Project 1: Submersible river drifter

Client: Marine Geophysics Laboratory

Description:

The Marine Geophysics Laboratory's "river drifter" (http://www.marinegeophysics.com.au/river-drifter/) is a floating sensor platform for measuring turbidity on the surface of the water at different locations. It consists of a microcontroller, GPS module, satellite communications system and marine sensors.

An extension project is the "submersible river drifter": a floating and diving sensor platform for measuring sub-surface turbidity with depth and location information. You must implement all of the following features:

- Design a PCB to control DC motor with FWD REV, a geared motor that forces the instrument to dive.
- When the instrument dives, readings must be made from several sensors (i.e. turbidity, temperature and depth).
- Upon resurfacing, the instrument must grab its current GPS coordinates and transmit its data to a simplex service on the Globalstar satellite network.
- GPS transmission is drastically inhibited by water coverage. Therefore, an antenna must be designed to ensure the GPS transmitter is above the water when attempting to send a signal.

Commented [MR1]: Antenna design is not something we would want in this subject!

Hints:

- This project favours electronic and software design equally.
- Much of the mechanical and data collection system has been designed. You will be integrating a diving control system to the existing river drifter instrument.

Project 2: Remote control car

Client: JCU Robo Club

Description:

The pride and joy of the JCU Robotics Club is in need of a tune-up. You must develop an embedded system to control the operation of a remote control car. The car will be used extensively for marketing purposes and will have a long service life. You must implement all of the following features:

- Design a PCB that responds to PWM signals to control the speed, steering, lights and horn of a ready-made remote control car.
- Implement closed loop steering controls so that the direction of the car can be controlled more intuitively.
- Replace the current MOSFET speed controller with a large solid state relay.
- Ensure all connections are secure and robust (i.e. by using KK headers).
- Develop a wireless controller to operate the car remotely with Zigbee communications modules.

Hints:

- This project favours electronic and software design equally.
- You will need to design control circuitry for various peripherals, and implement a PID controller in software for the steering.

Commented [MR2]: Again the same problem. We should not ask the students to do something that is not covered in this subject.

Project 3: Satellite tracking system

Client: JCU Robo Club

Description:

Rowan University is launching a CubeSat (i.e. a miniaturized satellite) next year and they have asked the JCU Robo Club to assist with data retrieval. You are required to design a computer controlled antenna rotator which can position a directional antenna at a given azimuth and elevation based on the position of a satellite. You must implement all of the following features:

- Design a PCB to control either servo motors or geared motors with feedback from rotary encoders to accurately position the apparatus.
- Communicate wirelessly with a computer to receive a desired position for the antenna to target using Zigbee communications modules.
- Incorporate a magnetometer to self-orient the apparatus to the true north bearing.
- Design the rotator apparatus for 3D printing. (The JCU Robo Club will provide filament and access to a 3D printer.)
- Design a Yagi antenna for the required frequencies using RF and transmission line principles.

Hints:

- This project favours electronic and software design equally.
- It will involve the design of control PCB for a multi-dimensional apparatus similar to the crane project in CC2511. A significant portion of the project involves 3D printing design. The design of the antenna is relatively simple.

> **Commented [MR3]:** Same concern as above. Also, I do not have background or enough knowledge about these concepts. So students cannot receive much help.