The goal of the project is to create an automated microclimate system which recreates any given ecosystem in real time. The ecosystem is controlled with a Raspberry Pi and the program is written in Python. The user is able to give the program a given weather station ID associated with Weather Underground, which the program then pulls the HTML code from the website providing the program with the real time weather information for that particular station. The program then processes the data and pulls the information wanted, like current temperature, solar radiation, hourly precipitation, and daily precipitation. The focus of the project as of now is mimicking solar radiation. The environment will be equipped with a semiconductor photodiode sensor which will give off a voltage proportional to the amount of energy given off by the light source. To create the scale of voltage versus light, data is collected with the photodiode sensor in the vicinity of a weather station which reports solar radiation. The data from the weather station and the data from the sensor can then be analyzed to create this scale. With this information, the program will then be able to take in the data from the weather station and adjust a light source to give off the correct amount of energy, matching the real time conditions. By creating a real time automated microclimate ecosystem, it can allow the user to recreate an environment and observe the subject that is being studied in its natural habitat from anywhere in the world.

Components

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raspberry Pi 3</td>
<td>VTB Photodiode</td>
</tr>
<tr>
<td>CdS Photoresistor</td>
<td>LMC6942 – Operational Amplifier</td>
</tr>
<tr>
<td>MCP3008 – ADC Chip</td>
<td>Software: Python</td>
</tr>
<tr>
<td>LM385 – Voltage Reference Diode</td>
<td></td>
</tr>
</tbody>
</table>

Future Improvement

The project at hand allows for many improvements. The ultimate goal is to create an automated microclimate ecosystem. Weather Underground provides many weather variables from locations all across the globe. By utilizing the data that is available it is possible to mimic all variables. On the top of the list of improvements is the addition of temperature sensors and a heat lamp to be able to mimic the actual temperature changes in real time.

ACKNOWLEDGEMENTS

- Weather Underground – weatherunderground.com
- University of Central Arkansas Department of Physics and Astronomy
- K. A. Nicol, R.G. Harrison. Balloon-borne disposable radiometer for cloud detection. Department of Meteorology, University of Reading. 21 February 2012

ABSTRACT

The light intensity is measured with a photodiode within a voltage divider circuit and a photodiode. As the light intensity increases, the voltage across the photodiode decreases and the voltage across the photodiode increases. Figure 1 depicts the circuit that is used to measure light intensity from both sensors.

Real Time Data Collection

Weather Underground is used to collect real time data for the selected area. The data collected was from a weather station located in Conway Arkansas that reports solar radiation (W/m²).

The user is able to input a specific weather station into the code, in this case it is the local station KARCONWA57. The program is then able to pull the HTML code associated with the webpage and process the information to pull out the selected data for a given time interval. In this case solar radiation data is being collected but as you can see in Figure 2 that there are many other variables that can be utilized.

The code in Figure 3 below depicts how BeautifulSoup, a web scraping package, is used to collect the data.

```
url = urllib.request.urlopen('http://weatherunderground.com/cond')
content = url.read()
soup = BeautifulSoup(content, 'html.parser')
titles = soup.get_text()
```

The collected data from both weather underground and the photodiode sensor are then transferred into a graphical user interface which updates every time the information is collected as seen in figure 7.