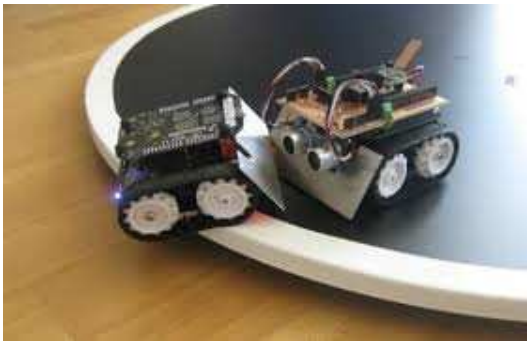
List of Proposed Senior Design Projects

Section Instructor: Ping Liang

1. Sumo-Robot (2 students/team, requires a minimum of two teams)



Push opponent off the stage. Design sensors and motor control. Must meet Robot-Sumo competition specification

2. Gesture controlled smoke/gas/motion detector with wireless transmission and vibrating alarm and smart-phone app for hearing impaired (2-3 students/team)

Smoke, CO and motion detector that wirelessly transmits alarm to a vibrator to alert a hearing impaired person in sleep. Vibrator also linked to smartphone to allow emergency alert over the Internet. Also allow using gesture to turn off alarm to teach it not to be triggered by some conditions, e.g., normal cooking fumes

3. FPGA implementation of fast computation of linear precoding (e.g., zero-forcing , MMSE) matrix for MIMO wireless communication (2 students/team)

Using FPGA to implement fast algorithms for computing linear precoding matrix for MIMO wireless communication

4. LED light based indoor positioning and navigation (2 students/team)

Design sensor array, hardware and signaling for indoor positioning and navigation using modulated LED lights

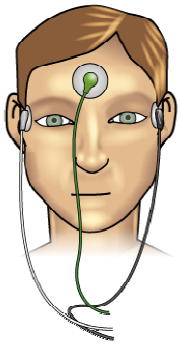
5. Hockey-Bots or Soccer-Bots (3 students/team, RoboCup competition, requires a minimum of two teams)

Each team builds minimum of two robots that cooperate and play against opponents to get ball into goal and prevent opponent from getting ball into your goal.

6. Bluetooth connected exercise sensors to accurately measure many types exercises (2-3 students/team)

Sensors worn on wrist (e.g., fitbit, Samsung Gear fit) have limited accuracy and cannot measure some exercises. Design a network of wireless wearable sensors that can measure walking/running, cycling, weight lifting, aerobics, etc. Collect and analyze the data on smartphone.

7. Using electrooculography (EOG) to track eye movement for controlling a computer game and to record stages of sleep (2-3 students)



Build the EOG circuit, analyze the digital signal, control a movement of an object on a computer screen, and recognize stages of sleep. Option: wirelessly transmit the data to a smartphone and control actions on the phone, and record sleeping patterns on the phone

8. Wireless car-to-car communication for intelligent highway (3 students/team, same as Dr Chomko's Project 10)

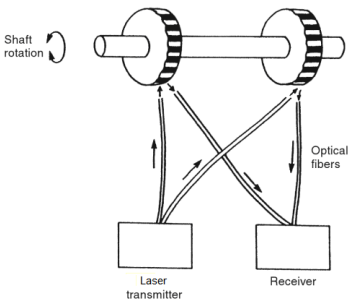
9. GPS based autonomous vehicle with obstacle avoidance (2-3 students/team, Similar to Dr. Chomko's Project 4)

Section Instructor: Roman Chomko

1. Hoverbike

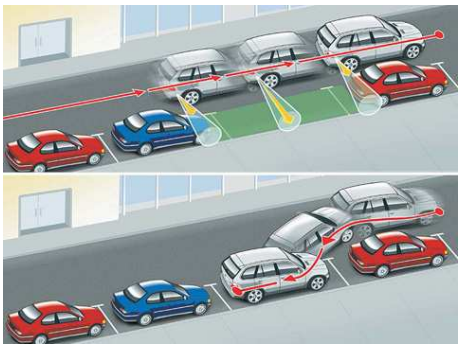
Design a prototype of a hover-bike. The action, control and construction is similar to that of a quad-rotor except that it uses only to rotor blades. The objective is to demonstrate the hover-bike's feasibility.

2. Optical (Laser)Torque Measurement System



Design a laser based optical torque measurement system which utilizes laser diodes and fiber-optical cables. The system must be capable of measuring the phase between two reflected beams of light, compare them and determine the torque due to the bending of shafts where wheels are mounted.

3. Autonomous Parking System

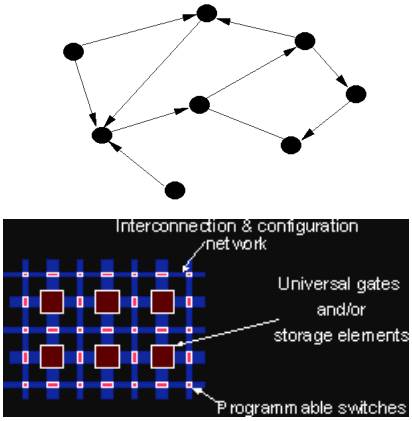


The objective is to detect a potential parking spot and maneuver the vehicle into that parking spot.

