STUDENT SUSTAINABILITY COMMITTEE

Funding Application – Step II

Funding Criteria

A. General Rules

1. Students, faculty, and staff are encouraged to submit requests for funding. Student-led projects require a faculty or staff sponsor in order to have funds awarded.
2. Funding can only go to university-affiliated projects from students, faculty, staff, and departments.
3. All SSC projects must make a substantial impact on students. This may be a direct impact or an impact through education and engagement. All SSC funding is 100% from student green fees, so the projects funded by the students must benefit them.
4. SSC encourages innovation and new technologies – creative projects are encouraged to apply.
5. Unless a type of expense is specifically listed below as having restrictions, SSC can generally fund it. The items referenced below should not be taken as comprehensive list.

B. Things SSC Can Fund, On A Case-By-Case Basis

1. SSC can fund feasibility studies and design work; however, it must work toward ultimately addressing a sustainability need on campus.
2. SSC can fund staff positions that are related to improving campus sustainability. Strong preference will be given to proposals receiving matching funding from departments and/or plans for maintaining continuity of the position after the end of the initial grant.
3. SSC can fund outreach events with a central theme of sustainability, provided their primary audience is the general campus community.
4. SSC discourages funding requests for food and prizes but will consider proposals on a case by case basis that prove significant reasoning.
5. SSC can fund repairs and improvements to existing building systems as long as it works toward the goal of improving campus sustainability; however, a preference is shown to projects utilizing new or innovative ideas.
6. SSC can provide departments with loans for projects with a distinct payback on a case by case base. Loans will require a separate memorandum of understanding between SSC and departmental leadership pledging to repay the award in full and detailing the payback plan.

C. Things SSC Will Not Fund:

1. SSC will not fund projects with a primary end goal of generating revenue for non-University entities.
2. SSC will not fund personal lodging, food, beverage, and other travel expenses.
3. SSC will not fund any travel expenses.
4. SSC will not fund tuition or other forms of personal financial assistance for students beyond standard student employee wages.

Your Step 2 funding application should include this application, the supplemental budget form, and any letters of support.

Please submit this completed application and any relevant supporting documentation to Sustainability-Committee@Illinois.edu. The Working Group Chairs will be in contact with you regarding any questions about the application. If you have any questions about the application process, please contact the Student Sustainability Committee at [sustainability-committee@illinois.edu.](mailto:sustainability-committee@illinois.edu)

General & Contact Information

Project Name:

Total Amount Requested from SSC:

Project Topic Areas: ☒ Land & Water ☐ Education ☒ Energy
☐ Transportation ☐ Food & Waste

Applicant Name:

Campus Affiliation (Unit/Department or RSO/Organization):

Email Address:

Check one:

☒ This project is solely my own **OR**

☐ This project is proposed on behalf of (name of student org., campus dept., etc.):

Project Team Members

Name	Department	Email
Diego Calderon	Computer Science	Diegoac2@illinois.edu
Elahe Soltanaghai	Computer Science	Elahe@illinois.edu
Name	Department/Organization	Email Address
Name	Department/Organization	Email Address

Student-Led Projects (Mandatory):

Name of Faculty or Staff Project Advisor: Elahe Soltanaghai

Advisor's Email Address: elahe@illinois.edu

Financial Contact *(Must be a full-time University of Illinois staff member)*

Contact Name: Jonathon Manuel

Unit/Department: Computer Science

Email Address: jonathon@illinois.edu

Project Information

Please review the proposal materials and online content carefully. It is <u>highly recommended</u> you visit a working group meeting sometime during the proposal submission process.

Please provide a brief background of the project, its goals, and the desired outcomes:

You may copy and paste your Step 1 application answer if nothing has changed.

Several urban and suburban areas report higher temperatures than their surrounding rural areas, a phenomenon known as the heat island effect. The combination of rising temperatures, frequent and harsher heat waves, and the heat island effect are increasingly harmful to air and water quality and, consequently, to people's health [2,3]. Prior work indicates that surface and air temperature are the best indicators of the conditions people experience with warmer weather [2,3]. Satellites can monitor surface temperature over large areas, and standard weather stations and mobile traversers can measure air temperature [2,3]. However, the methods for monitoring air temperature are expensive to deploy and maintain (they are power-hungry and rely on cellular networks for collecting data [4,5]). Therefore, we propose **developing low-cost and battery-free sensing systems to reduce deployment and maintenance costs**. By harnessing power from existing radio frequency signals, we can deploy battery-free tags that cost cents per unit, are scalable, and are environmentally friendly. We can leverage public transportation to collect the data from these tags (please see image at the end of the document).

By the end of this project, we aim to identify and monitor heat islands in Urbana-Champaign. We will:
1. Develop battery-free sensors to collect air temperature
2. Develop a prototype for the collection of data
3. Analyze the data to gain insight into hot spots in Urbana-Champaign
4. Compile our findings, display them in interactive maps, and communicate them to decision-makers
5. Develop an outreach program to engage with the community and discuss the benefits of urban planning and green infrastructure
6. Open source our code and hardware so anyone can use it

Where will the project be located? Are special permissions required for this project site?

