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
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.
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.