Madison International School

HighSchool

Computer Science

Internal Assessment
Development of Intelligent Solar Panel

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12’A

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Criterion A: Planning

Defining the problem

Society nowadays relies on electricity to function correctly. Mainly, everything is linked somehow to energy be it from simple jobs to large industries: it is a necessary mean. However, energy production is one of the main contributors to the release of greenhouse gases, especially carbon dioxide. At the moment the primary source of energy comes from fossil fuels, which profoundly affect the environment. We still rely on fossil fuels because of their low costs, as well as the inefficiency of alternate sources and their high costs.

Nowadays, there exist many alternate sources such as wind, solar, hydropower, and geothermal. However, these sources are often expensive and do not produce enough energy to cover a large area. Therefore, it is imperative that in the following decades, as scientists we figure out methods to enhance our energy production using renewable resources.

One of the main challenges is to change people's perspectives towards solar power because people often believe that is extremely expensive and hence not worth the investment. Even though this might be true at a certain point, it is essential to find ideas that both improve the efficiency of the solar panels and reduce the costs. The most common issue with solar panels is that they have a unique orientation, which diminishes their efficiency in a sizeable portion of the day.

The rationale for the proposed solution

In order to maximize the efficiency of a solar panel, the implementation of artificial intelligence is crucial. An outstanding thought-out addition of AI could allow the solar panel to track sunlight throughout the day, which could maximize its exposure to the sun. However, to implement AI, it is crucial to connect the solar panel to a pair of, strategically placed, servomotors – managed by an Arduino.

The Arduino programming language must be used to program the algorithm because of its simplicity as well as low cost. The algorithm embedded in the Arduino must analyze the amount of light sensed by solar sensors. After analyzing the light perceived by the four light sensors, strategically placed, the servomotors will move for the solar panel to rotate to the position where it maximizes its exposure to light.

Success criteria

- The solar panel alone is functional.
- Implementing the servomotor.
- The light sensors perceive the amount of light.
- The program can analyze the data delivered by the sensors.
- The program instructs the servo motor to rotate according to the information previously analyzed.
- The solar panel successfully tracks the sun.

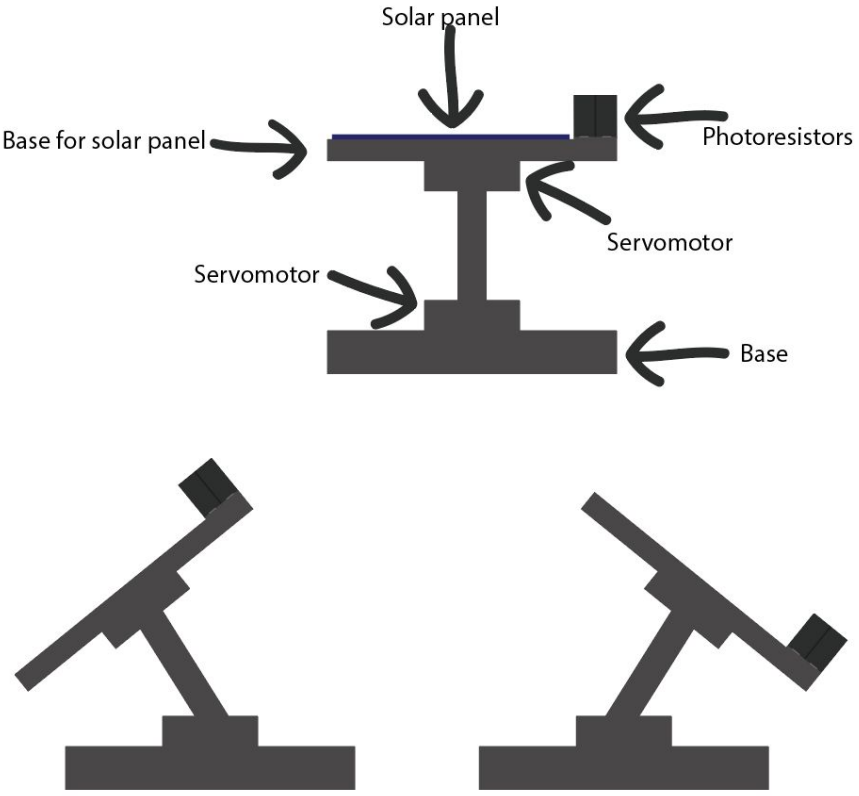
Criterion B: Solution Overview

# Task	Planned action	Planned outcome	Time estimated (days)	Completion date	Criterion
1	Talk to an expert in the field.	After talking to the expert, I had a clearer idea of how to accomplish the project.	1	23 October 2018	A
2	Research how to program the necessary algorithm, and learn a new programming language if needed.		1	30 November 2018	A
3	Begin the programming process.		2	1 December 2018	A
4	Design the solar panel.		2	30 December 2018	B
5	Research how to transfer the obtained energy from the solar panel.		3	10 January 2018	B
6	Plan the connection		3	15 January	B

