# OUC Solar Structure
# Group #9

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The OUC Solar Structure project will be sponsored by Orlando Utilities Commission. This multidisciplinary project will combine Mechanical, Electrical, Computer Engineering majors as well as Visual Art majors. The electrical and computer section of the project will be advised by Dr. Lei Wei and Dr. Samuel Richie. Engineers from Orlando Utilities Commission will also act as advisors and partners in the project.

## Project Description:

Solar energy derived from photovoltaics is a sustainable energy source that has recently become cost-efficient on-par with conventional energy sources, but without the carbon emissions that contribute to global warming. However, one of the disadvantages of using photovoltaics is the perceived notion that the resulting object will be ugly or lack aesthetic appeal. Photovoltaic panels may be used to express art while advocating for clean technology. In places like the Austrian town Gleisdorf and Chinese city Dezhou, photovoltaic structures are altering the landscape. These structures, from street lighting to solar trees, are meant to encourage environment-friendly energy sources that aid the main grid as well as being aesthetically pleasing.

Photovoltaic structures placed in highly populated locations is a start towards normalizing green energy. These structures would be symbols of humanity's initiative to care for mother nature. Being that photovoltaic technology can be considered modern/futuristic, customers will support a progressive entity investing in these structures while probably receiving governmental aid such as state or federal tax credits. Structures that share the same objective and goal as our project, that demonstrate a physical definition of our project description, are becoming more and more popular(Fig. 1).

Project OUC Solar Sculpture will be designed with the goal of combining beauty in an artistic sense and energy-efficient/saving technology (solar power) while maintaining an appealing visual to promote more people to the idea of switching to energy-efficient/saving structures as well as feeding green energy into the main grid. The prototype will be designed to be a scaled model of a sculpture that can compete with other models and be put on display in the Orlando City soccer stadium. The prototype should be able to survive the Central Florida environment, be oriented for efficient solar angle/orientation, provide a visual display (via UI or some form) of the estimated solar energy produced, and will abide by the Florida Building and Electric Codes.

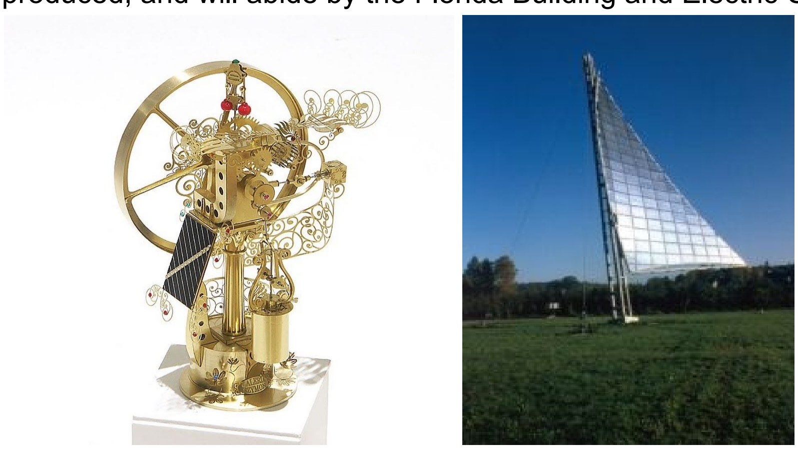


Figure 1. Structures that exemplify the intersection of photovoltaics and aesthetics.