If special permission is required for this location, please explain and submit any relevant letters of support with the application.

For the first stages of development, the project will be in Siebel Center for Computer Science (no special permissions required). Once we have a working prototype, we will contact facilities to learn how to place the tags across campus. The last step would be getting MTD to set the base stations in the city buses. We can also explore the feasibility of drones collecting data in remote places.

Other than the project team, who will have a stake in the project? Please list other individuals, groups, or departments affiliated directly or indirectly by the project. This includes any entity providing funding (immediate, future, ongoing, matching, in-kind, etc.) and any entities that benefit from this project.

Please attach letters of commitment or support at the end of the application.

At this stage only our project team have a stake in the project. We seek to use this phase to generate data and proof of concepts to apply to grants from the Department of Energy, NSF, and Microsoft Research.

How will this project involve and/or benefit students?

This includes both direct and indirect impact.

Heat islands contribute to higher daytime temperatures and reduced nighttime cooling. Therefore, there are many ways in which heat islands can affect the quality of life of students and the U of I community. For

example, heat islands increase the demand for cooling down buildings. This increased demand also results in additional greenhouse gas emissions in areas that rely on fossil fuel power plants [2,3]. If we identify heat islands, we can address them and reduce the heat stress around Urbana-Champaign, reducing energy usage in the summer and resulting in lower energy bills. Also, by reducing heat spots, we can avoid the increase in stormwater temperature and reduce the negative impact on aquatic life in our surroundings.

To complete this project, students will investigate how to deploy battery-free sensing systems for identifying heat islands. We could leverage this project to teach the community about urban planning and how it affects our lives. If we show our community the benefits of green infrastructure and how it can improve our quality of life, we can address the heat island effect in our community faster.

How will you bring awareness and publicize the project on campus? In addition to SSC, where will information about this project be reported?
We plan to publicize the project through the computer science department and our work's resulting publications. At a later stage of the project, we plan to develop a web app to visualize the data.

Financial Information

In addition to the below questions, please submit the supplemental budget spreadsheet available on the Student Sustainability Committee website. Submission of both documents by the submission deadline is required for consideration of your project.

Have you applied for funding from SSC before? If so, for what project?
We have not applied for funding from SSC before.

If this project is implemented, will you require any ongoing funding required? What is the strategy for supporting the project in order to cover replacement, operation, or renewal costs?
Please note that SSC provides funding on a case by case basis annually and should not be considered as an ongoing source of funding.
Yes, we will require and seek ongoing funding from external sources such as the department of energy. The costs of operation and renewal should be covered by external funding, and one of the project's main ideas is to reduce replacement costs related to battery malfunction.

Please include any other obtained sources of funding. Have you applied for funding elsewhere?
Please attach any relevant letters of support as needed in a separate document.
We have not applied to other sources of funding yet.

Environmental, Economic, and Awareness Impacts

How will the project improve environmental sustainability at the Urbana-Champaign campus? If applicable, how does this project fit within any of the [Illinois Climate Action Plan](#) (iCAP) goals?
Heat islands result in higher demand for electricity to cool down homes and affect vulnerable populations disproportionately. If we identify which hot spots in our community we need to address most, we can reduce their heat stress and therefore address the following problems:

- **Elevated emissions of air pollutants:** sunnier and hotter environments can directly increase the rate of ground-level ozone formation. When nitrogen oxides and volatile organic compounds react with sunlight and hot weather, ground-level ozone is formed, which decreases air quality [1].
- **Compromised human health and comfort:** with higher daytime temperatures and reduced nighttime cooling, students with chronic conditions, disabilities, or those taking certain medications are vulnerable to extreme temperatures. There has been a yearly average of 702 heat-related deaths in the US from 2004-2018 [2,3].
- **Poor water quality:** High temperatures on roads and rooftops can heat stormwater runoff, which releases into streams, rivers, and lakes. The rapid water temperature change can be fatal to aquatic life [2,3].

How will you monitor and evaluate the project's progress and environmental outcomes? What short-term and long-term environmental impacts do you expect?
Some examples include carbon emissions, water conservation, green behavior, and reduced landfill waste.
We will monitor the temperature across Urbana-Champaign and identify which spots do not cool down during the nighttime (compared to nearby rural or semi-urban areas).
We expect that in the short term, we will be able to show the community and decision-makers the urban areas with the most intense heat islands. In the long term, with public engagement, we expect that addressing the hot spots will reduce the cooling demand during the summer in those areas and therefore reduce the emissions. Depending on local government plans and actions, we also expect to avoid heated water runoff into streams and lakes, avoiding destroying ecosystems and declining water quality.

What are your specific outreach goals? How will this project inspire change at UIUC?
To address heat islands and equity, local governments must collect relevant data (where the heat hits the hardest) and make data and programs accessible and available to the public. After we collect the data, we aim to develop an interactive map showing the heat islands' location.
With this information, we hope to inspire UIUC students to become more involved in urban planning, development, and maintenance.

If applicable, how does this project impact environmental injustice or social injustice?

