ECPS 203
Embedded Systems Modeling and Design
Lecture 5

Rainer Dömer

doemer@uci.edu

Center for Embedded and Cyber-physical Systems
University of California, Irvine

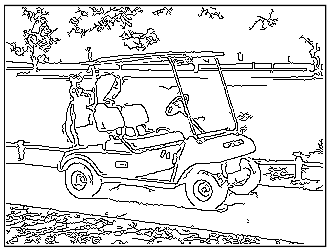
Lecture 5: Overview

- Project Discussion
  - Assignment 1 review
  - Assignment 2 review
- Project Drone Flight
  - Capture video footage for Canny real-time application
  - Drone flight demonstration around UCI engineering buildings
- Project Discussion
  - Watch the captured video footage

ECPS 203 Project

- Application Example: Canny Edge Detector
  - Embedded system model for image processing: Automatic edge detection in a digital camera

golfcart.pgm



golfcart.pgm_s_0.60_l_0.30_h_0.80.pgm

  - Application source and documentation:
    - http://marathon.csee.usf.edu/edge/edge_detection.html
    - http://en.wikipedia.org/wiki/Canny_edge_detector

Project Assignment 1

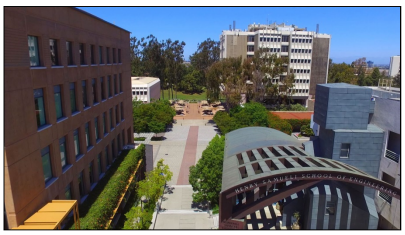
- Task: Introduction to Application Example
  - Canny Edge Detector
  - Algorithm for edge detection in digital images
- Steps
  1. Setup your Linux programming environment
  2. Download, adjust, and compile the application C code with the GNU C compiler (**`gcc`**)
  3. Study the application, determine function-call tree
- Deliverables
  - Source code and text file: **`canny.c`**, **`canny.txt`**
- Due
  - Wednesday, next week: October 11, 2017, 6pm

Project Assignment 2

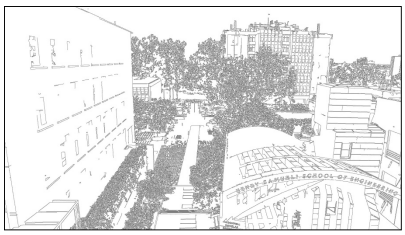
- Task: Clean C++ model with static memory allocation
  - Prepare the C++ source code for modeling in SystemC
  - Configure parameters for specific application
  - Apply static memory allocation
- Steps
  1. Fix the off-by-one bug in the **`non_max_supp`** function
  2. Clean-up the code for compilation without warnings
  3. Fix configuration parameters to compile-time constants
  4. Remove or replace dynamic memory allocation
- Deliverables
  - Source code and text file: **`canny.cpp`**, **`canny.txt`**
- Due
  - Wednesday, next week: October 18, 2017, 6pm

ECPS 203 Project

- Application Example: Canny Edge Detector
  - Embedded system model for image processing:
    Automatic edge detection in a digital video camera



Engineering001.bmp



Engineering001_edges.pgm

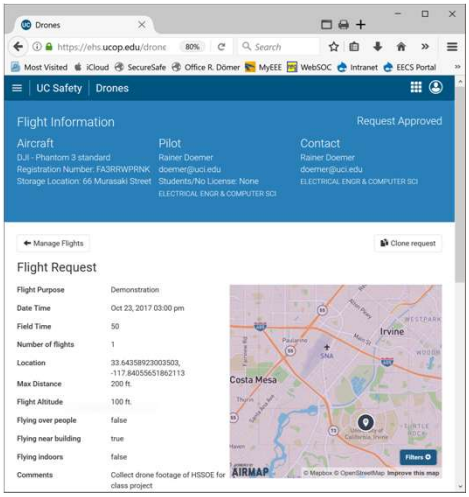
  - Process video shot by a drone flying over Engineering Plaza
    - Fly a drone over UCI Engineering Plaza, take video of buildings
    - Record a color video stream in high resolution, 2704 by 1520 pixels
    - Extract a set of video frames suitable for use in our test bench

ECPS 203 Project: Drone Flight

- Capture Video Footage of Engineering Buildings
  - Google Map of UCI Engineering Quad

ECPS 203 Project: Drone Flight

- Capture Video Footage of Engineering Buildings
  - Drone flights in US require approval by the Federal Aviation Administration (FAA)
  - On UCI campus, Environmental Health & Safety (EHS) department is in charge of Unmanned Aircraft Safety
  - ➢ Flight request approved
    - Thursday, October 19, 2017



ECPS 203 Project: Drone Flight

- Capture Video Footage of Engineering Buildings
  - Drone Equipment
    - DJI Phantom 3 Standard Quadcopter
    - Remote Control with Mobile Device

[Image source: dji.com]

  - Drone carrries a Camera attached to a Gimble
    - Video stream stored on a SD memory card, e.g. DJI_0001.MOV
    - Video is 30 frames per second
    - Frames are 2704 by 1520 pixels

ECPS 203 Project: Drone Flight

- Capture Video Footage of Engineering Buildings
  - Screen Shot of Drone Control App on Mobile Device

ECPS 203 Project: Drone Flight

- Capture Video Footage of Engineering Buildings
  - Meet the drone pilot at the blue umbrellas on Engineering Gateway Plaza