	between the base, servomotor, and solar panel.				
7	Make a list of materials needed.		10	16 January 2018	B
8	Plan the process of constructing the solar panel.		15	25 January 2018	C
9	Start developing the solar panel.		20	27 January 2019	C
11	Connect the solar panel with an electronic device.		2	20 February 2019	C
12	Talk to an expert in solar panel to analyze the functionality of mine.		1	25 February 2019	D
13	Ask for the evaluation of my computer science teacher.		1	27 February 2019	E
14	Analyze possible improvements.		3	28 February 2019	E

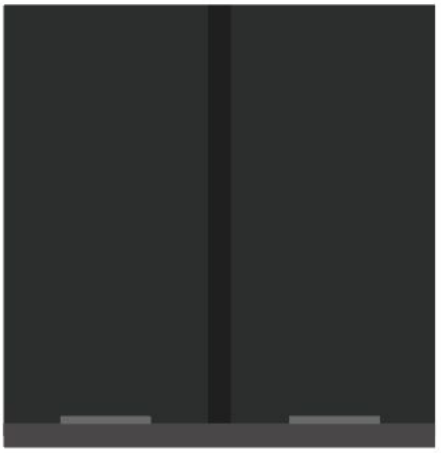
Criterion B: Design

Solar panel with different positions

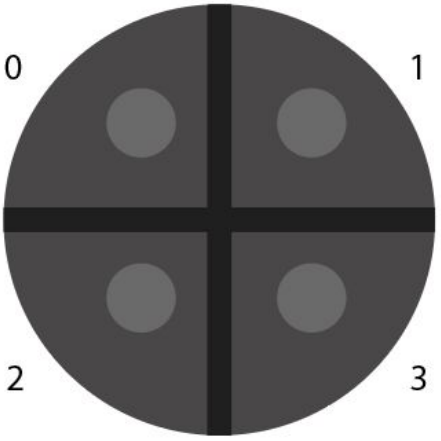


Photoresitors

Front view



Top view



Algorithm structure

Initial variables

Set the initial angle of the vertical servomotor

Set the maximum angle of the vertical servomotor

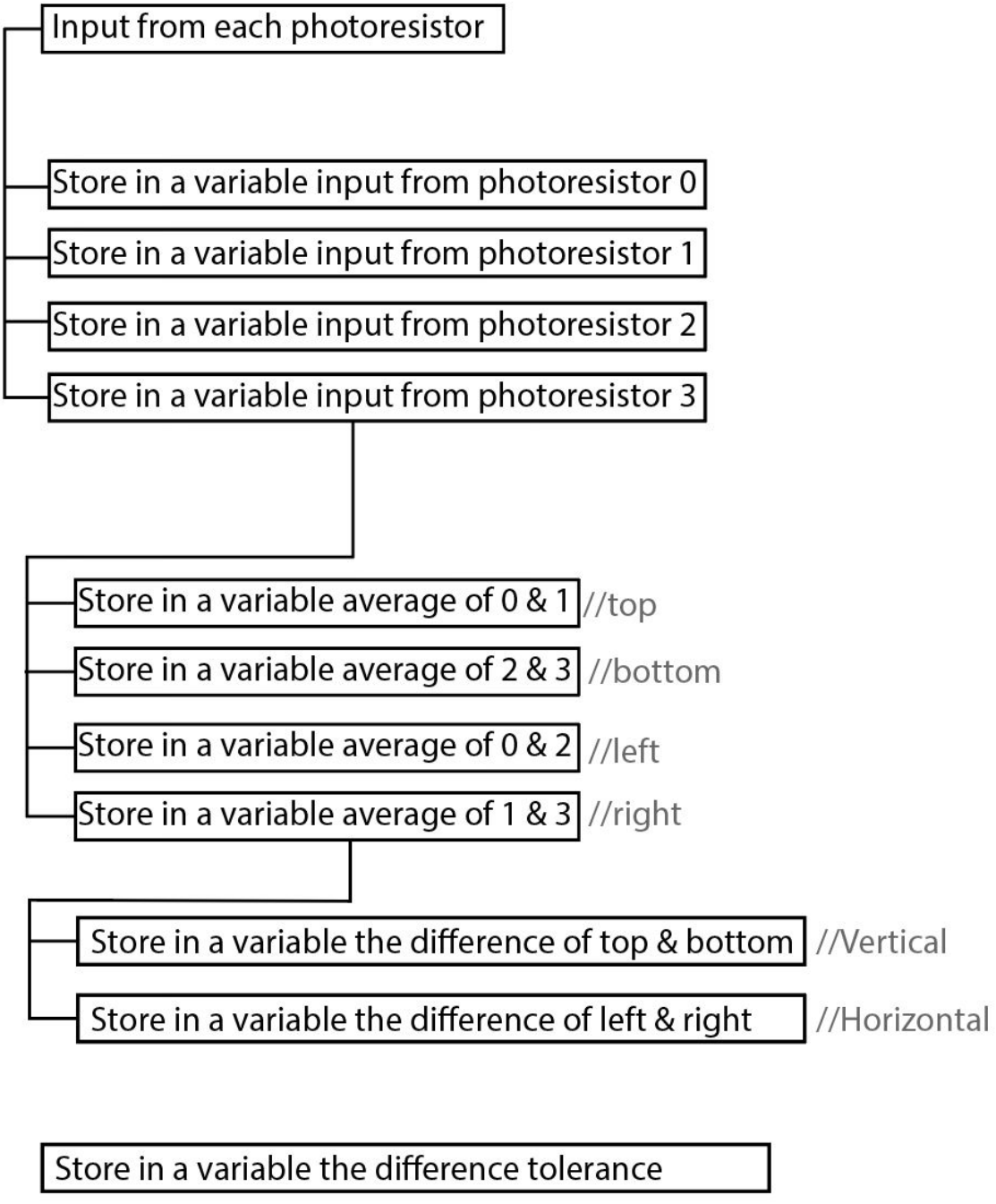
Set the minimum angle of the vertical servomotor

Set the initial angle of the horizontal servomotor

Set the maximum angle of the horizontal servomotor

Set the minimum angle of the horizontal servomotor

Loop starts


Input from each photoresistor
Store in a variable input from photoresistor 0
Store in a variable input from photoresistor 1
Store in a variable input from photoresistor 2
Store in a variable input from photoresistor 3
Store in a variable average of 0 & 1
//top
Store in a variable average of 2 & 3
//bottom
Store in a variable average of 0 & 2
//left
Store in a variable average of 1 & 3
//right
