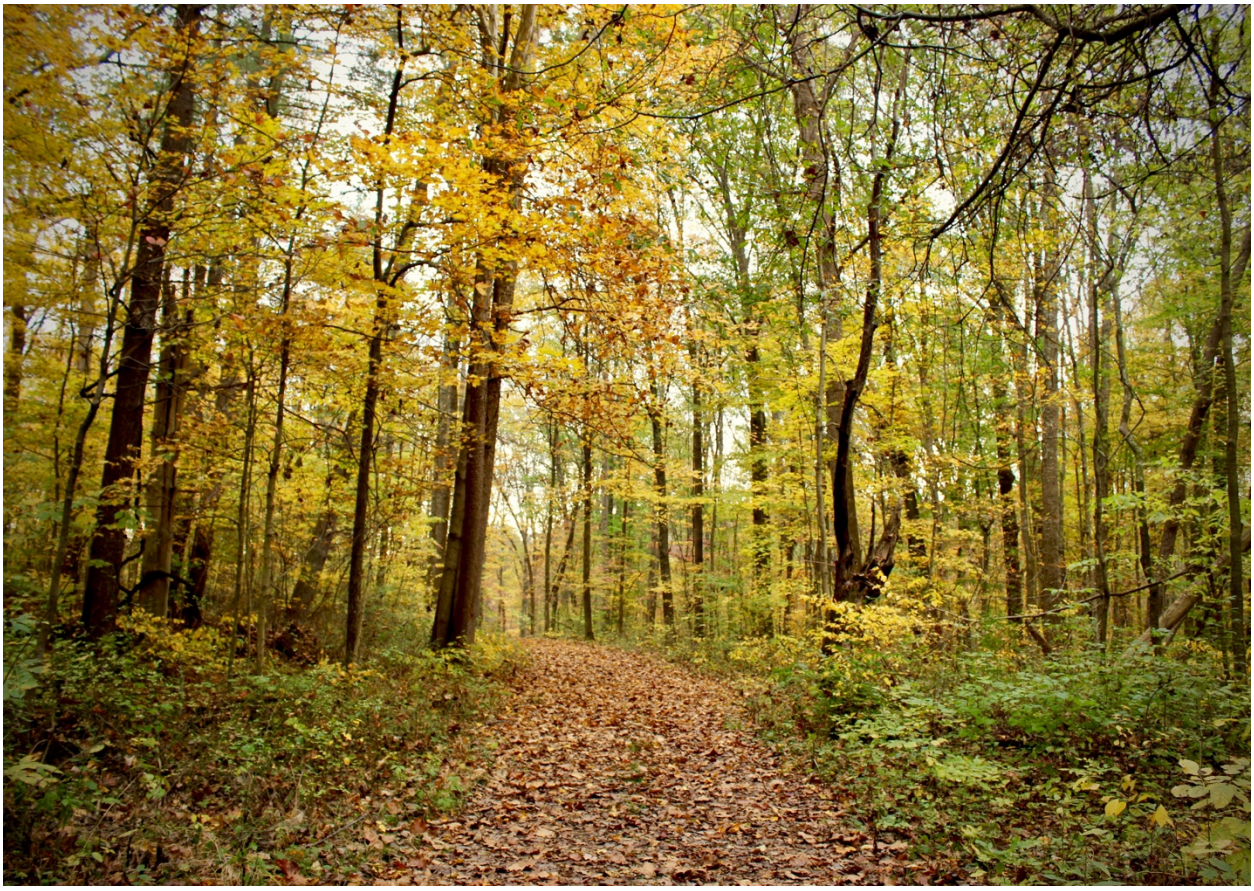
HOOSIER NATIONAL FOREST
DARK SKIES DESIGNATION



SUSTAINING HOOSIER COMMUNITIES

2017-2018

A partnership between CSCI-P442: Digital Systems & the Hoosier National Forest

Table of Contents

Acknowledgements

This project was completed as a collaboration between the students in CSCI-P442: Digital Systems and the Hoosier National Forest as part of the 2017-2018 Indiana University Sustaining Hoosier Communities (IUSHC) initiative. IUSHC is a program within the IU Center for Rural Engagement (CRE).

This report represents original student work and recommendations proposed by the students in CSCI-P442: Digital Systems for the Hoosier National Forest. The contents of this report represent the views of the students in CSCI-P442: Digital Systems and do not reflect those of IUSHC, CRE, Indiana University, Lawrence County, or Hoosier National Forest.

