University of Toronto, Faculty of Applied Science and Engineering
Department of Electrical and Computer Engineering

ECE 243S – Computer Organization – 2016

Project Proposal Form

After ensuring that your project idea is unique, you will use this form to describe your project (point form preferred), assess its difficulty, and outline what you expect to achieve each week of your project work. You **must submit the filled form on Blackboard two days before your scheduled project lab session and bring it to the first project lab session.**

The TA will advise you if changes are needed to your project proposal so it is sufficiently, but not overly challenging. After you implement the changes, **the TA will then approve your project proposal.** You will then make **two copies** of the final filled form: one will be kept by the TA, and the other one will be for your reference. Your ability to successfully implement all that was approved in your proposal will determine your project functionality marks.

Group Info

Station Number	First Name	Last Name	Student Number	Contribution [0..100] (filled during 3rd lab)
73	Sarina	Sit	1001461624	
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One Sentence Project Description (as posted on Piazza)

Self-orienting solar panel system that also models power distrubtion within a city depending on load requirement.

Technical Description of the Project

Describe your project in more technical details and include a system block diagram.

We would like to implement a pair of solar panels that will orient themselves towards the general direction of highest light intensity. At the highest level, we are modeling a smart grid.

1. Three light sensors will be used to measure light intensity in the x, y and z directions. This data will be polled by the NIOS II and compared to reference values that will be set during an initialization period.

2. Based on the results of the light sensor readings the NIOS II will turn on a motor for varying amounts of time to turn the panels to maximize their light exposure and resulting generating capacity. One motor will be responsible for rotation about the z axis. The other motor will move the panel along an axis parallel to the x-y plane (i.e. tilt). These processes will be subroutines that are called from a main loop. There will also be a subroutine to handle the PWM for the motor control.

3. The solar panels will generate an electric current (in the event that the current they generate is very small, a battery will be substituted as a source). This current will be fed into a transistor bank which will be controlled by the NIOS II. This portion models the city. When the touch sensors detect a touch (Lego figure arriving home) an interrupt will be sent to the NIOS II and it will respond by routing current to the appropriate house (turning the light on by adjusting the transistor bank).

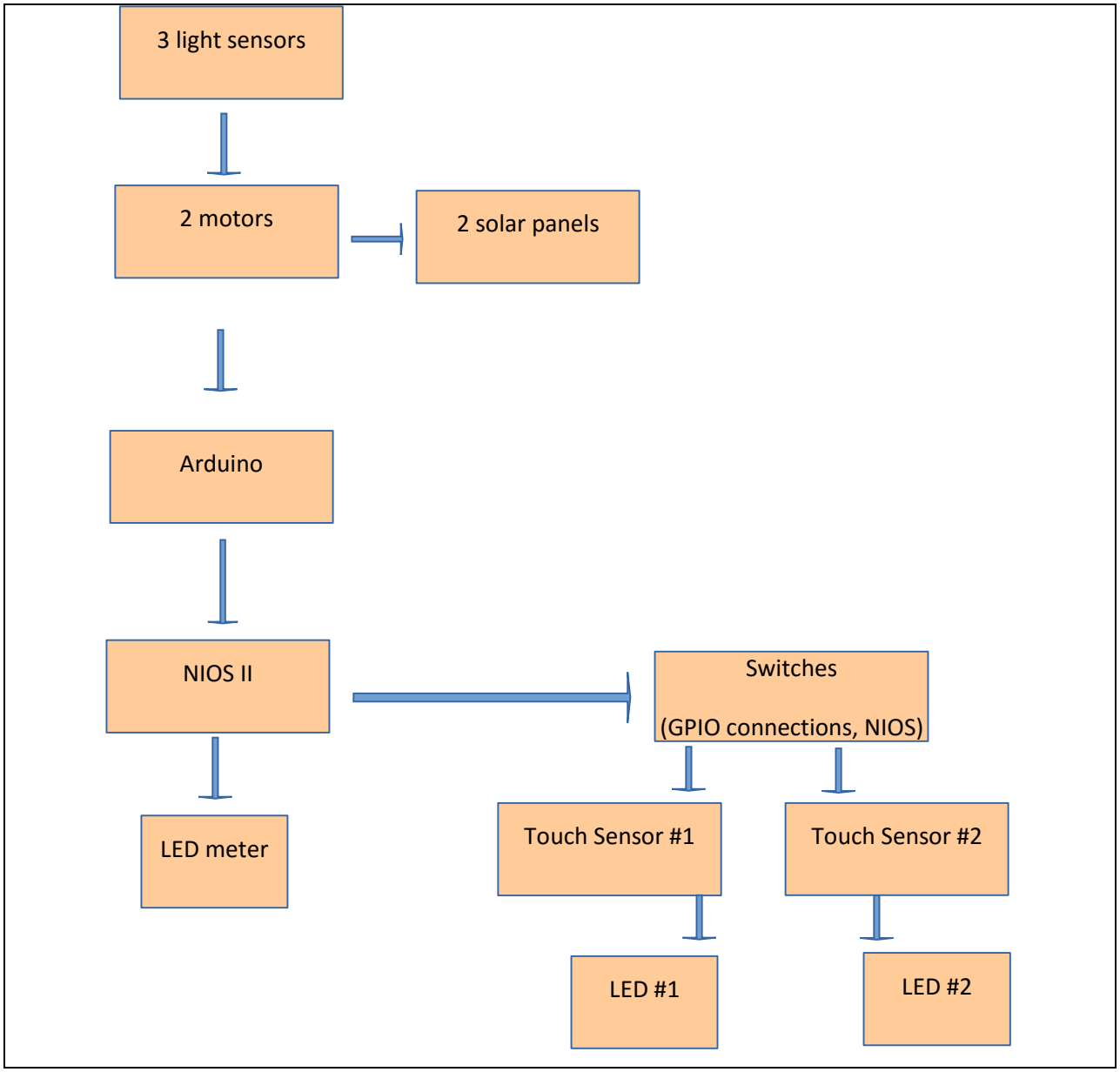
4. An Arduino will be used to measure the current generated by the solar array and convert this analog value to a digital one that will be sent to the NIOS II.

