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Your response has been recorded.

Below is a summary of your responses

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### **Innovation[X] 2021-2022 Proposal Application**

The School of Innovation and Innovation Partners are calling for proposals for the next round of our Innovation[X] Program, which provides grants that allow multidisciplinary teams of faculty, undergraduates, graduate students, and postdocs to work together to address complex real-world challenges.

Faculty may apply for grants of up to **\$20,000** to facilitate year-long projects. The number of grants to be awarded will depend on funding and application levels. Funding begins September 1, 2021.

Additionally, we have partnered with the Mays Innovation Research Center to fund a set of proposals to study the process of innovation itself. Successful proposals for this subset will pursue topics such as, barriers to or preconditions for innovation, the effects of law and policy on innovation, the behavior or psychological requirements for innovation, innovation and health, the social impacts of innovation, international comparisons of innovation, or novel measurements of innovation.

Proposals are due by 11:59 PM on our **newly extended** deadline of **February 22, 2021** and must be submitted using this online form.

NOTE - Only one team leader/faculty member needs to submit a proposal for a given project.

Reminder of Requirements:

- Teams must consist of an interdisciplinary set of faculty members, and must include two (2) faculty members from different colleges/schools.
- Teams must include a multidisciplinary team of 10-20 students, both undergraduate and

graduate, from across the university.

- At least 8-10 of these students must be undergraduates.
- The team must include students from at least two (2) different colleges/schools.
- Students must participate in the project for both Fall 2021 and Spring 2022 semesters, with limited exceptions.
- Proposals should demonstrate a team-based approach to a complex problem and include meaningful deliverables.

Please contact Assistant Director Emily Finbow at [innovationx@tamu.edu](mailto:innovationx@tamu.edu) or 979-862-6071 with questions.

For which tracks would you like your proposal to be considered?

- Track A - Traditional Innovation[X] Project**
- Track B - Special Track - "Process of Innovation" Innovation[X] Project
- Both Track A and Track B

Project Title

Innovation for Secure Energy For Homes

*Please provide the following information for the Primary Point of Contact for the Project (Project Leader)*

Prefix

Dr.

First Name

Tracy

Last Name

Hammond

## Email Address

hammond@tamu.edu

## Phone Number

979-353-0899

## Gender Identity

- Man
- Woman**
- Trans Man
- Trans Woman
- Genderqueer
- Non-Binary/Gender non-conforming
- Not listed above, please specify

Prefer not to respond

## Ethnic and Racial Identity

- Hispanic/Latino/a/x
- American Indian or Alaska Native
- Asian/Pacific Islander/Desi-American
- Black/African American
- White**
- Bi-racial / Multi-Racial (please specify):

Not listed (please specify):

Prefer not to respond

## Project Information

Please provide brief background/context for the issue this project seeks to address. (2,000 character maximum)

The frigid weather Texas experienced in February 2021 illuminated shortfalls in both the state's energy infrastructure and long-term policies that led to over four million residents struggling to survive without power. Most of Texas is on an isolated electrical grid that was overtaxed and ill-prepared for the cold weather, nearly causing a system-wide outage that could have lasted weeks or months. Texas's Electric Reliability Council of Texas (ERCOT) did not take the prerequisite steps to prepare the energy grid for cold weather. A report by the Federal Energy Regulatory Commission and the North American Electric Reliability Corporation, titled "Report on Outages and Curtailments During the Southwest Cold Weather Event of February 1-5, 2011." found that the Texas energy grid was not properly prepared for the cold weather that occurred in 2011 and 1989. Both years saw cold snaps similar to the 2021 storm, and after both events, experts recommend Texas take immediate action to reinforce their grid. Additionally, the North American Electric Reliability Corporation (NERC) produced a report in 2019 warning that Texas had insufficient energy reserves compared to other regions in the US. The recommendations from these previous reports were not mandatory, and Texas did not mandate these vital preparations for the past 32 years due to economic concerns and fears of overregulating. While energy security starts with resilient generation, small-scale solutions could be more easily implemented to mitigate the damage caused by future storms. Renewable energy sources like wind and solar are growing fast but still have technical issues and inconsistent adoption. Cleaner energy sources need to be explored, providing consumers with more innovative energy distribution and usage opportunities. These new approaches require new sensors, building best practices, smart meters, and more to help utilities and consumers improve energy efficiency and security.