## Block Diagrams

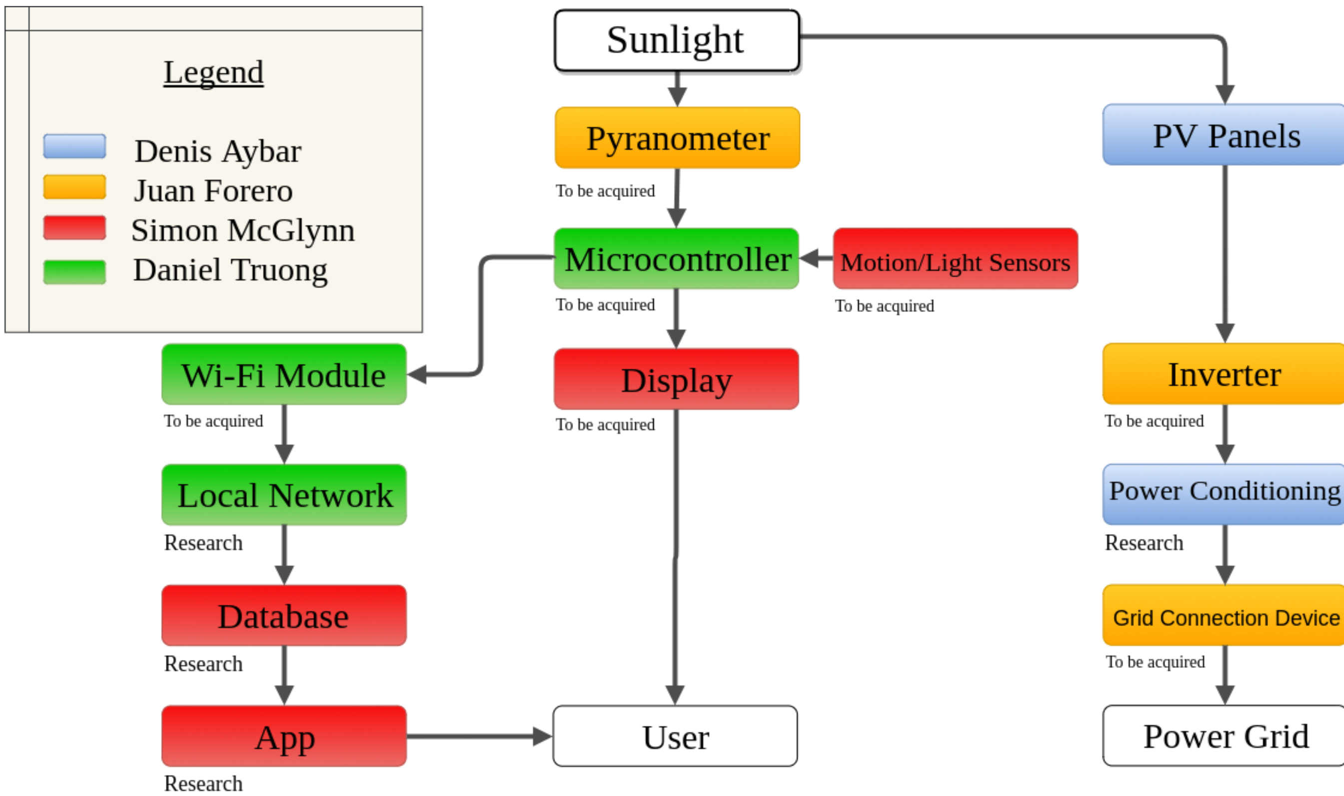



Figure 2. Block diagram of hardware requirements of project and relationships between each component, as well as team member responsible for the execution of each part.

