Earth's Seasonal Heat Absorption and Climate Regions A SMART demonstration project.

By: J. Renna, A. Lincoln H.S., Brooklyn

and

R. Vera, IS 125, Woodside.

Project Outline:

- Helping students to understand basic Earth Science concepts
- Goals
- Materials
- How did we build the Earth-Sun model?
- Circuit board and sensors
- The model in the classroom
- Results and Conclusions
- Acknowledgements

Helping students to understand basic Earth Science concepts:

It has been estimated that 1,000 times more energy reaches Earth's surface from the sun each year than could be produced by burning all the fossil fuels mined and extracted during that year.

Although this may seem easy to understand, it is difficult to explain what are the factors participating and how they impact the absorption of heat by the Earth and the existence of different climate regions.

Regularly, students perform experiments that use conventional thermometers at different angles but, they lack a globe model specifically designed to understand how the shape of the earth, the distance from the Sun, and Earth's tilted axis, all play a role at how our planet absorbs heat, and how this phenomenon defines the existence of different climate regions.

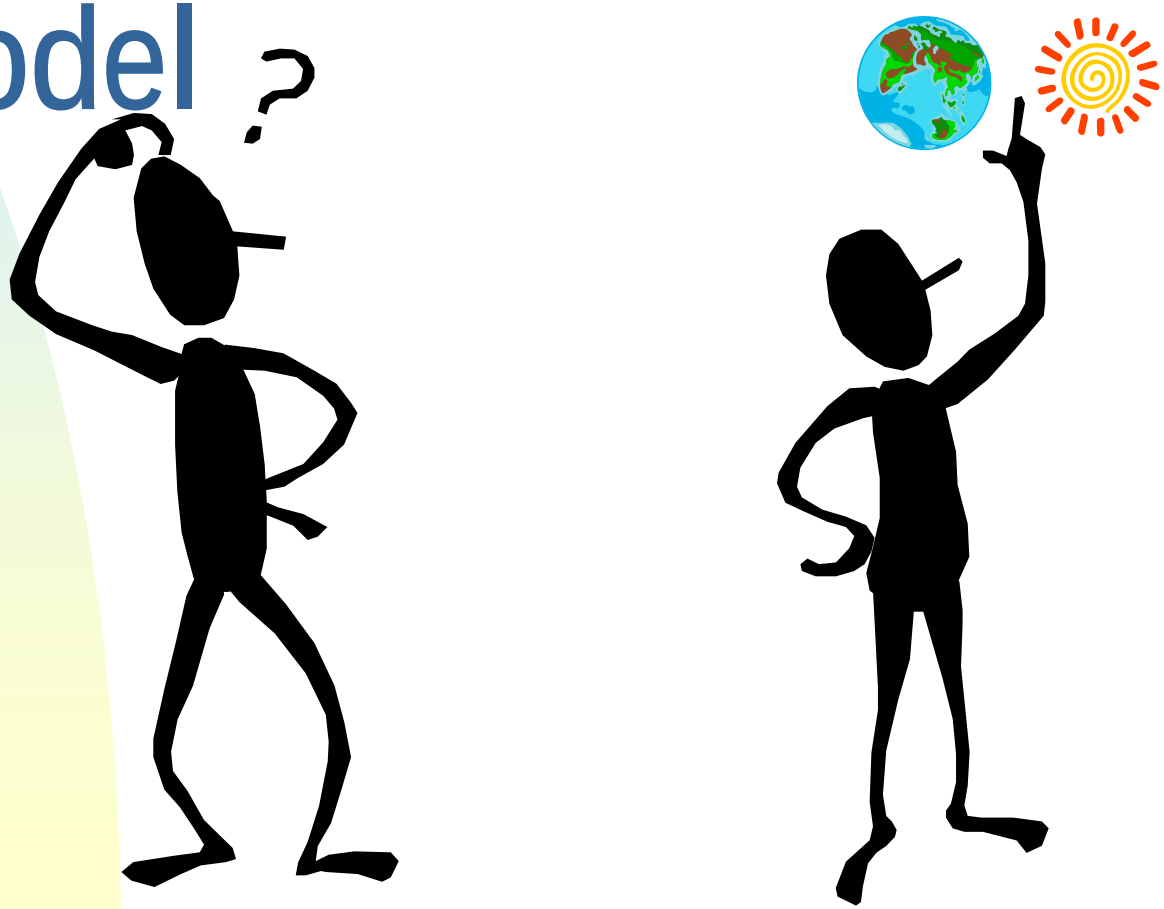
Goals:

- To help students to understand and apply Earth Science concepts related to our planet and the way heat is absorbed and distributed all over the Earth
- To understand what are climate regions, and how they are affected by the shape of the Earth and the seasonal absorption of heat
- To engage students by using a mechatronics Sun-Earth model in classroom activities

Materials Used:

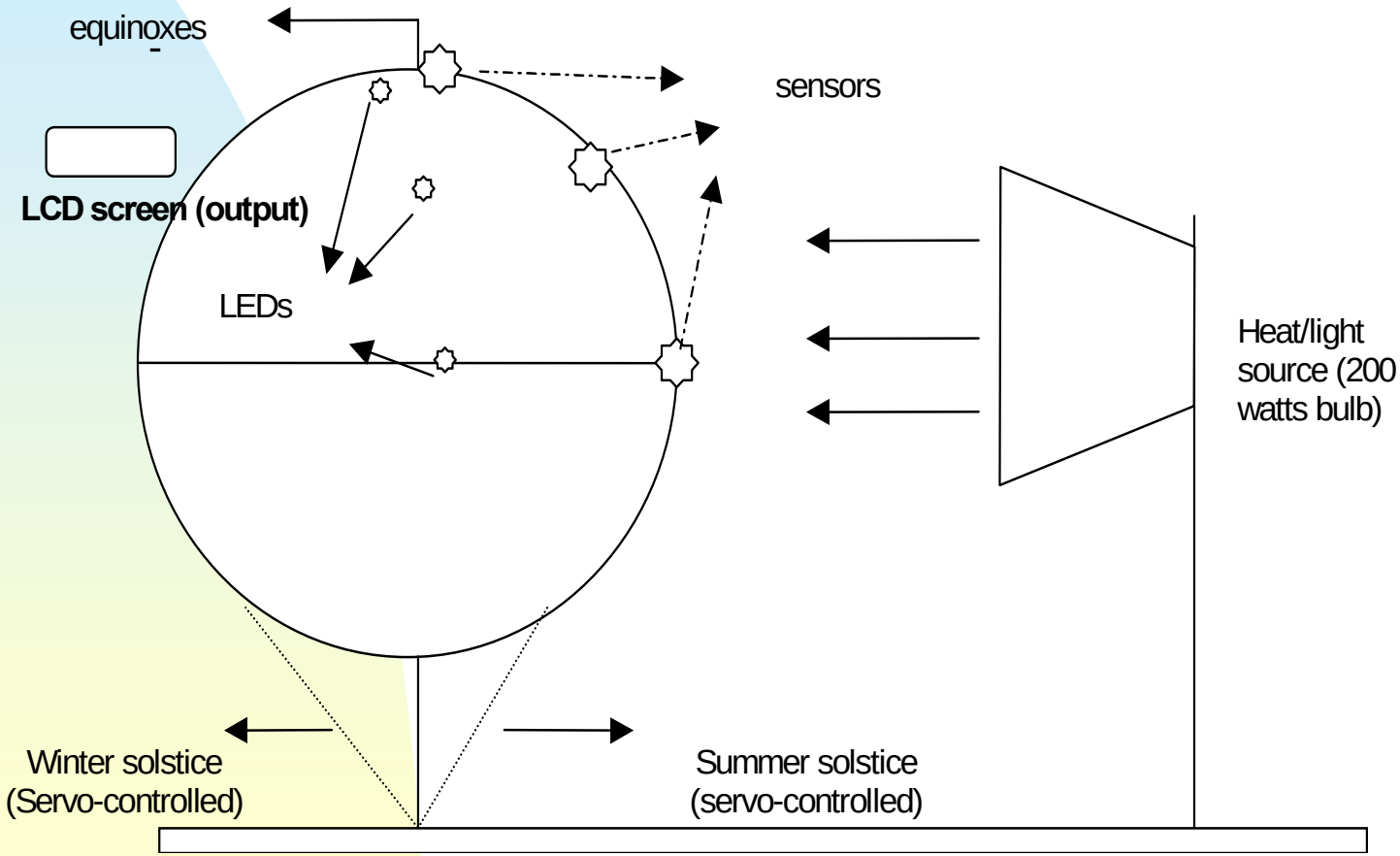
- 3 AD592 analog temperature probes
- 3 resistors (100 Ω)
- 3 resistors (470 Ω)
- 1 resistor (220 Ω)
- 1 potentiometer (100 kΩ) with plastic knob
- 1 circuit board
- assorted electrical wires
- 15 pin female connector
- 1 servo motor
- 4 capacitors (0.22 µF)
- 1 lamp with cover (200 watts)
- 1 ring stand
- 1 plastic sphere or Earth's model
- 1 steel bar (1/4')
- 1 plexiglass sheet
- 1 serial LCD screen (16 x 2)
- 1 protractor
- epoxy glue
- Basic Stamp software

How did we build the Earth-Sun model ?