Store in a variable the difference of top & bottom
//Vertical
Store in a variable the difference of left & right
//Horizontal
Store in a variable the difference tolerance

//The tolerance must be both positive and negative for it to have a range

- Check if the vertical difference is within the tolerance //if false
  - Check if top > bottom //if true
    - Increase the vertical angle
    - Check if vertical angle has reached maximum //if true
      - Vertical angle = vertical maximum
  - Check if top < bottom //if true
    - Decrease the vertical angle
    - Check if vertical angle has reached minimum //if true
      - Vertical angle = vertical minimum

- Check if the vertical difference is within the tolerance //if false
  - Check if left > right //if true
    - Decrease the horizontal angle
    - Check if horizontal angle has reached minimum //if true
      - Horizontal angle = horizontal minimum
  - Check if left < right //if true
    - Increase the horizontal angle
    - Check if horizontal angle has reached maximum //if true
      - Horizontal angle = horizontal maximum

Loop ends

https://www.instructables.com/id/How-To-Build-A-Solar-Panel/

https://www.youtube.com/watch?v=_L3XTe7chaQ

https://www.wikihow.com/Build-a-Solar-Panel

https://create.arduino.cc/projecthub/kutluhan-aktar/light-intensity-and-solar-panel-energy-detector-c2bb5d?ref=platform&ref_id=424_trending___&offset=6

https://blog.udemy.com/arduino-ldr/

https://www.youtube.com/watch?v=_6QIutZfsFs
https://browndoggadgets.dozuki.com/Guide/Dual+Axis+Solar+Tracker+2.0/14?lang=en