TOWARD SMART RESILIENCE: SMART SYSTEMS FOR SITUATIONAL AWARENESS OF FLOOD IMPACTS AND TRANSPORTATION ACCESS (SSSAFT) IN COMMUNITIES

1951821
Jamie Padgett, Rice University
PG, FY2020

Principal Research Investigators

Jamie Padgett
Stanley C. Moore Professor
Department of Civil and Env. Eng.
Rice University

Philip Bedient
Herman and George R. Brown Professor
Department of Civil and Env. Eng.
Rice University

Danielle King
Assistant Professor
Department of Psychological Sciences
Rice University

Devika Subramanian
Professor of Computer Science and of
Electrical and Computer Engineering
Rice University

Community Partners

Primary Partners

City of Houston
Chief Resilience Office and
Smart City Council

Houston TranStar
Integrated Transportation and
Emergency Management

The Texas Medical Center
Emergency Management Office

Additional Engaged Community Organizations

- University of Texas Health Science Center at Houston
- National Weather Service
- Texas Children's Hospital
- Harris County
- University of Houston
- Harris County Flood Control District
- Harris County Office of Homeland Security, Emergency Management
- Harris Health System
- Montgomery County Hospital District EMS
- Hatzalah of Houston
- Westlake Fire Department

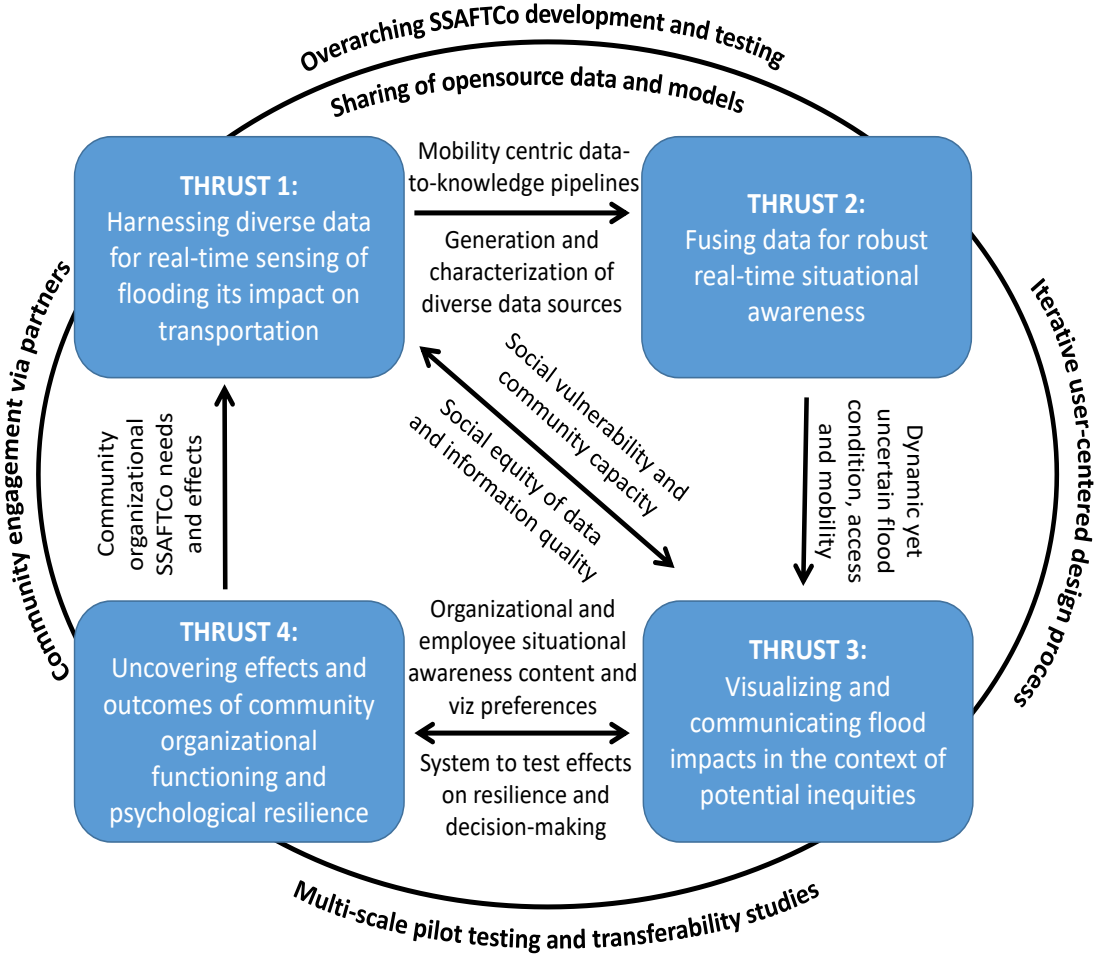
Project Overview

Visual Schematic

Smart Systems for Situational Awareness of Flood Impacts and Transportation Access (SSSAFT)

Project Vision

SSAFTCo



Project Overview

Use-Inspired Research

Inputs from emergency responders and decision makers helped refine the SSSAFT framework and future IRG proposal.

