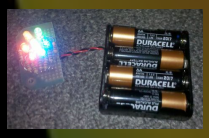
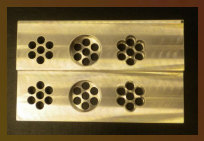
P11543: Variable LED Hemispherical Imager

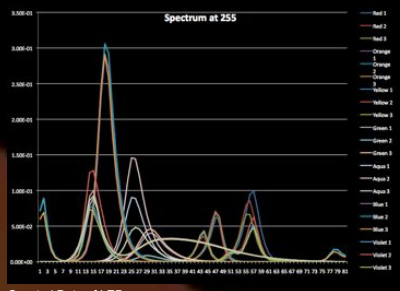
Objective Design a test platform that can control clusters of LEDs placed in various locations on a hemisphere in order to test the reflectance of various materials.

Cluster

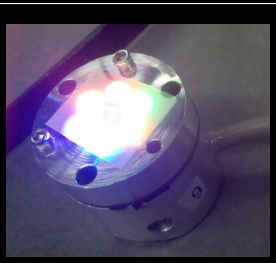
The cluster incorporates a selection of seven user replaceable 5mm LEDs, a reflector to focus the light, and provides an interface to the hemisphere. The perimeter LEDs are chosen to cover the entire spectrum of visible light; wavelength ranges from 380nm to 700nm. The Cluster utilizes magnets to mount to the dome.

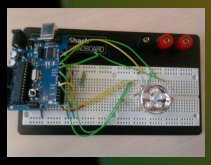

Cluster Prototype #1


Different Reflector Designs

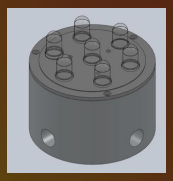


Spectral Data of LEDs


Cluster with Diffuser (on)


Cluster Prototype #2 with Arduino


Unpopulated Printed Circuit Board


Cluster Housing CAD Model


Final Reflector

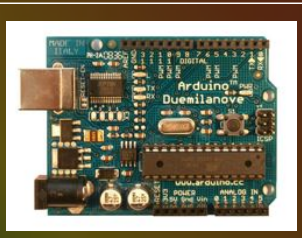

Cluster with Cable (on)

Controls

The LEDs are individually controlled using an Arduino Duemilanove microcontroller via MATLAB. This allows for varying intensities of each LED. The controls are connected to the cluster with a cable harness.

```
>> DomeInit(): % Establishes communication with Arduino
>> DomeSet(a,b): % Selects Arduino 'a' and passes intensity vector 'b'
to selected cluster.
>> DomeClose(): % Ends communication with Arduino
```

MATLAB Code Used to Control Clusters



Arduino Microcontroller

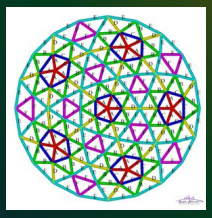

Black Box

Geodesic Dome

The geodesic dome is one meter in diameter and made out of steel struts of varying lengths, which are bolted together at the vertices, which serve as mounting points for the clusters.

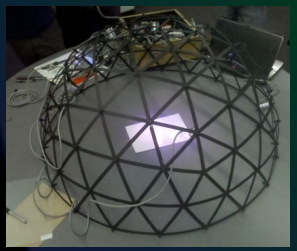

3V Octahedral Prototype


2V/L2 Icosahedral Prototype


4V Octahedral Assembly Diagram


Final Geodesic Dome with Clusters Illuminating Sample Area


Assembled Geodesic Dome


Finished Geodesic with Clusters Attached

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