**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.*

**General & Contact Information**

**Project Name:** WaggleNet

**Total Amount Requested from SSC:** $15,000

**Project Topic Areas:** [ ]  Land & Water [x]  Education [ ]  Energy

[ ]  Transportation [ ]  Food & Waste

**Applicant Name:** Jimmy He

**Campus Affiliation (Unit/Department or RSO/Organization):** Student Organization / Research Project

**Email Address:** miaoh2@illinois.edu

**Check one:**

 [ ]  This project is solely my own ***OR***

 [x]  This project is proposed on behalf of (name of student org., campus dept., etc.): WaggleNet

**Project Team Members**

|  |  |  |
| --- | --- | --- |
| **Name** | **Department** | **Email** |
| Jimmy He | Electrical & Computer Engineering | miaoh2@illinois.edu |
| (Prof.) Christopher D. Schmitz | Electrical & Computer Engineering | cdschmit@illinois.edu |
| Michael Chen | Electrical & Computer Engineering | yuxuanc5@illinois.edu |
| Name | Department/Organization | Email Address |

**Student-Led Projects (Mandatory):**

Name of Faculty or Staff Project Advisor: Christopher D. Schmitz
Advisor’s Email Address: cdschmit@illinois.edu

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

Contact Name: Christopher D. Schmitz

Unit/Department: Electrical and Computer Engineering

Email Address: cdschmit@illinois.edu

**Project Information**

*Please review the proposal materials and online content carefully. It is highly recommended 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.*

Our primary goals is to create an intuitive and complete open-source IoT solution for both research and general use. Through our system, data collection should be as easy as placing the sensors where you want them. Once a sensor is placed and added to the system through a few button clicks, our cloud-based platform takes care of everything else. From managing the wireless devices to storing and presenting the data, all other details are handled behind the scenes. Since our motivation is research rather than profit, the cost of adding a sensor will be well below those of commercial offerings. The open-source nature of the project leverages non-proprietary solutions and allows developers to expand our data-collection system to new uses. Specifically, our Smart Sensor initiative enables everyone to easily configure their own custom sensors to work with the WaggleNet system, providing an ever-growing sensor portfolio to our other users.

A more ambitious goal of WaggleNet is to bridge the gap between research and application. Users (commercial, hobbiest, and research) will have an opportunity to share data with any research project, while benefiting from predictive analytics models derived from researchers’ findings in return. We envision this feedback loop to greatly speed up the research process and dramatically cut down the efforts to speed the transition of research outcome into practical benefit.

Deliverables of WaggleNet include the following:

- Field-tested, mass-producible design files of the WaggleNet hardware lineup that includes sensors, wireless network nodes, and routers.

- An automated system that configures the aforementioned hardware during manufacture.

- The WaggleNet Cloud deployed in the AWS platform, ready to support WaggleNet users and hardware.

- A debugged system through pilot tests of the system at our partnering facilities, and deployments in general user’s beehives and fields.

- The capacity to aggregate, anonymize, and share datasets from WaggleNet Cloud with researchers, and the platform to host machine-learning models for processing of the collected data.

**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 this phase, storage space will be minimal and the Electrical and Computer Engineering Building (ECEB) will suffice for meetings, contruction, and temporary storage of completed devices. The project also consists of the server (offsite through AWS) and devices deployed to our volunteers, many of whom are listed as "stakeholders" below.**

**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.*

- Leung Student Venture Fund Committee

- UIUC SoyFACE Farm

- Carl R. Woese Institute of Genomic Biology

- UIUC Pollinaterium

- Robinson Bee Research Lab

**How will this project involve and/or benefit students?**

*This includes both direct and indirect impact.*

**Our project introduces exciting and unique research opportunities for students in ECE, CS, and ISE, as well as other anticipated areas of engineering. Participants in the different aspects of WaggleNet system design will gain valuable practice in solving real-life problems and experience workflows analogous to major tech firms. To many students, this can be a unique and valuable first-step to their career. The open-source nature of WaggleNet also extends their network greatly by allowing them to interact and collaborate with other developers in the Open Source community. Our Smart Sensor initiative allows students to invent their own sensor and integrate it into WaggleNet’s ecosystem at almost no cost, saving them all the hassle of creating a large system to support their invention.**