Characters remaining: 29

What are the goals for this project? (5,000 character maximum)

This project is a two-semester design project where senior architecture students work with computer science students to design smart home solutions. The immediate goal is to create a small-scale academic incubator between the Department of Computer Science and Engineering and the Department of Architecture to provide undergraduate students an opportunity to collaborate with peers, gain hands-on experience, and generate new solutions to tackle growing energy issues. The architecture students will focus on developing energy-efficient building and land-use planning designs and best practices. The computer science students will design the sensors and networks that enable the architecture students' innovative designs. During the Fall semester, classes taught by both team leaders will meet twice a month as part of their courses to collaborate on student lead design projects. Dr. Mark Clayton's ARCH 405 Design Studio course will conduct literature reviews of smart building technologies and best practices. Dr. Tracy Hammond's CSCE 291 and CSCE 491 Undergraduate Research courses will design the software and prototypes needed for the architecture student's green infrastructure projects. Students from both departments will work on group projects to satisfy the project requirements of their courses. Both instructors have complete "design control"

over their courses and will guide the students through their projects. During the Spring semester, Dr. Clayton and Dr. Hammond will recruit interested students from the fall classes to continue developing and testing their projects as part of an independent research course. We expect to retain ten students from the Fall semester who will continue two or three selected design projects throughout the semesters. Additionally, these students will be paid a stipend during the Spring semester to support their work. The individual group design projects will determine their approach to improving green infrastructure, but could include: distributing power generation to the consumer through neighborhood microgrids using photovoltaics, wind, batteries, or other systems; power exchange between electric vehicles, homes, and other buildings in emergencies; residential energy efficiency technology from high insulation, infiltration barriers, heat pumps, and geothermal heat pumps; better connected smart homes and devices that more efficiently regulate and reduce power usage; industrialize house production using 3D printing or factory fabrication and assembly that minimize energy use; or other facets of design that improve energy efficiency. These projects can be used by students interested in completing an undergraduate thesis or publishing in journals. Depending on the success of the projects, potential commercial applications could be developed. Participating students will have an opportunity to visit the Austin Energy Green Building (AEGB) and Center for Maximum Potential Building System. These institutions focus on green community innovation to promote sustainable environmental, economic, and human well-being development. The AEGB developed the first sustainability rating system in the US. The Center for Maximum Potential Building Systems is a non-profit life cycle planning and design research center that collaborates with businesses and professional firms. Students will have an opportunity to visit these facilities during the fall and spring semesters and learn about the current research and potential career opportunities. Another goal is to evaluate the pedagogical effectiveness of this project for future collaborations. A graduate research assistant with the Institute for Engineering Education and Innovation will be a team leader for the project and work with Dr. Clayton and Dr. Hammond to review the project's impacts and publish findings in the appropriate journals and conferences. This analysis will potentially provide insight into future engineering education programs and the potential small-scale solutions for policy and technical issues.

Characters remaining: 951

**What are anticipated outcomes from this project? (e.g., publications, website, app, data collection for further research/grant) (2,000 characters maximum)**

There are three categories of anticipated outcomes for this project: pedagogical, design innovation, and broader impacts. As part of this project's administration, a pedagogical review will potentially provide insights into this teaching model's effectiveness. These insights will help inform future projects and contribute to the growing program evaluation field and engineering education. A graduate student from the Bush School's Master of Public Service and Administration program will develop performance measures to assess the impact on the students' skill mastery, engagement, and design project efficacy. The individual student design projects that will occur through the Fall and Spring semester will provide innovative solutions for the country's growing energy and policy issues. These innovations could include but are not limited to smart home designs that enable efficient energy usage or sensor network design that more effectively support smart home systems. Ideally, the students' designs could be further expanded on in the students' graduate studies or implemented by the green-infrastructure initiatives in Austin or similar institutions. This project also aims for broader educational impacts by giving undergraduate students experience working in an interdisciplinary team to solve real-life infrastructure challenges. Students from the Department of Architecture and the Department of Computer Science and Engineering do not have many opportunities to collaborate or participate in research projects. We will engage undergraduate

opportunities to collaborate or participate in research projects. We will engage undergraduate students in research efforts, encouraging them to pursue graduate studies or inspire future career aspirations. This project will introduce more students to the interest area of sustainable design that could foster future innovators.