Urban heat islands affect people disproportionally. For example, excessive heat is a financial burden on low-income households. Also, high temperatures and sunny days can decrease air quality and trigger asthma. The EPA found that environmental factors make asthma more common among low-income populations [5]. Through this project, we can provide local governments with relevant data to create equitable and accessible programs to mitigate heat islands.
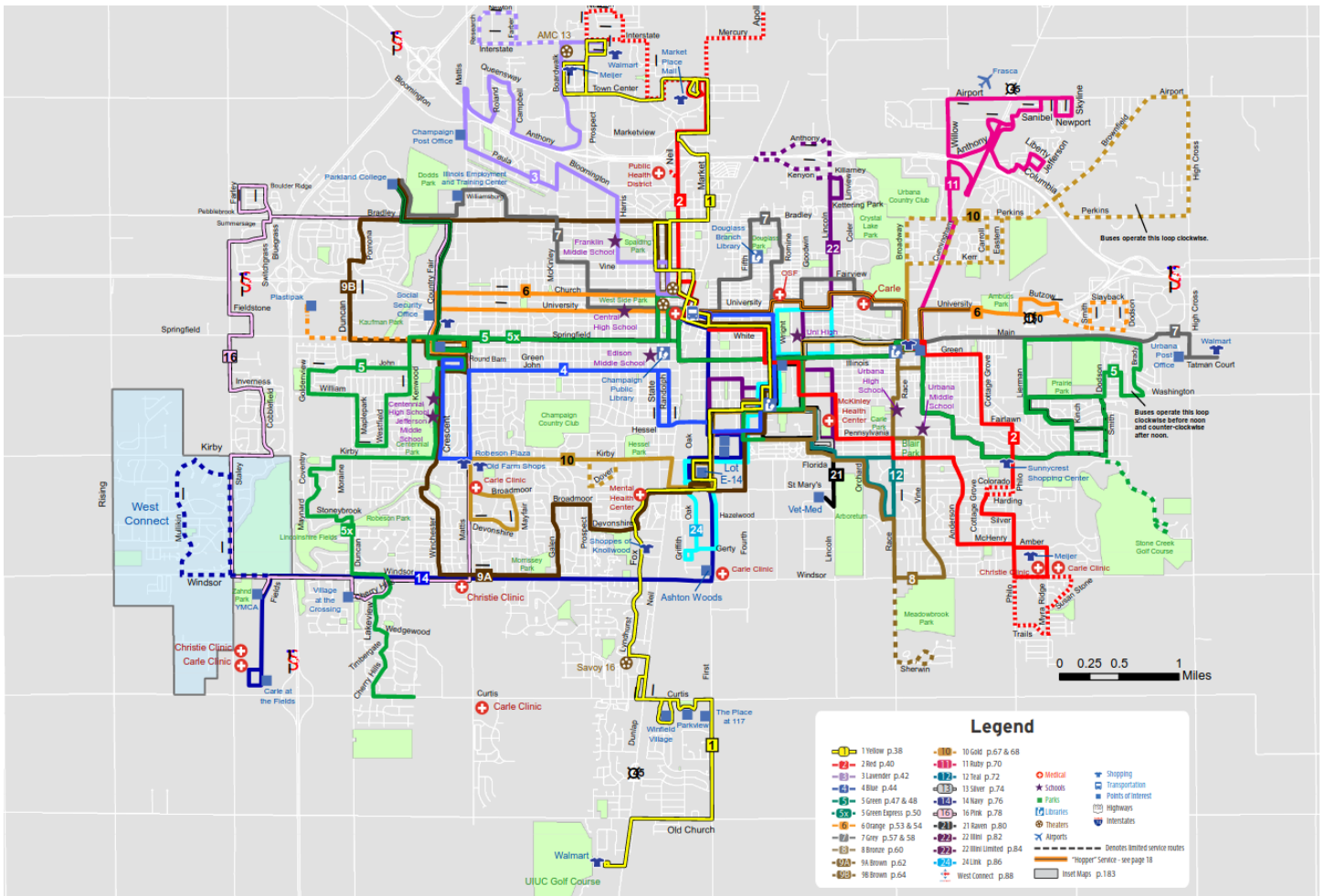
The figure above shows the bus routes that service Urbana-Champaign, which covers most of the urban area in the two towns.

References

1. Ozone pollution - Washington State Department of Ecology. https://ecology.wa.gov/Air-Climate/Air-quality/Air-quality-targets/Air-quality-standards/Ozone-pollution
2. Heat Island Impacts | Heat Island Effect | US EPA. https://19january2021snapshot.epa.gov/heatislands/heat-island-impacts_.html
3. https://www.epa.gov/heatislands/measuring-heat-islands
4. X. Yu, et al. 2020. Optimizing Sensor Deployment and Maintenance Costs for Large-Scale Environmental Monitoring. In IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems, vol. 39, no. 11, pp. 3918-3930.
5. "Heat Islands and Equity." *EPA*, Environmental Protection Agency, https://www.epa.gov/heatislands/heat-islands-and-equity.