

. 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 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

Real-Time Analytics for Data Visualization

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

. Prefix

Dr.

. First Name

Ann

. Last Name

McNamara

. Email Address

annmcnamara@tamu.edu

. Phone Number

9798454715

. 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)

Just in the past 24 months, an astounding 90% of the world's data has been created. Roughly 2.5 quintillion bytes of data are generated by humans every day. It goes without saying that skills including filtering, analyzing, understanding, visualizing, and interacting with such data, are increasingly valuable and highly sought after. In fact, predictions claim that data scientist careers will grow 19% over the coming decade. This project will investigate non-traditional methods for analyzing and visualizing data, relying on leaders' collaborative strengths from Statistics, Fine Arts, and Computer Science. Students will work in small interdisciplinary teams to explore the viability of Virtual Reality (VR) as an interactive medium for Data Analytics and Visualisation. Real-time interaction in 3D will set these projects apart from the mainstream. VR offers much potential for data analytics visualization. By immersing ourselves in the data, we can take advantage of the greater space on offer, more natural interactions, and viscerally analyze multi-dimensional data. Working in tandem, students from Statistics will focus on data filtering and analytics. The Fine Arts (Visualization) students govern the creative aspects, including design, environments, aesthetics, and user-interface. The Computer Science (Visualization) students will focus on the technical (hardware and software) implementation. It is envisioned that all three groups will collaborate and learn from each other to deliver a project based on their combined strengths, which could not be achieved without contributions from each discipline. Spatial sound can also be incorporated into VR, providing a platform to communicate important dynamics within the visualization that may be challenging to attend visually. In Summary, the issue this project seeks to address is how to best leverage new interactive media platforms to advance the current state of the art in data analytics and visualization.

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

The goals for this project are to 1. Teach students concepts of Data Visualization and real-time interactive computing 2. Allow students to experience working with real-world data in an interdisciplinary team 3. Show students how to mine the web for their information regarding trends in social media content and activity levels. Show them how to prepare that data, through analytics, for presentation. (the students will propose the topic)4. Consider non-traditional mechanisms of information delivery, including visual and spatial sound cues in Virtual Reality. Introduction to Data Visualization and real-time interactive computing will be based on Dr. McNamaras Data Visualization Course. Students will learn the D3.js to realize visualizations, creating 2D traditional charts including bar charts, scatter plots, circular bar plots, bubble plots, hexbin diagrams, and chord diagrams (<https://www.developer.com/open/an-overview-of-d3.js-chart-types.html>). Real-time interactive computing education will be delivered via books (Virtual Reality, by Samuel Greengard, Virtual Reality, by Lila Bozgeyikli) and video lectures in Virtual Reality (<https://www.linkedin.com/learning/comptia-a-plus-220-1001-cert-prep-9-portable-computing/virtual-reality-2?u=74650722>). Content creation will be achieved using the unreal real-time graphics engine (<https://www.linkedin.com/learning/unreal-essential-training-2019/real-time-visualization-with-unreal-engine-4?contextUrn=urn%3Ali%3AlyndaLearningPath%3A5a1472b8498e47e9f9c70aa8&u=74650722>) Students will work in teams of three, two undergraduate students (one Statistics, one Visualization) and a graduate student from Visualization. We will have two teams, six students total. The project will involve scraping, cleaning, and analyzing real-world social media websites for visualization in a novel 3D immersive real-time environment. Led by Dr. Akleman, students will first clarify their research objective, selecting keywords (e.g., pandemic, weather) to search on and the appropriate social media sites to target (e.g., Reddit, Facebook, Twitter). They will then form a succinct research question. They will then filter the data based on their specific project and identify the most salient data attributes (columns). After finding and removing incomplete data, the students will classify the data based on the content of interest and sort the data. Students may use lambda functions for these tasks. A lambda function is a small, nameless function applied to every value in a column. This may take more than one iteration to yield robust data, i.e., more search terms may be needed or more than one social media site. The teams may also need to resample the data and aggregate it over specific time intervals, for example. Using what they have learned from Data Visualization, the teams will create some traditional plots to uncover patterns. However, the crux of the project will be transforming the data into a format consumable by VR. To allow the user to fully immerse in the data and interact in 3D in a meaningful manner, some key design and research challenges will need to be solved. For example, the meaningful axes on which to plot the data will the data change over time, the appropriate scales or dimensions, and how the user will interact with the data. Professors Klein and Walsh will oversee the design of the immersive visualizations following the guidelines provided here: 1. Reticle use: Overlaying a visual aid or "reticle" makes targeting objects much easier. The best reticles are unobtrusive and react to interactive elements 2. UI Depth & Eye Strain: Many things affect text legibility. Font size, contrast, spacing, and more play a role. Virtual reality adds another factor: depth. About 3 meters from the viewer is a good distance for a comfortable UI 3. Using Constant Velocity: VR can make people feel sick in some situations, such as during acceleration and deceleration. Good motion is smooth, with constant velocity 4. Keeping the User Grounded: Many reference points are necessary to maintain user position and orientation 5. Maintaining Head Tracking: Latency should remain low 6. Direct Gaze: leverage lighting cues can direct gaze 7. Leveraging Scale: Large differences in scale between user & environment are very effective in VR. Scale affects how the user perceives their environment and their physical size in the world 8. Spatial Audio: Leverage the user's position and field of view when triggering audio. It's an effective way to engage the user & immerse them in the environment 9. Gaze Cues In VR, you always know where the user is looking. The user's gaze can be utilized as a cursor/trigger passive interactions in the environment 10. Making beautiful VR Experiences In summary, the faculty leadership team will leverage their diverse strengths and those of the students to create novel VR experiences to capture, transform and present real-world data in new platforms