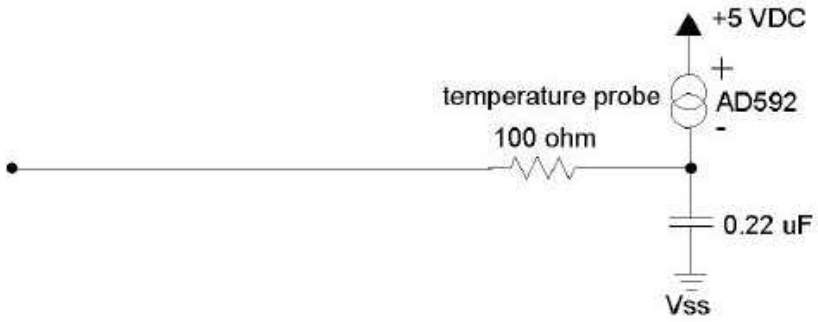


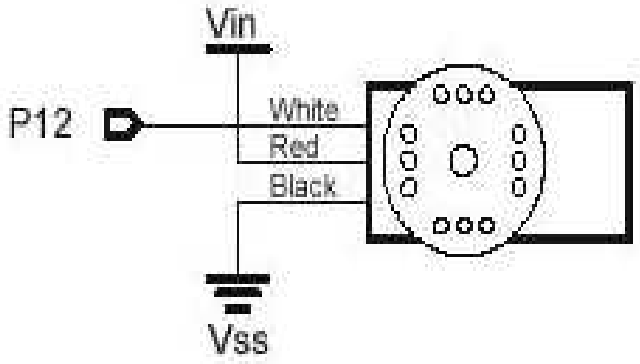
Model diagram concept

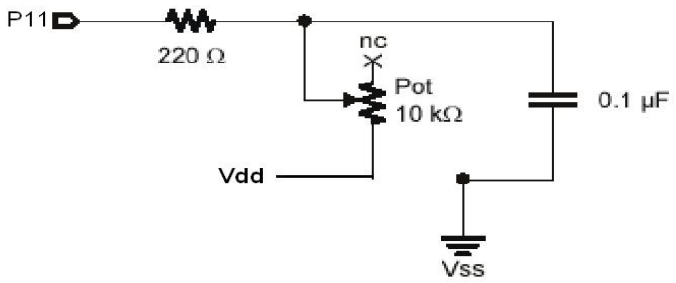
Model diagram.

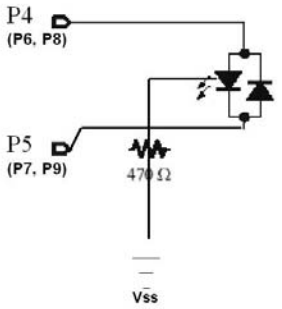


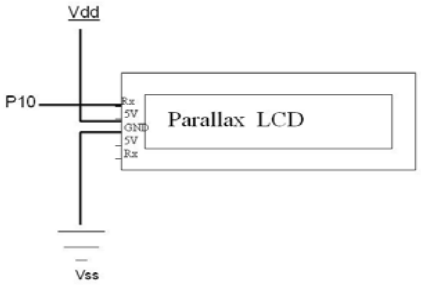
Circuit diagrams:



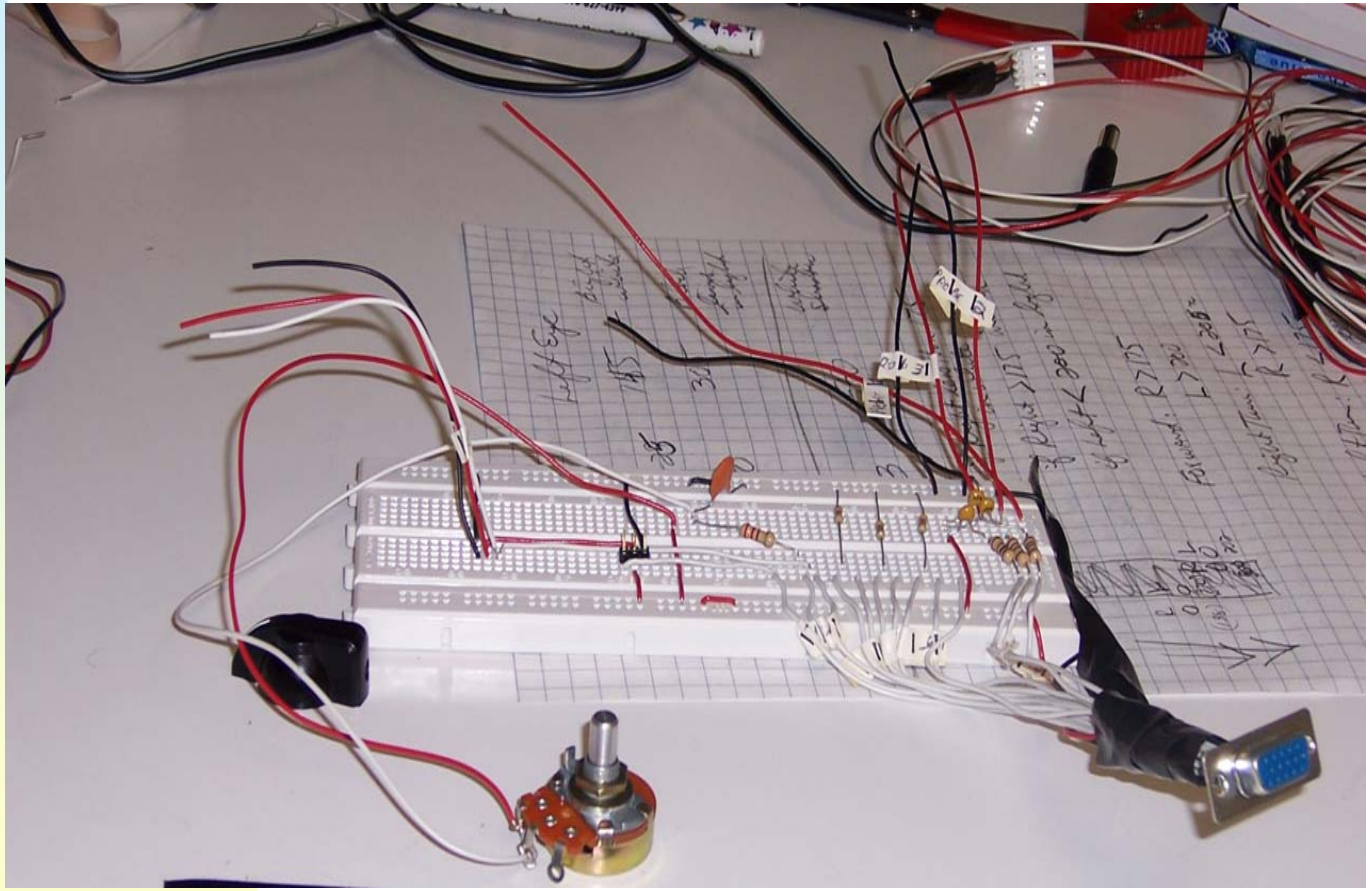




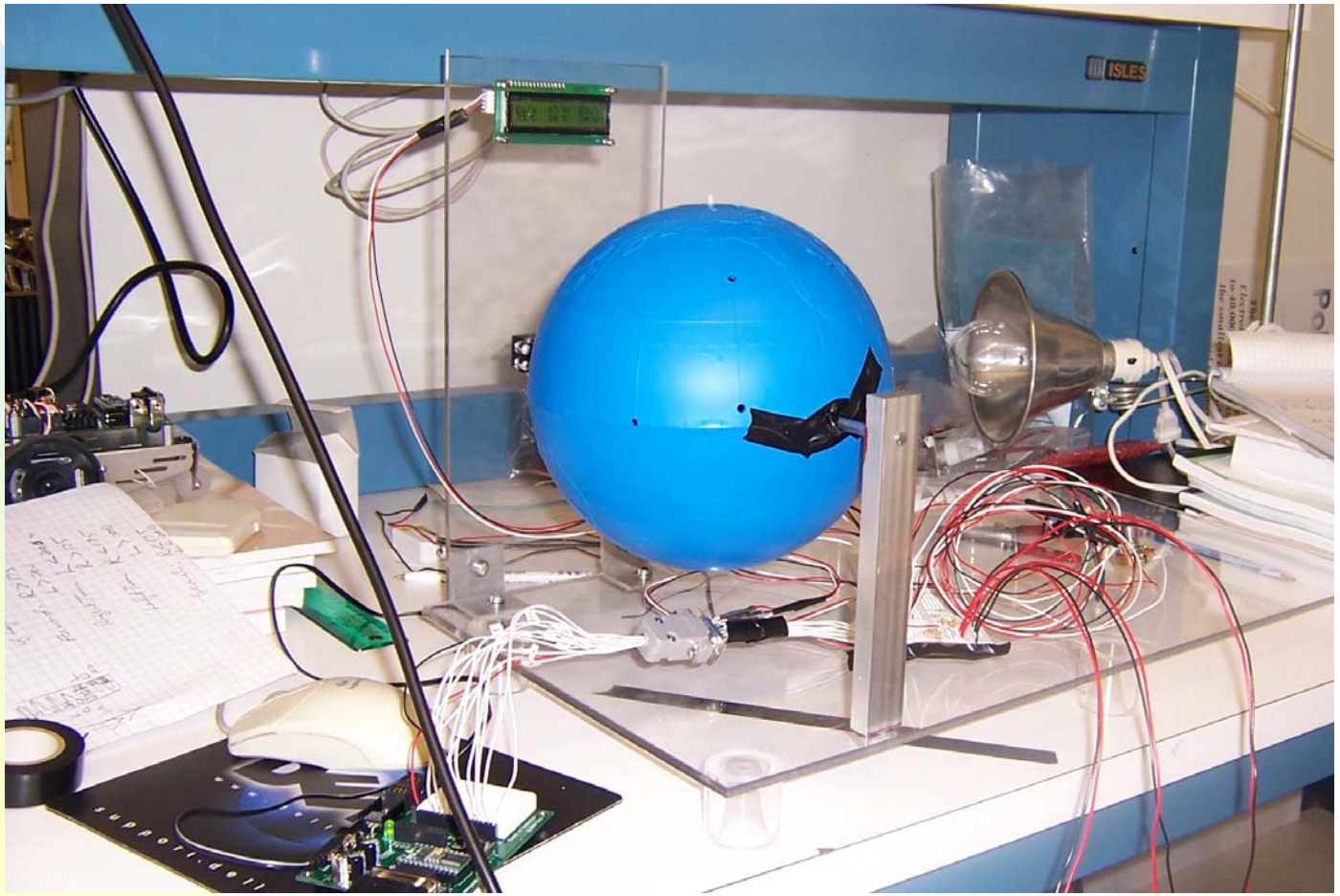