5. The NIOS II will read the data from the Arduino and display the "power" that is being generated on the lower four onboard LEDs. On the upper four LEDs the current "load" on the grid will be displayed. In both cases a greater number of LEDs will correspond to a greater power supply/demand.

6. The houses producing the load on the grid will be printed to the terminal through the JTAG UART whenever the load interrupt occurs.

The three primary components to the model are:

1. Using the motors to have the solar panels track a light source based on sensor data
2. Responding to applied loads (in the form of interrupts) by routing power to the appropriate location
3. Visualizing this process as it happens.


3 light sensors
2 motors
2 solar panels
Arduino
NIOS II
Switches
(GPIO connections, NIOS)
LED meter
Touch Sensor #1
Touch Sensor #2
LED #1
LED #2

Technical Description of the Project Core

The project core is a minimum part of your project that you are committing to deliver. Failing to implement this part will result in loss of functionality marks.

Describe your project core here.

Our minimum viable product is as follows:

1. Turning solar panels to face direction of highest light intensity.
    - Initialize sensors and store initial light intensities from each of the sensors. This will allows us to have an intensity to compare against.
    - Continuously poll for new data
    - Compare to old data
    - Decide which motors to turn and for how long
    - Turn motors

2. Responding to interrupt from touch sensors.
    - Detect changes from touch sensors

3. Representing power distribution and supply and demand
    - Establish which sensor the interrupt came from
    - Display result (either 0 or 1, depending on the “home) onto terminal window with the JTAG UART and model with LEDS

Assessment of Project's Difficulty

Please check off each accomplishment you propose in your project and indicate whether that accomplishment is part of the project core and whether it is interrupt-driven (if applicable). For accomplishments with multiple units such as the LEDs, switches, motors, etc., indicate the number of such units used. For example if you are using two Lego motors place the number 2 in the column instead of a checkmark.

Accomplishment	Proposed?	Project Core?	Interrupt?	Demonstrated? (to be filled by your TA)
Push buttons				
Digital protoboard				
VGA			N/A	
Lego motors	2	yes	N/A	
Lego sensors (value mode)				
Lego sensors (state mode)	yes	yes	yes	
Linking C with assembly	yes		N/A	
JTAG UART transmit	yes			
JTAG UART receive	yes			
Timer	yes	yes		
Hexkeypad (rows or columns only)				
Hexkeypad (rows and columns)				
DMA transfer				
Nios II Custom Instruction			N/A	
Audio Codec output to speakers				
Audio Codec input from microphone				
PS/2 Keyboard				
PS/2 Mouse				
SD Card Reader				
Custom Bus Component				
Ethernet				
IrDA UART				
Video input				
ADC				

Please describe any other devices or complex software algorithms you will use. Remember to keep this relevant to ECE243 (not fancy electronic circuits or complex mechanical systems).

1. Arduino to convert analog data to digital and send it to NIOSII
2. Solar panels
3. Touch sensors

Project Milestones

Describe what parts of your project you will have fully implemented in each of the three project lab sessions. Keep in mind that you will have to demonstrate your project during the third project lab session. The key here is to design incrementally: get something working quickly and keep adding to it. TAs will not accept the "integrate everything in week 3" approach.

First project lab session

- Create assembly code that will enable interrupts for the touch sensors
- Ensure that variations in sensors will cause action (interrupt handler)
- Action will be written to terminal, displaying a 0/1 to represent the sensor that was "requesting power"

Second project lab session

- Get solar panels to turn depending on light intensity data coming from the Lego sensors
- Using digital data from Arduino, display output onto LEDS

Third project lab session – Demo

- Fine tune accuracy of solar panel movement
- Implement LEDS to represent loaded/unloaded homes and the power meter

TA Notes

This page is filled by your TA.

Approval

Approved by _____

Date

_____

First project lab session

Second project lab session

Third project lab session – Demo