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

The anticipated outcomes are - Student co-authored publications - Project apps that will be available on GitHub - Seed data and preliminary results to target larger external funding. Benefit to Students The students will gain an education in data visualization, analytics, virtual reality, and human-computer interaction. We will lead them through the research methods, empowering them to conduct publishable research. They will gain experience in collaborative problem-solving. The graduate students will benefit from experience in a leadership role. The students will have an opportunity to visit and (hopefully) present their work at SXSW in Austin in the Spring of 2022.

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

The proposed project is a new endeavor that will bring together artists, statisticians, and computer scientists to create, curate, develop and evaluate new mechanisms of interaction with large real-world data sets.

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

IRB Approval is not required for this project.

. *Team Participants*

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

Dr. Ann McNamara, Associate Professor, Department of Visualization, College of Architecture Barbara Klein, Instructional Assistant Professor, Department of Visualization, College of Architecture Dr. Derya Akleman, Instructional Associate Professor, Department of Statistics, College of Science Michael Walsh, Associate Professor of Practice, Department of Mechanical Engineering, College of Engineering, and Department of Visualization, College of Architecture

. 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.*

We will identify and recruit students at the beginning of the semester.

. 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)

Ideally, we would have two teams with five members per team, one graduate student from statistics will lead one team, and one graduate student from visualization will lead the second team. Each team will comprise four undergraduate students, with two undergraduates from Statistics and two from Visualization. Of the two undergraduates from Visualization on each team, one would have a more traditional art background and one would have a more technical (computer science) background. Ideally, there would be one graduate and four undergraduates on each team. The graduate student would assume the team-lead role.

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

Not at this time.

. *Travel*

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

- Yes
- No
- Not sure yet

. Where would the team travel?

Austin TX for SXSW - we are budgeting a modest amount to pay toward registration. Travel to Austin should simply be a 90 minute drive.

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

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

All students would be expected to travel as the cost of attending SXSW for one day and traveling to Austin is not prohibitive

. *Collaboration with Students*

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

4

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

1

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

0

. 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)

Graduate students will be appointed as project managers. Teams would meet weekly in their groups, and also weekly with the three faculty leads. Every two weeks, we would have a larger group meeting with all of us to give progress reports and collaborate across teams. If safe to do so, we will meet in person; if not, then via Zoom or similar video-conferencing software. The tasks will be divided with input from the team members themselves. That way, they can leverage their strengths, outline their intended contributions, and be held accountable for the effort they promise. The Faculty leads will also ensure the work is fairly distributed and work with the teams to re-distribute work. Collaborative tools such as the G-suite will be used to keep track of tasks and project progress. All four Faculty leads have extensive experience leading projects like this through courses they offer at Texas A&M.

. 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)

Students will get a robust education in data visualization, analytics, interactive techniques, virtual reality, real-time 3D content creation, research methods, and collaboration. In addition the graduate students will assume leadership roles and gain experience planning and executing a large project spanning two-semester.