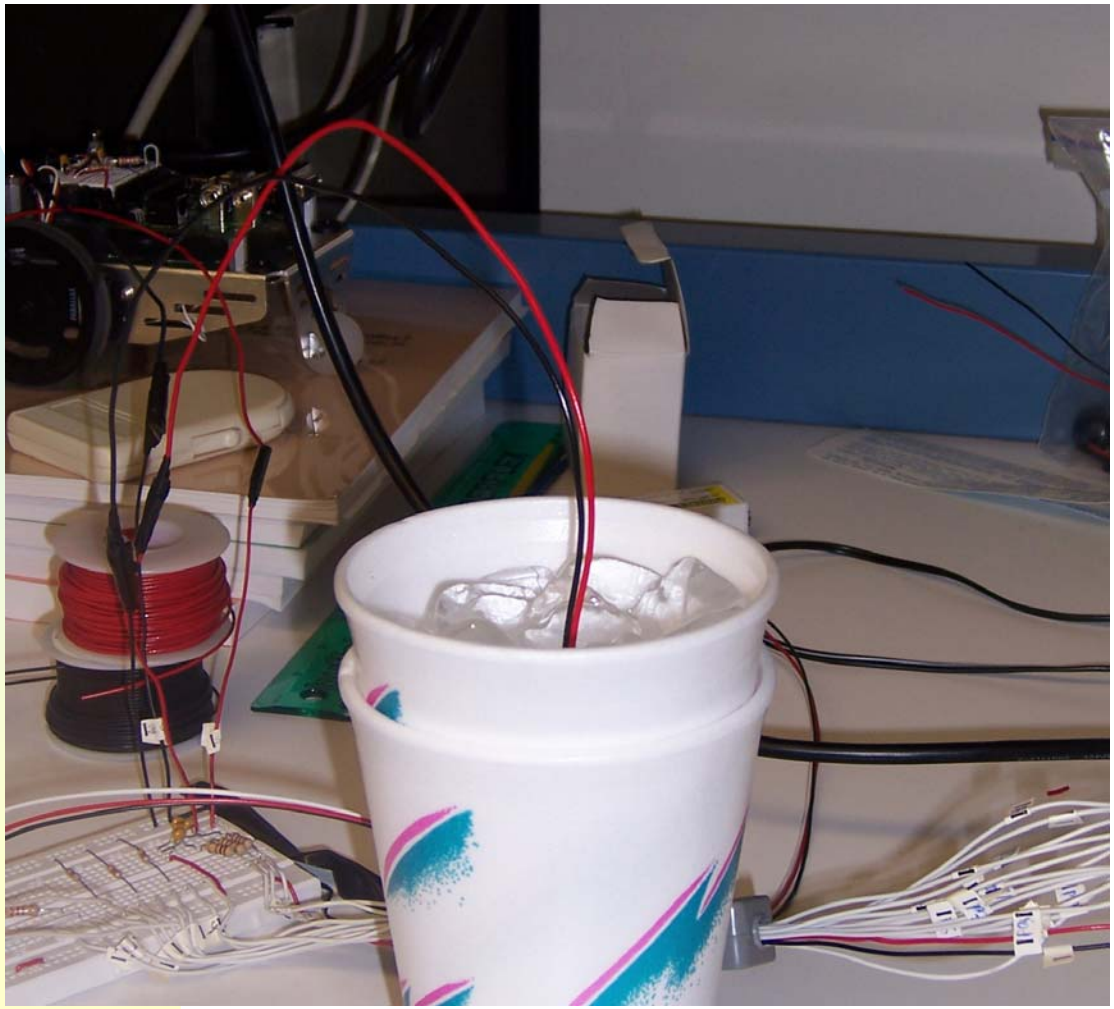
Circuit board with potentiometer and 15 pin connector