**New research projects will be enabled by the WaggleNet system in Entimology, Crop Sciences, Environmental Sciences and other areas who could leverage low-cost, turn-key low-data rate telemetry. Devices developed by WaggleNet will dramatically improve the flexibility and lower the barrier of data collection whether in the lab or out in the field, enabling students and researchers to conduct scientific research with significantly greater ease and lower cost. Furthermore, with end users being able to share data with research projects, researchers will gain precious insights they would never have with traditional research methods.**

**Furthermore, WaggleNet presents precious opportunities of involving the engineering population on campus in solving sustainibility issues that they would not be aware of, such as saving the nation's pollinators. It not only helps raise awareness, but also provides them access to tools they can cheaply obtain, easily tinker and efficiently deploy, so they can create innovative solutions with their unique technical advantages.**

**How will you bring awareness and publicize the project on campus? In addition to SSC, where will information about this project be reported?**

WaggleNet has aroused significant public interest. The Daily Illini has published two reports. WCIA 3 did a local news presentation. The College of Engineering has interviewed the founding members and produced two reports on College of Engineering and Department of ECE Official Website. Prof Schmitz recently gave an overview on WaggleNet at the Central-Eastern Illinois Beekeeping Association and gathered considerable responses from Illinois beekeepers.

WaggleNet owns a public website at https://www.wagglenet.org. We also have a Slack group (linked from our public website) and a Jira system for internally tracking progress and roadmaps, both completely open to public registration. All of our source code is published under the UIUC NCSA License on WaggleNet's GitHub.

Besides carrying over the existing efforts, WaggleNet aims to form its own publicity division from our existing CineSquad, a small division specialized in creating promotional videos. WaggleNet will continue to collaborate with more student organizations and launch more programs and workshops to the larger student audiences (using talks and hands-on activities on IoT systems). We will also continue to seek Social Media coverage and begin involvement in academic, technical, and industrial conferences.

# Financial Information

*In addition to the below questions, please submit the supplemental budget spreadsheet available on the Student Sustainability Committee* [*website*](http://ssc.sustainability.illinois.edu/?page_id=2087)*. 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?**

No.

**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 have modest funding under the Leung Student Venture Fund Award. Now in our second year, these funds have aided our spearheading innovationative experiments within the research group. We are applying for relevant NSF funds. We are also seeking funding from collaborating research bodies and University entities to pay for relevant R&D work and equipment manufacturing cost.

In addition, WaggleNet aims to become self-funded. We have consulted with the Technology Entrepreneurship Center to incorporate as a non-profit entity for the manufacturing, operation and sales of our products to the general public. Precautions are being taken to ensure that R&D only happens on campus and does not involve the business entity, and that any profit generated from sales will stay in the University as research funding. WaggleNet is currently participating in the I-Corp Workshop.

**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 are current under the following funds:

- Leung Student Venture Fund Award

- State fund for Education Innovation

# 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**](https://icap.sustainability.illinois.edu/) **(iCAP) goals?**

Our project is strongly in line with Chapter 12 "Sustainability Research" of the 2015 Illinois Climate Action Plan. From that chapter, "Already a world leader in sustainability and climate research, Illinois is developing opportunities for researchers from diverse disciplines to come together to explore new frontiers in discovering solutions to the challenges ahead." The WaggleNet solution (low-cost, low-power, and turnkey) is an attractive method for monitoring anything, whether it be honeybees, crops, levies, or bridges. Sustainability research across disciplines will benefit from a single easy open-source solution that allows data collection and sharing.

**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 fully expect the data collected from honeybees to have near immediate impact on winter survival rates. WaggleNet software includes a feedback channel by which event classisfiers can be evaluated by the beekeeper providing feedback to researchers on the accuracy. We also will collect data regarding treatments provided to the bees based on information gathered from the monitoring system and analyse the data for statistical evidence of successful increase in survival rates. We are still learning about other applications such as those in crop sciences, but we will work to improve surveys for all applications of WaggleNet as they gain traction.**

**What are your specific outreach goals? How will this project inspire change at UIUC?**

**Many K-12 schools are developing gardens or adopting honeybees in efforts to change their footprint and educate our children in sustainability. Our outreach goal would be to visit (virtually, when travel is not feasible) as many as three schools per semester to deply monitoring devices to allow the students to become part of this worldwide research project. The visibility of this project will help to highlight the University of Illinois as the leader in sustainability research.**

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

**The massive amount of data collected by WaggleNet's open platform dramatically improves the transparency of our environmental conditions and can enable discovery of important insights on the environment. We confidently expect these insights and their relevant research outcomes to influence environmental injustice through public opinion and legislation.**