. *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-21 Recruit teams and begin Data Visualization Instruction October-21 Project formulations, Data Visualization Education
November-21 Begin data collection. December-21 Begin Interactive and Real-Time Education. Write up results from data collection. Project
tasks for following semester. January-22 Data filtering, cleaning, sorting, labeling February-22 Prepare data for integration into real-time
immersive VR March-22 Attend and Present at SXSW, Austin April-22 Write up Final results and prepare publication submission May-22 Write
up Final results and prepare publication submission

. Timeline Upload (if needed)

[timeline.xlsx](#)

9.5KB

application/vnd.openxmlformats-officedocument.spreadsheetml.sheet

. 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.

[budget.xlsx](#)

10.5KB

application/vnd.openxmlformats-officedocument.spreadsheetml.sheet

. 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*)

N/A

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

2 Research Assistantships 25 weeks, 10 hours per week, \$15 per hour (2 x 3750) TOTAL \$7500

. INSTRUCTION (Teaching) - PHD STUDENT

N/A

. POST-DOCTORAL OR STAFF EFFORT

N/A

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

8 Undergraduate Student Stipend 25 weeks, 5 hours per week, \$11 per hour (8 x 1375) TOTAL \$11000

. INSTRUCTIONAL, RESEARCH OR OFFICE SUPPLIES

N/A

. COMPUTERS AND MINOR EQUIPMENT

Dr. McNamara has a VR lab equipped with computers and equipment. We will also likely make use of the VR Stage at Rellis Campus managed by Professor Walsh

. TRAVEL - DOMESTIC

10 travel allowances to AUSTIN SXSW one-day student passes (150 per student) TOTAL \$1500

. TRAVEL - INTERNATIONAL

0

. CONTRACT WORK

0

. MEETINGS - BUSINESS

0

. OTHER - MISC.

0

. 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.)*

None. However, if awarded we would approach the college for additional support

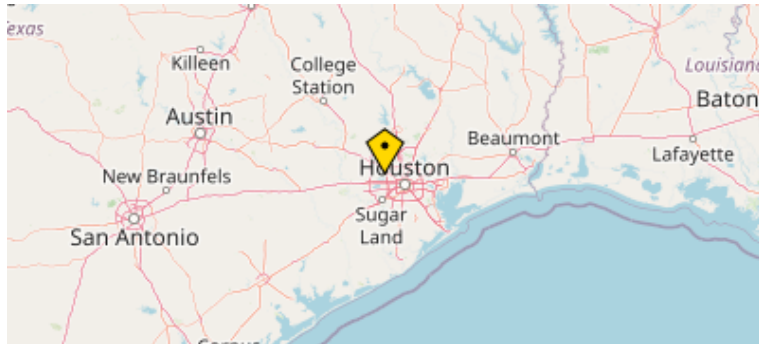
. Please name a Unit/Business Manager who could administer funds for project, if requested. Include their name, email address, and phone number:

Christopher Novosad, cjn@tamu.edu, 979.845.1258

Location Data

Location: ([29.862701416016](#), [-95.584602355957](#))

Source: GeolIP Estimation



Month	Tasks
September-21	Recruit teams and begin Data Visualization Instruction
October-21	Project formulations, Data Visualization Education
November-21	Begin data collection.
December-21	Begin Interactive and Real-Time Education. Write up results from data collection. Project tasks for following semester.
January-22	Data filtering, cleaning, sorting, labeling
February-22	Prepare data for integration into real-time immersive VR
March-22	Attend and Present at SXSW, Austin
April-22	Write up Final results and prepare publication submission
May-22	Write up Final results and prepare publication submission

Research Assistantship	Weeks	Hours Per Week	Pay Per hour	Total	
Graduate Student 1	25	10	\$15.00	\$3,750.00	
Graduate Student 2	25	10	\$15.00	\$3,750.00	\$7,500.00

Undergraduate Assistants	Weeks	Hours Per Week	Pay Per hour	Total	
UG Student 1	25	5	\$11.00	\$1,375.00	
UG Student 2	25	5	\$11.00	\$1,375.00	
UG Student 3	25	5	\$11.00	\$1,375.00	
UG Student 4	25	5	\$11.00	\$1,375.00	
UG Student 5	25	5	\$11.00	\$1,375.00	
UG Student 6	25	5	\$11.00	\$1,375.00	
UG Student 7	25	5	\$11.00	\$1,375.00	
UG Student 8	25	5	\$11.00	\$1,375.00	\$11,000.00

Student Pay Total \$18,500.00

Travel \$1,500.00 (\$150 per student, SXSU Student Registration is \$115)

Total Requested **\$20,000.00**