

Research Development Fund – Fall 2022 Application

Application Title: Interactive Research and Learning Center for Urban Digital Twin

Lead contact for RDF Application:

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Key Participating Units: College of Agriculture and Life Sciences; School of Architecture; College of Engineering: Civil & Environmental Engineering, Computer Science & Engineering, Electrical & Computer Engineering; College of Arts and Sciences: Geography, Geology & Geophysics, Mathematics; TAMU Health Science Center: Environmental and Occupational Health; Texas A&M Engineering Experiment Station; Center for Housing and Urban Development; Hazard Reduction and Recovery Center; Institute for Sustainable Communities; Center for Health Systems & Design; Microclimatic Design Research Group; Human Behavior Laboratory; Earthquake Modelling Lab; Cyberinfrastructure and Decision Intelligence Lab; Geospatial Exploration and Resolution Lab; Immersive Visualization Center; Center for Population Health and Aging; Data Science Institute; High Performance Research Computing; ENDEAVR Institute

RDF Amount Requested (\$): \$725,999; Fund Matching by Team (\$): \$772,626+

Executive Summary

Advancements in location-aware technology, information and communication technology, and mobile and robotics technology during the past two decades have transformed the focus and need of urban environment research from mostly static assessments to spatial, temporal, interactive, and dynamic relationships which integrate human behaviors across multiple environments and scales. Simultaneously, projections show that, globally, more people will live in areas designated as vulnerable or high-risk relative to contemporary and future urban issues (e.g., sea level rise, depopulation, natural disasters, crashes involving vulnerable road users, etc.), suggesting more communities will experience multi-hazard risk increase. Disasters and public health crises are global challenges as well as a significant source of property loss, social disruption, and inequality. Communities can reduce vulnerability while increasing social and physical resilience through research-driven, evidence-based planning, design, and policy development. However, silos within the social, health, and engineering sciences as well as yawning gaps between research and practice have made sustainable and equitable development difficult. A digital twin is a digital representation of a physical object or system, which is linked to real time data inputs. The objective of this proposal is to create an **Interactive Research and Learning Center for Urban Digital Twin** to provide an integrated platform which affords research infrastructure enhancements, aligned with the newly issued Infrastructure Investment and Job Act, through: (1) integration of both virtual reality (VR) and augmented reality (AR) with three dimensional models for creating multiscale scenarios with high fidelities; (2) community engagement and the implementation of cutting edge sensors (e.g. drones, and connected automated vehicles) which will directly feed into 3D, AR, and VR urban models to create dynamic urban digital twins; and 3) development of artificial intelligence (AI)-assisted decision making and agent (e.g., facilities) control system. Such research infrastructure enhancements will thrust The Texas A&M University System (TAMUS) to the forefront of technological research capabilities. The center will simultaneously visualize, analyze, and design interactions between the built environment and human action, rather than simply adding another lab on human activity or built environment research. It projects to impact, at minimum, 6 Colleges, 12 Departments and Programs, and 17 research institutes, centers, and labs across the TAMUS and will balance the ability to capture high resolution built environment data and human dynamics data while being accessible enough so that any researcher can learn to run simulations with minimal staff support. Most importantly, this will be a true convergence accelerator for the TAMU research enterprise, increasing transformative research for communities in the 21st century and the promise for external funding through basic, translational, and applied research.