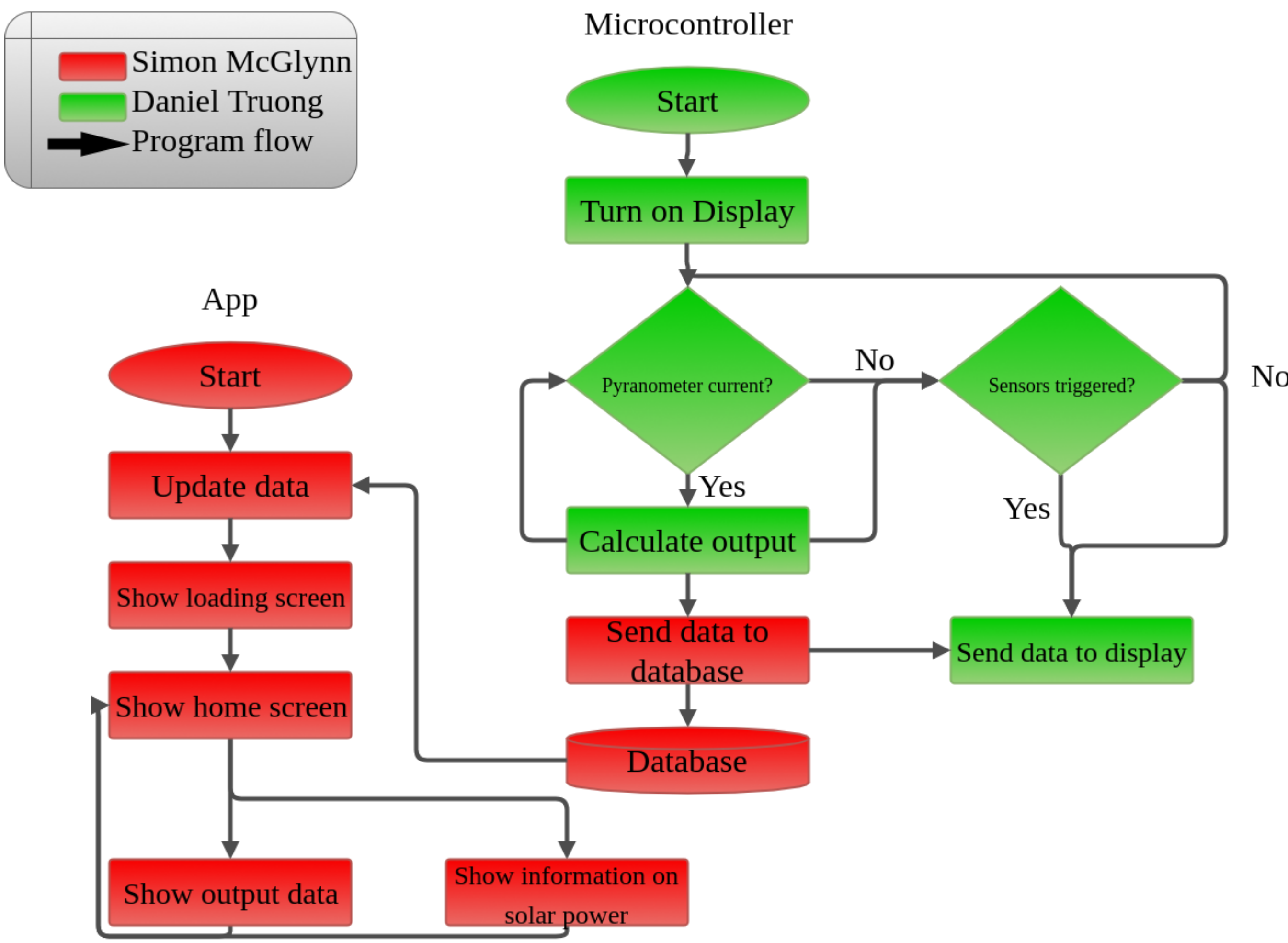


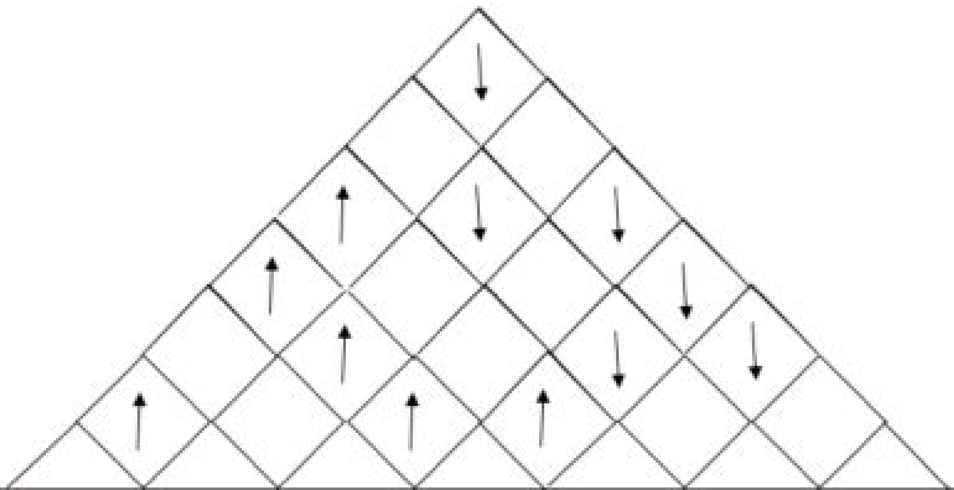

Figure 3. Block diagram of software flowchart.