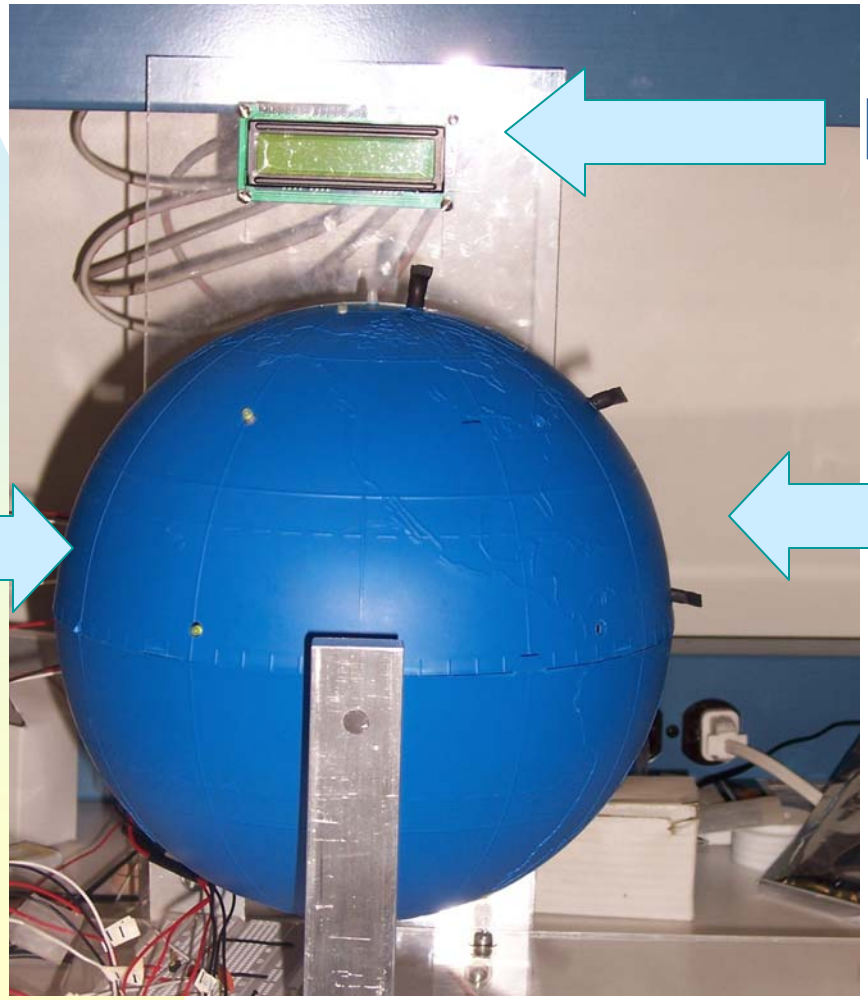
Assembling the prototype



Calibrating the AD592 temperature sensors



Side view of prototype with LEDs and sensors installed

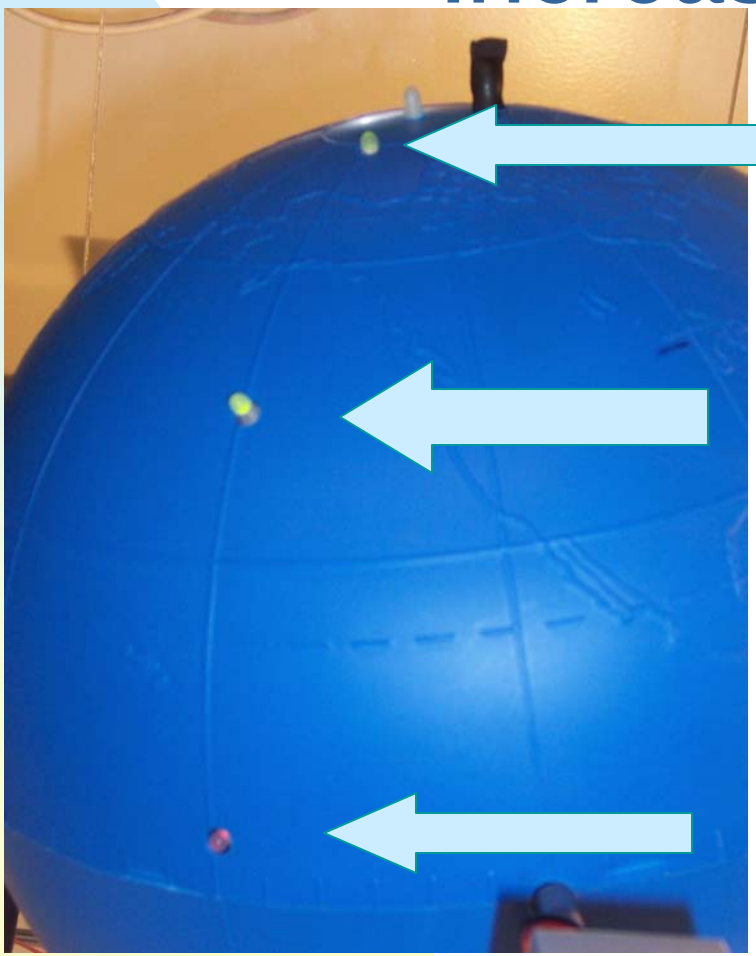


LCD Screen

