Spring 2009 Project Proposal
ECE 191
Programmable Motion Sensor
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Introduction

We have all experienced the frustrations of motion sensing devices behaving badly. Maybe the towel dispenser wouldn't give any paper towels, or the motion-sensing water faucet wouldn't turn on, or the room lights turned themselves off while you were working quietly at your desk. Or worse still, the elevator door tried to take off your arm! Students on this project will have the opportunity to be part of an effort to not only greatly improve existing motion sensing applications but also to create new applications of motion sensing in both the Green Technologies and Health Information Technologies sectors, both of which are hot areas for funding and jobs! This project will create an embedded motion sensing circuit that can be programmed with custom application logic, depending on the target application. The use in green technologies is obvious as our sensor will enable more effective energy saving light switches to be developed. However, a new application to which we shall apply the programmable motion sensor is detecting how much people are using the stairs in buildings on campus, since researchers in our School of Medicine are eager for this capability for their research on physical activity. By retrofitting our sensor into existing light switches in the stairwells, we will be able to detect and record stair usage patterns.

Project Components

Design a circuit to interface an Atmel AVR microcontroller to an infrared transmitter and receiver.

Modify existing C code to drive the transmitter at a programmable frequency as well as read the corresponding levels of received light reflected off objects in the room.

Use MATLAB to analyze the received signal patterns in response to different activities including walking towards and away from the sensor at different rates, waving hands in front of it, etc.

Design and implement an algorithm to detect the various activities

Design and layout a PCB that will interface the programmable motion sensor circuit to a Watt Stopper brand light switch as used in the Calit2 building (I have already hacked and reverse engineered this switch. It is straightforward to interface a custom 5V control circuit to it!).

Optional: Investigate novel applications of your own using your programmable sensor, including exploring novel business opportunities, government stimulus grants, etc. (I will help you form a company if you want!)