4. Autonomous Ground Vehicle

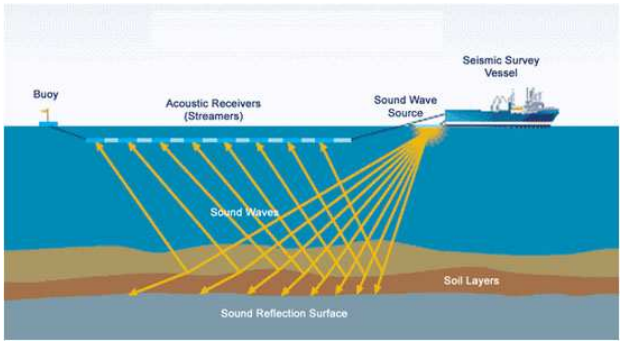
a) A test unmanned ground vehicle (UGV) must be remotely controllable;
b) UGV must be capable of providing its status to the command and control center such as location, speed, telemetry, etc.;
c) Other features may be added depending on the size of the project team;
d) The choice of a test vehicle is optional - wheeled or with tracks

5. Reconfigurable Hardware System



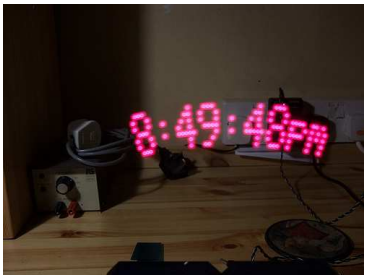
The objective of this project is to develop a prototype of a reconfigurable multicontroller-based system, so that each microcontroller must be capable of controlling different hardware components. This situation may appear in systems with redundancy so that, for example, in case of some microcontroller failures other microcontrollers may take over the function of the failed microcontroller, or in other cases the microcontroller may perform other functions, say, instead of controlling sensors they may control robotic arms.

6. Hydrophone for Underwater Communications



The objective is to design an underwater acoustic digital communication system capable of delivering basic submarine telemetry information to surface station (buoy or ship).

7. Persistence of Vision (POV) Text Display

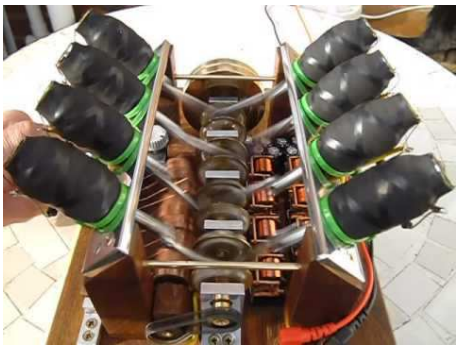


Persistence of vision (POV) is the phenomenon of the eye by which an afterimage is thought to persist for approximately one twenty-fifth of a second on the retina. The objective is to design such a system capable of displaying basic text and images.

8. Control of Remotely-Controlled Helicopters

The objective is to design a joystick based Xbee-based wireless networked control system for flying remotely-controlled (RC) helicopters.

9. Solenoidal Motor Electric Vehicle



The objective is to design a 2 or 4 “cylinder” solenoidal electric motor to be used in RC cars.

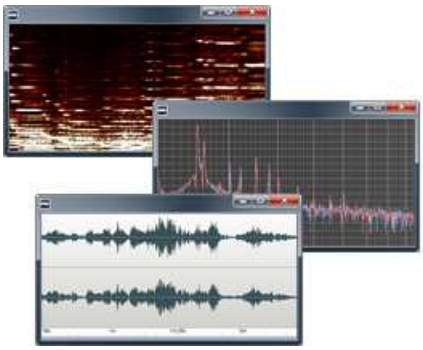
10. Vehicle-to-Vehicle Communication System (V2V)

Vehicular Communication Systems are an emerging type of networks in which vehicles and roadside units are the communicating nodes; providing each other with information, such as safety warnings and traffic information. As a cooperative approach, vehicular communication systems can be more effective in avoiding accidents and traffic congestions than if each vehicle tries to solve these problems individually.

The objectives are:

- **a)** The vehicle should be a model car with an autonomous/manual navigation capability;
- **b)** The vehicles (or vehicle emulators) must communicate among themselves traffic information such as their vehicle info (truck, SUV, sport, etc.), location via GPS, speed, road/whether conditions including also historical data;
- **c)** Based on the information, the vehicle must advise the driver the best route to be taken;
- **d)** Provide remote video monitoring;
- **e)** (*optional*) display advised route choices in GoogleMaps.

11. Digitally Controlled Analog Filters and FFT Analyzer



The objective of this project is to develop a digitally controlled analog filter with FFT sound analyzer capabilities.

The objectives are:

- **a)** Design any type of a filter of your choice such as an active four-pole low-pass Butterworth filter with a cut-off frequency of about 40 kHz
- **b)** The filter performance is to be monitored on a PC and its parameters readjusted (re-calibrated) using digitally controlled variable resistors, for example, AD7376;
- **c)** The system performance must be verified by filtering sound signal (music?) obtained from PC-based audio outputs, and monitored on a PC screen via FFT sound analysis of inputs and outputs;