IU Faculty

Bryce Himebaugh, School of Informatics, Computing, and Engineering
bhimebau@indiana.edu

Community Partner

Andrea Crain, Public Affairs Officer – Hoosier National Forest
acrain@fs.fed.us

SUSTAINING HOOSIER COMMUNITIES

About Sustaining Hoosier Communities

Indiana University Sustaining Hoosier Communities is an initiative that partners with a local community within south central Indiana to explore, understand, and resolve challenges and projects identified by the community. Based on a tested model for university/community engagement that has been successfully implemented by over 25 universities and their community partners, Sustaining Hoosier Communities is a yearlong collaboration between Indiana University and a single community partner.

Indiana University's faculty who opt in to Sustaining Hoosier Communities match their courses to the projects based on their areas of research, expertise, and teaching. Each course uses a cross-disciplinary approach to explore and solve sustainability issues identified by the community partner through project-based research. Faculty and community stakeholders agree before classes begin on a scope of work and deliverables for each class, and project liaisons are identified by the community and the university to coordinate this unified effort.

Sustaining Hoosier Communities is just one example of many types of community engagement Indiana University plans to pursue as part of the Center for Rural Engagement. By harnessing the research, expertise, energy, and service of Indiana University's faculty, staff, and students, Indiana University and our local partners work collaboratively to improve the health, prosperity, and vitality of southcentral Indiana.

To learn more about IU Sustaining Hoosier Communities, visit **www.shc.indiana.edu**.

To learn more about the IU Center for Rural Engagement, visit **www.rural.indiana.edu**.

Sustaining Hoosier Communities Project Process

About the Course

CSCI-P442: Digital Systems equips students with the tools, techniques, and approaches to design a low-power, wireless, embedded system based on provided design constraints and specifications. Students were partnered with the Hoosier National Forest to design a system to track light pollution that would simultaneously satisfy the requirements for an International Dark Sky Park designation. An International Dark Sky Park refers to a publicly or privately owned parcel of land with exceptional quality of starry nights that is specifically protected for its scientific, natural, educational, or cultural significance. The initial target area of this proposed system was north of Bedford in Lawrence County, and the system was composed of a set of distributed light sensors, a low-power, wireless network gateway, and a web interface. Students demonstrated the ability to read and create electronic circuit schematics, to create a printed board and design documentation, and to communicate data across a wireless network to a centralized data repository.

About the Hoosier National Forest

The Hoosier National Forest is a 203,000-acre preserve nestled within the rolling hills of south central Indiana, providing a number of back-country trails and campgrounds for Hoosiers to enjoy. To increase the number of visitors and help preserve this natural resource, students in CSCI-P442: Digital Systems worked with Public Affairs Officer, Andrea Crain, to develop a low-power, wireless network gateway, light sensors, and a web interface to track light pollution for the parts of the Hoosier National Forest within Lawrence County. The data from the student-designed systems will be used to satisfy the requirements for the ongoing application for the Hoosier National Forest to receive International Dark Sky Park designation.

The Project: Connecting Course & Community

The Hoosier National Forest located in south-central Indiana has been working on an application for International Dark Sky Park designation to increase the number of visitors and to reduce the amount of light pollution in order to protect the Forest's natural beauty. Students in CSCI-P442: Digital Systems implemented two different projects for the Hoosier National Forest to assist with its Dark Sky application. An accelerometer based trail counter was designed and will be mounted on a wooden footbridge and used to count the number of pedestrians using the trail. A forest-based light monitoring device will be deployed in the Hoosier National Forest to collect light measurements and track light pollution. The data collected from these projects will be used to address the ongoing monitoring requirements for the Dark Sky designation application

Currently, prototypes of the web interface and light sensors have been created. Over the summer of 2018, students will deploy the sensors into the test area north of Bedford and will continue to collect and monitor light pollution within the Hoosier National Forest throughout the following academic year.

Student Outcomes

- Implemented an environmental monitoring embedded system based on design constraints and specifications of the Hoosier National Forest
- Developed an accelerometer-based trail counter to track the number of pedestrians within parts of the Hoosier National Forest
- Developed a forest-based light monitoring device to monitor light pollution, which will assist with the Dark Sky designation application
- Demonstrated the ability to analyze simple networks involving resistors, read and create electronic circuit schematics, and apply SPI and I2C communication links to connect sensors with an embedded CPU
- Utilized laboratory test and measurement equipment, including an oscilloscope, function generator, multimeter, and protocol analyzer
- Gained skills in project management and professional communication working with real clients to address a pressing environmental issue within a rural community

Community Partner Outcomes

- Prototype of a web interface and light sensors to track light pollution within the Hoosier National Forest
- Quantitative data regarding light pollution and trail use to assist with the Dark Sky designation application
- Assistance in deploying, analyzing, and evaluating the data collected from the student-designed environmental monitoring embedded system
- Greater understanding of the technological aspects to strengthen the Hoosier National Forest's Dark Sky designation application

RURAL ENGAGEMENT

A BRIGHTER FUTURE *for* ALL