GPS Training System
**Introductory Description:**
Imagine having a device for running capable of displaying a wide array of information to its user including; distance, time, speed, and elevation. This running device allows its user to do just that. It has a small LCD screen that displays all of this information so it can be viewed by the user. Three buttons on the device are used to control the power, mode, and start/stop functions. The mode button allows the user to switch between the current values and the average values of the entire workout. After the workout is over the data can be loaded onto a computer using a serial port connector, so it can be viewed again at a later time. This module gives a runner all the information they need for training without inconveniencing them with a heavy addition.

**Designer’s Description:**
A device meant for runners must be kept small and light because added weight is unwanted and awkward to carry. Research shows that while modules without built in antennas are smaller, once an antenna is added the device is approximately the same size as one with a built in antenna. This means that the running system should be based around a small, lightweight module with a built in antenna. A runner does not want to be constantly switching the mode of a device. For this reason it is useful to have a LCD screen able to show all of the current workout information at one time. A mode button will be included to toggle between current and average values because the screen cannot contain all of the data at one time. Another button will enable the user to start and stop the workout at any time, allowing them to pause the collection of data when needed. One more button controls the power of the device so it can be turned on and off. All of these components need to be powered, so a small rechargeable battery will be included to drive them. Another feature that will be included is a serial port, which will allow the user to connect the device to a computer and download their workout data so it can be viewed at another time.
This block diagram shows all of the components that were mentioned earlier, and how they interact with each other. It shows the rechargeable battery supplying power to all of the circuitry so the device can operate. The diagram also shows the microcontroller communicating with the GPS module and the LCD screen so the data collected can be displayed. All three buttons communicate directly with the microcontroller telling it how to react. The external appearance of the GPS is shown on page 5; several different views of the device are shown, giving a general idea of its appearance.

**Project Benefits:**
If used correctly a GPS can be a positive addition to an athlete’s training. Being able to monitor the speed, distance, and elevation gain of a workout allows an athlete to keep the goals they set for themselves. Monitoring speed can help athletes to keep an even pace, which can improve their times and even make them smarter runners. The GPS also gives athletes a better idea of the improvements that they are making in their training. The module contains a serial port which allows the user to transfer workout data onto their computer to help track progress over time. Runners often base their workouts off of distances, paces, elevation gains, and times. Having a device that can keep track of all of this information enables them to bring training to a new level. A GPS based system would enable them to keep track of all of that information and monitor their progress throughout their training.

**Project Impacts:**
A small GPS is useful for many applications, one of these being running. Runners often like to keep a particular speed during a workout. This GPS allows them to track their speed along with other useful information, helping the runner to assure that they keep their training goals. This device is particularly useful for a runner training for a specific distance because it can accurately track distance in an area unknown to the runner. Another impact of a training GPS is that people might be influenced to exercise more frequently given that they know more about the progress they are making. Being able to see progress would likely motivate them to continue training.

**Competing Products:**
There are many products on the market that have similar applications. The leading competitor for GPS running modules is Garmin. They offer several different styles ranging in size, price, and complexity. All of their running GPS modules are in the form of a wrist watch. They range in size from 3.26”x1.71”x0.7” to 2.1”x2.7”x.7”, and their weights range from 2.6 ounces to 2.75 ounces. Most of these devices monitor speed, distance, altitude, time, and some include heart rate monitors. The device proposed will have all of these functions with the exception of the heart rate monitor.
This is the Forerunner 305 it is the most advanced product that Garmin offers in the form of running GPS systems. The suggested retail price for this GPS watch is $323.06. Along with the functions mentioned earlier, this watch offers connectivity to computers and vast storage of waypoints and routes. The training system proposed also has computer connectivity, allowing the user to store multiple workouts and see their improvements over time.

**Project Development:**
This project will be designed and built primarily within the engineering lab at Western Washington University. The computers in the lab should have all of the software needed to create the GPS. The device will be tested anywhere outside where it can receive a signal from satellites. Demonstration of this device will be difficult because the demonstration room is within the engineering building. GPS technology needs contact with satellites in order to receive its signal and effectively display the location, so the device will not operate within the building. In order to conquer this obstacle a video of the GPS operating is one option, another is having an outdoor demonstration where people can view the GPS in action. Although the GPS cannot be operated indoors, there could be information from a previous usage left on the screen so observers could see the display and the effects of the buttons.