LEDs

AD592 sensors

LEDs change color as difference in temperature increases

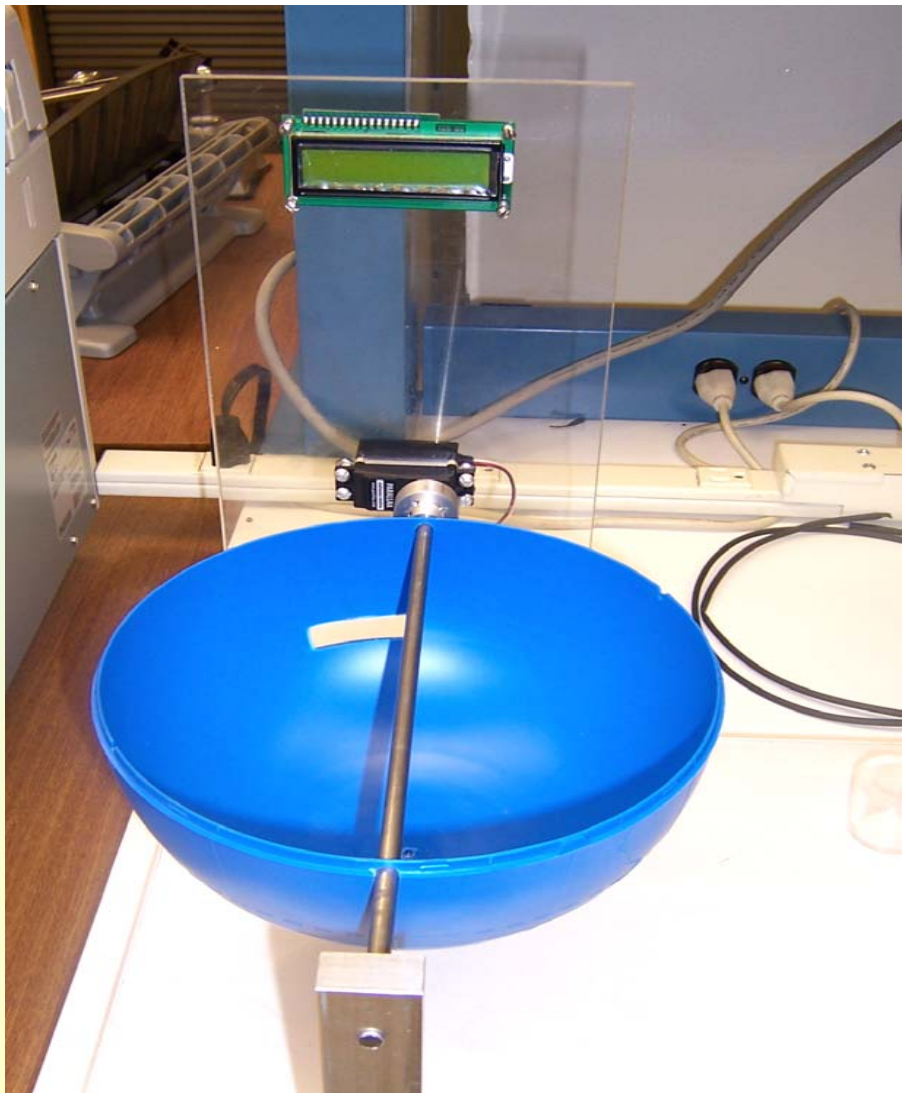


Polar region (90° North)

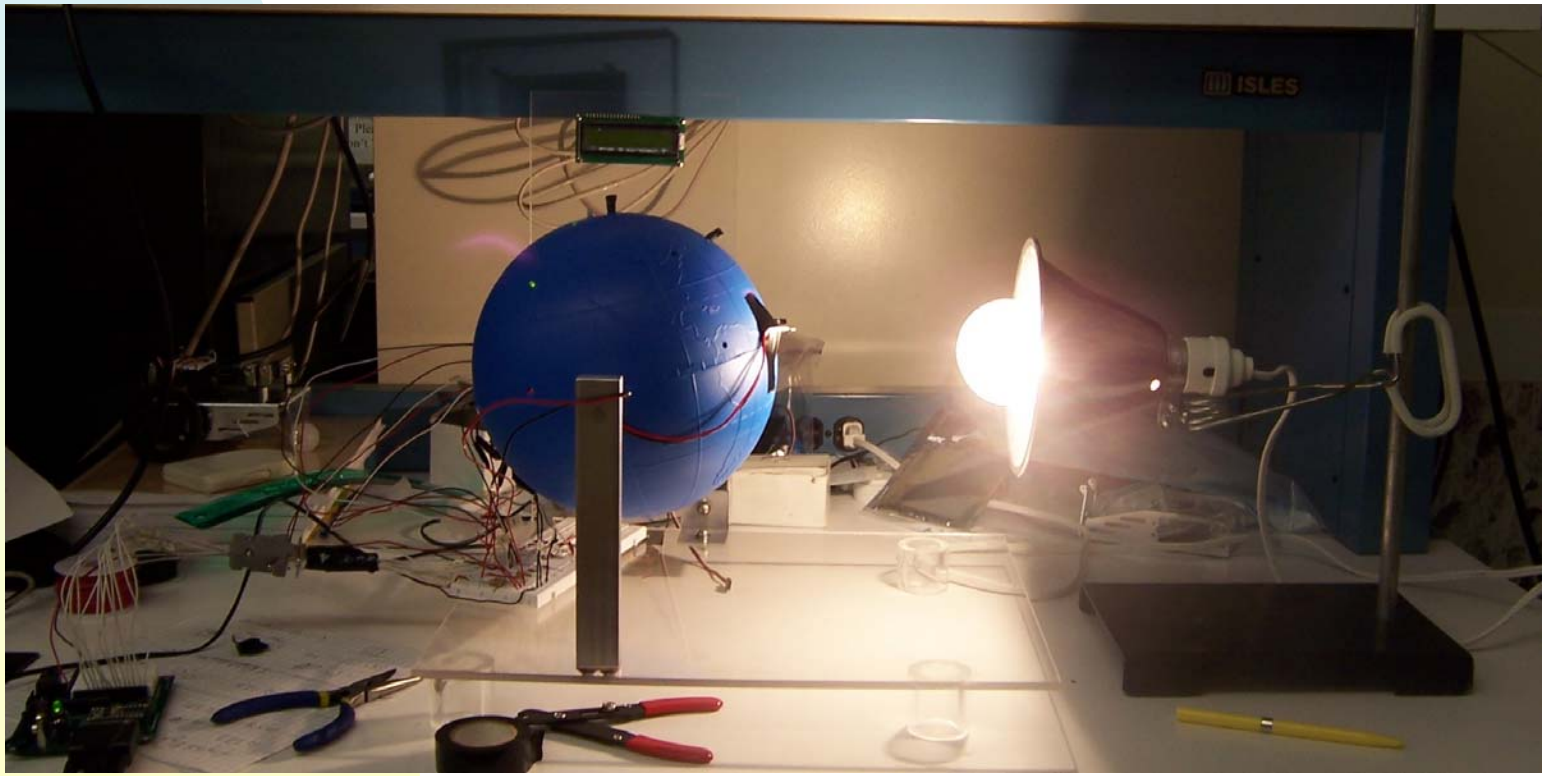
Middle latitude(45° North)

