EE 382: Introduction to Design

Remote Sensing of Road Conditions using UAVs

Department of Electrical Engineering

New Mexico Institute of Mining and Technology

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Course Overview

Instructors:

- Dr. Kevin Wedeward
- Dr. Aly El-Osery

Time/Place:

- TR 2:00pm - 5:00pm
- Workman 187 for lectures and presentations
- Workman 116/187 for work on project

Course Overview (cont.)

Prerequisites:

- EE 308 and EE 308L (microcontrollers)

- EE 321 and EE 321L (analog electronics)

- EE 333 (electricity and magnetism)

- EE 341 (signals and linear systems)

- Declared electrical engineering as a major

Course Overview (cont.)

Goals: Students will

- work in teams,

- implement key aspects of a design process,

- design and build a prototype electronic system,

- conduct experiments to characterize and verify design,

- communicate aspects of the design process through oral presentations and written documents, and

- manage the design process.

Course Overview (cont.)

Grading:

- Survey Paper - 10%
- Statement of Work - 10%
- Conceptual Design Review (Presentation) - 10%
- Mid-term Design Evaluation - 20%
- Final Project Evaluation - 30%
- Final Design Presentation - 10%
- Demonstration for Faculty, Family and Friends - 0% (for fun)
- Final Report (including electronic version) - 10%
- Individual grades will be assigned; each student must participate in each graded-component of the course to pass the course.

Course Overview (cont.)

Budget

- The team's budget is $3000.
- Use order form to purchase items through the department; fill it out, have it signed by instructor.

Project

Monitoring of road conditions is an essential component in ensuring their quality and safety. Timely collection of relevant data provide means for identification and rectification of road deformations. Specific goals include identification of relevant metrics for road assessment achievable through the use of UAVs, identification of required sensors to obtain those metrics, collection of accurate navigation information, and minimizing power consumption to prolong operation time.

Project Goals

The focus of this semester is to

- perform analyses and trades to demonstrate concept feasibility,
- develop a prototype to demonstrate the ability to measure a subset of the
- relevant metrics for road assessment, and
- provide a preliminary demonstration of the proposed system

Suggested Groups

The whole class will work as one team with groups focusing on different aspects. A possible break down of the groups is listed below with each group being 4 students

- Systems group
- Two Position, Navigation and Timing (PNT) groups
- Two sensors groups
- Data analysis/Testing group

Systems group

- Manages the different teams and the project as a whole

- Handles scheduling and purchasing

- Interacts with all teams and vets specifications

- Handles integration of documents

- Power regulation and management

- Common processing architecture

- Integration of all the codes for the different subsystem

Two Position, Navigation and Timing (PNT) groups

- Select appropriate GPS module
- Select appropriate inertial sensors
- Develop code to provide location and attitude of the UAV
- Provide timing signals to other systems for data logging

Two sensors groups

- Select sensors to characterize the road
- Develop necessary interfacing circuits to the microcontroller
- Develop timestamped data collection code
- Each group must be unique in the feature they extract

Data analysis/Testing group

- Responsible for data collection and storage
- Develop and implement a user interface for downloading, archiving and
- displaying collected data
- Responsible for offline processing and analysis of collected data
- Testing and evaluation of the entire system

Highway Performance Monitoring System Field Manual

Key focus

Pavement condition as outlined by the *Items to be reported* in the HPMS Field Manual

Reference

Highway Performance Monitoring System Field Manual