Light Sensor Project Introduction

Clare Barnes and Michael Mitsch

One of the many goals of the International Dark Sky Association and the Forestry department is to monitor light pollution and measure the effects of efforts to lower light pollution in rural areas or forest areas. The current solution does not allow for the data to be collected over long periods of time or time stamp the data it has collected. This makes it difficult to monitor the light in the sky over the entirety of the night, as the amount of light changes over the course of the night. It is also difficult to monitor the exact effects of certain lights, like lights during sporting events, lights during holiday seasons, or the effect of lights when only the routine street lights are on. Being able to monitor the light pollution over long periods of time would help to give a baseline of current pollution so that the forestry department can see whether pollution is improving or getting worse, especially with their efforts to mitigate pollution with solutions like focusing light direction or using light covers.

The main objectives of the system are to be able to measure light frequently, to be able to function for long periods of time without upkeep, to use low power, to not be disruptive to the natural environment, to collect and store some volume of data, and to be easy to use and interact with. The system, in order to be useful, must be weather resistant, have an accuracy of +/- .01 of the light unit of measurement, have a battery life of at least one week (but hopefully several months), not penetrate the ground in it’s deployment, and be able to withstand temperatures of -40 to 105℃.

An existing solution is the Unihedron Sky Quality Meter. This alternative is more expensive than the proposed embedded system above is projected to be, which would make it less accessible to citizen scientists and the Forestry service. This meter also needs human assistance to gather data, and does not time-stamp the data. So while it is a trusted way to gather light data, it can not gather enough data to really do a full analysis of the current state of light pollution. Whereas the data from the proposed system will gather light data over many nights in their entirety, the data gathered from the meter provides a snapshot of one night. Light, even naturally, changes over the course of one night and the pollution could change between nights, so the data from the meter, while accurate, is not very useful for fully understanding the state of our skies.

The embedded system, though, will have many challenges in its development. The main challenges would be making sure that the clock for the system is accurate and does not reset so that the data is time stamped correctly and making sure that the battery is durable and will last for several months. If the battery can not last very long, or the time stamp is wrong, then the device will not be useful enough to usurp the trusted device, Unihedron Sky Quality Meter.