Characters remaining: 203

Is this proposed project an extension of existing work or a new endeavor?  
(1,200 character maximum)

This project is a new endeavor using existing courses and labs. Dr. Clayton's ARCH 405 Design Studio course and Dr. Hammond's CSCE 291 and CSCE 491 Undergraduate Research courses will participate during the Fall and Spring semesters to develop novel innovations. These existing courses are project design classes that focus on students getting design experience, which provides an ideal opportunity for collaboration and innovation. Both architecture and engineering are fields that benefit from students getting industry-related expertise and opportunities to visit research centers. This unique collaboration between these two majors and colleges is a new model that hopes to synergize with current engineering education goals and provide new insights into green infrastructure and program evaluation.

Characters remaining: 395

Is Institutional Review Board (IRB) approval required for this project?

No IRB approval is anticipated for this project.

### *Team Participants*

Please list all Team Leaders below (including yourself), including Prefix, Name, Title, and Department/School.

Dr. Mark Clayton, Professor of Information Management, Department of Architecture, College of Architecture  
Dr. Tracy Hammond, Professor of Computer Science and Director of the IEEI, Department of Computer Science & Engineering, College of Engineering

Do any of the team leaders listed above have plans for a sabbatical or other extended leave away from campus during the 2021-22 academic year? Note: Selecting "yes" will not automatically disqualify a team, but rather will indicate that we need to have a discussion with your team about the nature of the planned leave in relation to the project.

No

Please list all Team Contributors below, including Name, Title, and Department/School. *Please exclude anyone you already listed as a Team Leader.*

Drew Casey, Graduate Research Assistant IEEI Bush School of Government and Public Service Dr. Paul Taele Assistant SRL Lab Director; Visiting Assistant Professor; Department of Computer Science & Engineering

Do you plan to assign someone other than a faculty leader as a “project manager” for your team (i.e., a graduate student, postdoc, staff person)?

- Yes
- No
- Not sure yet

What would be the ideal composition of team members for this project? What majors, disciplines, skills, backgrounds, or perspectives would you like to have on the team? (2,000 characters maximum)

The team will be composed of undergraduate seniors from the Department of Architecture and the Department of Computer Science and Engineering. Since the project will utilize existing courses, the composition will be mainly students participating in ARCH 405 class and students from the Dr. Hammond’s Sketch Recognition Lab (SRL). The SRL students have experience with activity recognition algorithms, wearable technologies and sensors, computer networking, and software design.

Characters remaining: 1523

Will your team also include any external organizations or individuals as either partners, clients, study subjects, beneficiaries of the work, etc.?

Pliny Fisk (Austin) Co-founder and co-director of the "Center for Maximum Potential Building Systems" Austin Energy Green Building (AEGB)

*Travel*

Does your proposal include travel for students beyond Bryan/College Station?

**Yes**

No

Not sure yet

Where would the team travel?

Austin to visit Austin Energy Green Building (AEGB), the Center for Maximum Potential Building Systems, and Pliny Fisk's sustainable house model.

When do you anticipate that this travel would take place? (e.g., Fall 2021, Spring 2022, some other academic break, TBD)

Once each semester (Fall 2021 and Spring 2022)

Do you expect that all students selected for the team would be able to travel, or just a select number?

All students participating during the Fall courses and the students selected to continue their projects during the Spring semester will be able to travel.

### *Collaboration with Students*

Ideally, how many undergraduate students would you select to participate on this team? (Numeric responses only, please)

30

Ideally, how many graduate students would you select to participate on this team?

6

Ideally, how many professional or doctoral students would you select to participate on this team?