## Project Requirements/ Constraints:

Table 1. The constraints of the project given by the sponsor as well as the physical constraints of some of the parts used.

| Item | Requirement/ Constraints |
|---|---|
| PV Panel Power | Minimum 850 kWh annual output |
| Statue Height | 5 to 15 feet |
| Statue Diameter | 2 to 8 feet |
| PV Panel Orientation (Spring) | 62-86° |
| PV Panel Orientation (Summer) | 62-86° |
| PV Panel Orientation (Fall) | 38-62° |
| PV Panel Orientation (Winter) | 38-62° |
| PV Panel Weight | 20-50 lbs |
| PV Cell | 156 $mm^2$ |
| Structural Integrity | Withstand Central Florida environment |
| Efficiency Percentage | 10-14% |
| Budget | Between $1000-$2000 |
| Malleability | Depends on Design (0-10%) |
| Distance between PV Panels | Depends on Design (0-6 inches) |
| Solar Inverter Efficiency | 80-90% |
| Solar Inverter Output Power | 300W |
| Accepted Standards | Florida Building and Electric Codes |

## House of Quality:



| | | Angle | Efficiency | Dimensions | Power Output | Inverter Efficiency | Microcontroler | Abide by Accepted Standards |
|---|---|---|---|---|---|---|---|---|
| | | + | + | + | + | + | + | - |
| 1) Panel Efficiency | + | ↑ | ↑↑ | ↑ | ↑↑ | | ↓ | ↓ |
| 2) Aesthetics | + | | ↓↓ | | ↓ | | ↑↑ | ↓ |
| 3) Durability | + | ↓ | ↓ | | ↓ | ↓ | ↓ | ↑ |
| 4) Costs | - | | ↓ | ↓ | ↓↓ | ↓ | ↓ | ↑ |
| Targets For Engineering Requirements | | 62°-86° | 10%-14% | 5'-15' Height<br>2'-8' Diameter | >850KWh/year | 80%-90% | >90 LEDS | UL61215-1, 1741, 2703, 1703, 4730 |

## Costs:

Table 2. An Estimate of the parts required to complete the project and their costs.

| Item | Price | Quantity | Cost |
|---|---|---|---|
| PV Panels | $300 | 2 | $600 |
| Inverter | $150 | 1 | $150 |
| Microcontroller | $40 | 1 | $40 |
| PCB | $20 | 2 | $40 |
| Battery | $62 | 1 | $62 |
| PV Cells | $15 | 4 | $60 |
| LEDs | $5 | 10 | $50 |
| Miscellaneous | N/A | N/A | $600 |
| Total | | | $1602 |

## Project Deadlines/Milestones:

Table 3. Known Senior Design 1 and 2 deadlines and estimates of how long each one will take to complete.

| Senior Design 1 | | |
|---|---|---|
| **Description** | **Duration** | **Dates/Deadlines** |
| Brainstorm Ideas | 1 week | 8/25 - 9/1 |
| Project Selection | 2 weeks | 8/25 - 9/8 |
| Divide and Conquer | 1 week | 9/8 |
| Research and Design Process | 5 - 6 weeks | 9/8 - 10/20 |
| Update Divide and Conquer | 1 week | 9/22 |
| 60 pg Documentation - Draft | 4 weeks | 9/22 - 11/3 |
| 100 pg Documentation | 2 weeks | 11/17 |
| Final Documentation | 2 weeks | 12/4 |
| Order/obtain Parts | 2 weeks | 12/4 |
| **Senior Design 2** | | |
| Attempt to Assemble Prototype | 4 weeks | 1/8 - 2/5 |
| Test Prototype and Research Redesign | 2 weeks | 2/5 - 2/19 |
| Modify Prototype | 1 week | 2/19 - 2/26 |
| Testing Phase/Debugging | 1 - 2 weeks | TBD |
| Finalize Prototype | TBD | TBD |
| Final Report | TBD | TBD |
| Presentation | TBD | TBD |

Sources/ References: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