Tropical region (equator)

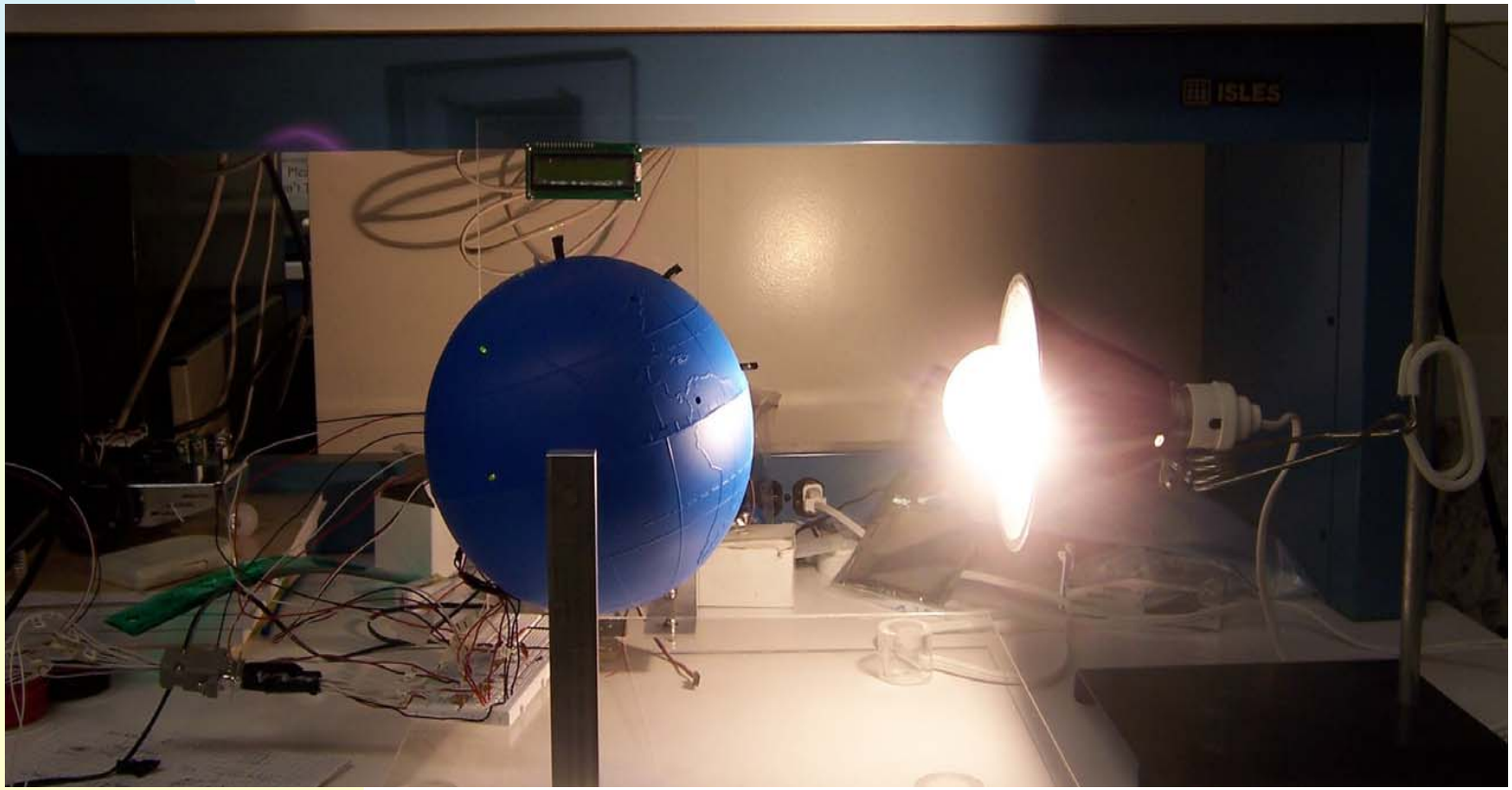
Servo motor for season's settings



Model in the classroom, Equinox setting:
solar noon at the equator



Model in the classroom, Solstice setting:
solar noon at Tropic of Capricorn



Results and Conclusions

- The Earth-Sun insolation model effectively shows the differences in heat absorption at three latitudes set in the Northern Hemisphere
- The differences among the AD592 probes' readings make it easier for students to understand climate regions and factors affecting heat absorption and distribution.

Acknowledgements

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