Industrial Sponsor: J. Reising

Radio Direction Finder

Client requires a small transmitter and a directional receiver that will function as a direction finder. The pair must operate over a distance of at least 100 feet. The receiver must indicate the direction of the transmitter to +/- 10° at distances between 50 and 100 feet. Both units must be battery-powered.

The transmitter must fit in 2 in x 2 in x 1 in volume. The receiver must be portable enough to be carried by one person easily.

In addition to a working prototype, client wants a plan for manufacturing these units in 100 piece quantities. All applicable safety requirements must be met.

Multi-Purpose Sensor Module

The client requires a sensor module that will accept either voltage or current input with user-selectable ranges: 0-1 volt, 0-5 volts, 0-10 volts, ±10 volts, 0-10 ma, 0-1 ma, 0-100 ma. The module must interface to a PC via RF or USB interface and download digital samples with 10-bit resolution at rates as high as 1000 samples per second. The data rate must also be user-selectable as 10, 100, or 1000 samples per second. Also desired is the necessary software to display results on PC. Two versions of the software are required: an application to run on a single PC, and a Web application.

The design should result in a single prototype, the itemized cost of all parts for the prototype, and a cost estimate for manufacture in 100 piece quantity.
**Musical Tone Measurement Device**

The desired product in this project is a device to measure the fundamental frequency of musical tones over the range 30 Hz to 2 KHz. Input to the device should be by means of a built-in microphone. The device should display the closest musical note and the frequency of the fundamental to 1% accuracy on a built-in display. The device should be battery-powered.

The desired outcome is a single prototype, the itemized cost of all parts for the prototype, and a cost estimate for manufacture in 100 piece quantity.

Note: Specifications for an available commercial device are advertised as below:

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuning Range</td>
<td>Seven octaves, 27Hz - 6,000 Hz</td>
</tr>
<tr>
<td>Tuning Precision</td>
<td>Better than one cent</td>
</tr>
<tr>
<td>Battery Life</td>
<td>60 hours of continuous use</td>
</tr>
<tr>
<td>Dimensions</td>
<td>1 1/4” wide, 6” long, 3/4” thick</td>
</tr>
<tr>
<td>Weight</td>
<td>2 ounces</td>
</tr>
<tr>
<td>Power supply</td>
<td>6 volts</td>
</tr>
<tr>
<td>Battery Type</td>
<td>CR2032 coin cell; two batteries required</td>
</tr>
</tbody>
</table>

**Sound to score converter**

The client for this application desires a device to which sound, either voice or musical instrument, could be input, and a musical score corresponding to the input sound would be output.

The client is a songwriter who is not musically skilled. The client would like to be able to sing into the device and have the musical score available for a musician to play the tune for the song. Another application would be to generate the score to improvised music from a non-MIDI instrument, such as a standard guitar.

An additional optional feature would be the ability to play back the sounds corresponding to the musical score.
Bicycle Trainer

The client desires an apparatus on which a bicycle can be mounted for stationary training with programmable variable resistance to the force applied by the user on the pedals. The purpose is to allow the user to train or exercise indoors while experiencing a variable load such as would be encountered on an actual ride.

The finished system should be easy to attach or remove from a bicycle. The load should be variable in such a way that at least 60 changes in load could be made within a one hour time period.

At least three built-in default load profiles should be provided: one continuously increasing load, one for interval training, and one for a series of repeated inclines more gradual than that for interval training.

The user must be able to enter other load profiles covering one-hour time periods. The preferred entry method is from PC, but other methods might well be acceptable to the client.
Guitar Effects Pedal Controller

There are a number of guitar pedals on the market providing various special effects for electric instruments. One example is the adjustable digital delay shown at the right. Each of the three dials on the left adjusts the intensity of one effect. Although many of these pedals can be switched on and off by means of a foot switch, the intensity of each effect is only adjustable by means of one of the dials.

Another type of pedal available is shown at the left. This pedal controls the intensity of a single effect by means of the foot pedal, and the effect may be switched on and off by depressing the pedal all the way, operating the pushbutton switch, which toggles the effect on and off. The client knows of no readily available combination of a foot-activated intensity control and a multi-effect pedal.

What the client desires is a special effects pedal that combines special effects with a foot-activated on/off/intensity controller. The controller should be switchable to control any of the (minimum of three) rotary knob functions by means of a switch located on the side of the pedal housing. The special effects could in principle be any effects commonly available in a guitar pedal.

The completed controller should be housed in a rugged enclosure suitable for regular use in professional performances.