detector
- Star Trek Communicator
- Universal Translator – Fact or Fiction?
- Vehicle Ground Truthing System
- Wireless Sensor Network Health Diagnostic

Comments

- Resources:
  - In winter quarter we will have a dedicated work space for the ECE682 projects
  - We can make available an indoor robotic testbed (20 x 50 x 22 feet)
- I allow some flexibility for each team to determine the functionality and specifications.
- Project specifications need to be verifiable, so you will need to develop a test plan.