How will you facilitate collaborative inquiry on the team? How often and in what format will the team meet? How will you divide tasks? How you will ensure effective management of the project (e.g., appoint a student as a project manager, assign that role to a faculty leader, etc.)? (2,500 character maximum)

The project will be a collaboration between Dr. Clayton and Dr. Hammond with a graduate research assistant as a project manager. These three individuals will work with undergraduate and graduate students throughout the year on developing design projects. The undergraduate students will participate in ARCH 405, CSCE 291, and CSCE 491 classes during the Fall semester. During the Fall semester, all architecture students meet weekly during their class, and all computer science students will meet weekly during their class. As part of the curriculum, the entire team of undergraduates will meet every other week to brainstorm and develop projects to meet their classes' requirements. During the Spring semester, the students invited to return will meet every week. The faculty members and the graduate students will participate in these meetings to help guide students through their projects. During the Spring semester, the team will reduce to a small group of students who chose to continue with the project as part of an independent research course. Both the architecture and computer science students will work together and meet weekly.

Characters remaining: 1356

What might students gain from their participation (e.g., conducting research directly with subjects, contributing to publications, using language skills)? What unique and differentiated learning opportunities would be available for graduate students? (2,500 character maximum)

This project aims to provide undergraduate students with experience working in an interdisciplinary team to solve real-life infrastructure challenges. They will develop team building and cross-disciplinary communication skills. Students from the Department of Architecture and the Department of Computer Science and Engineering do not have many opportunities to collaborate or participate in research projects, especially with other departments. This novel opportunity will engage undergraduate students in research efforts, encouraging them to pursue graduate studies or inspire future career aspirations. This project will introduce more students to the interest area of sustainable design that could foster future innovators. Additionally, the students will receive research credits during the second semester.

Characters remaining: 1684

*Timeline and Budget*

Identify the timeline for the project, including start, completion and major project milestones.

*NOTE - You may use the text box or upload a table or file in the next question.*

September 1, 2021, to April 15, 2022. Fall - ARCH 405 class, Biweekly meetings, CSE 491 class, visit Austin. Spring - 10 student workers and CSCE 491 class

Timeline Upload (if needed)

Drop files or click here to upload

Total Budget Request (numeric response only, please). As a reminder, the maximum amount that can be requested is **\$20,000**.

20,000

You may upload a budget table here encompassing the categories below, or you may complete the fields below through this form as applicable.

For each item listed below or on your budget table upload, please enter both dollar amount and any relevant notes/justification.

Drop files or click here to upload

**GRADUATE OR RESEARCH ASSISTANTSHIP (PHD)** (*Suggested range: \$15-18/hour; note: RAships for students in graduate school should include costs for tuition remission and fees*)

No

## RESEARCH ASSISTANTSHIP (*Suggested range: \$12-15/hour*)

No

## INSTRUCTION (Teaching) - PHD STUDENT

No

## POST-DOCTORAL OR STAFF EFFORT

No

## UNDERGRADUATE STUDENT STIPEND OR WORK STUDY (*Suggested range: \$11-14/hour*)

(Total: \$12,000) During the spring semester, we will pay 10 students for 10 hours a week at \$12 per hour. Students will be paid to continue their projects started during the fall semester.

## INSTRUCTIONAL, RESEARCH OR OFFICE SUPPLIES

No

## COMPUTERS AND MINOR EQUIPMENT

(Total: \$3,000) Test sensors and lab supplies will be purchased based on the design needs of the student projects.

## TRAVEL - DOMESTIC

(Total: \$5,000) A bus will be chartered during the Fall semester to accommodate both classes of students traveling to Austin for a one-day visit to research centers. During the Spring semester, a smaller group of students will take a return trip to Austin. The travel costs are expected to be \$5,000 for chartering a bus and a van for the two trips.

## TRAVEL – INTERNATIONAL

No

## CONTRACT WORK

No

## MEETINGS – BUSINESS

No

## OTHER – MISC.

No

Please briefly note below any other sources of project funds. (*Projects that match or leverage additional funds are strongly encouraged. Please note any such funds, awarded or proposed, here so that we understand the comprehensive outlay for the project.*)

The Institute for Engineering Education and Innovation will provide 40% a Graduate Research Assistant. The total for the 8 months of the project is \$10,211.

Please name a Unit/Business Manager who could administer funds for project, if requested. Include their name, email address, and phone number:

Sarah Wall, swall@cse.tamu.edu | 979-845-3804