"During Harvey, which roads were clear and which ones were not was pretty much hear-say and therefore not always accurate. There was one point where I was trying to get through a certain street that I had heard was clear and by the time I got there it was totally not. So, having that kind of information is crucial. If we could know what streets are clear and which are not, that would totally change the game. Otherwise, it's just like whack-a-mole trying to piece things together.
–A Houston EMT Personnel

Data sources for real-time flood condition

Desired method for uncertainty communication

Desired spatial and temporal resolution

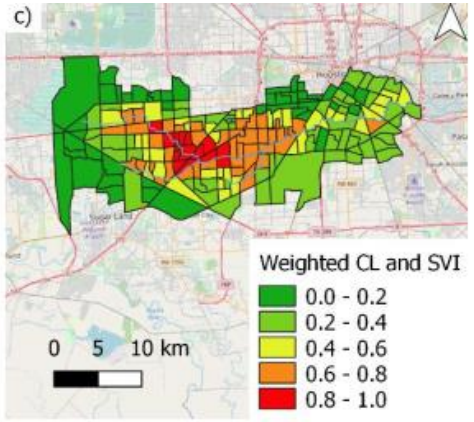
Reasons for trusting current platforms

PG Activities

- Team building, partner development and expansion, gaps analysis
- Stakeholder, advisory and partner engagement
- Public webinar via SSPEED Center
- Structured interviews with 24 stakeholders to understand needs
- Pilot study launch
- Automated data collection in collaboration with partners (authoritative, physical, social)
- Explore and evaluate probabilistic frameworks for data fusion
- Synthesis of pilot study findings
- Data publication, dissemination, documentation of organizational resilience requirements

Project Update

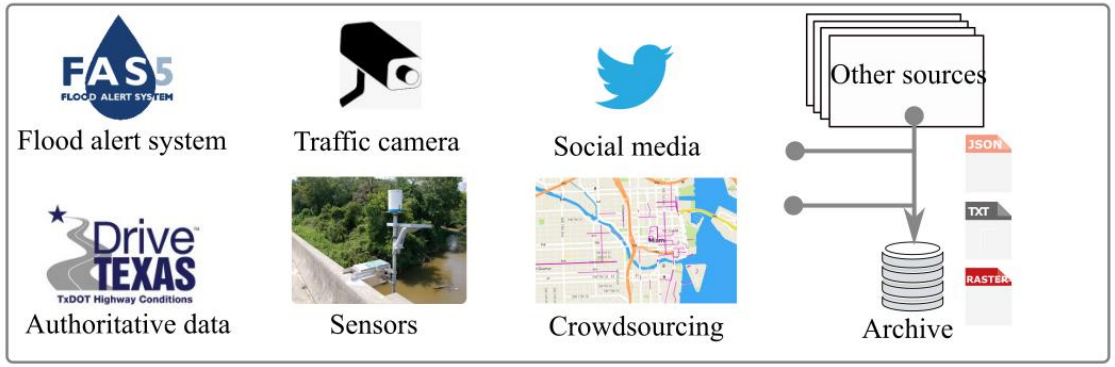
1. Community engagement and pilot studies



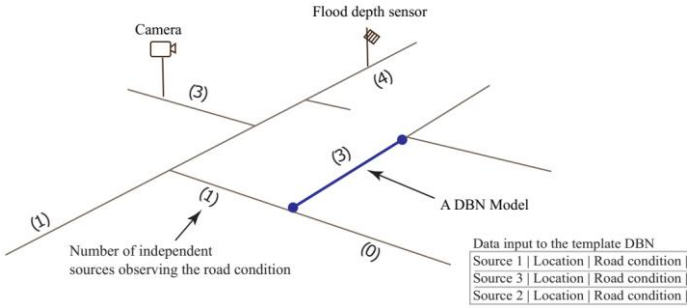
2. Structured interviews

- One-on-one interviews with 24 employees responsible for responding to flood events.
- Interviewees include emergency response personnel, decision-makers, risk managers, and high-level admins.
- Collected inputs ranging from the current practice, need assessment, and feedback on mock-up visualizations.

3. Automated data collection and archiving with community partners

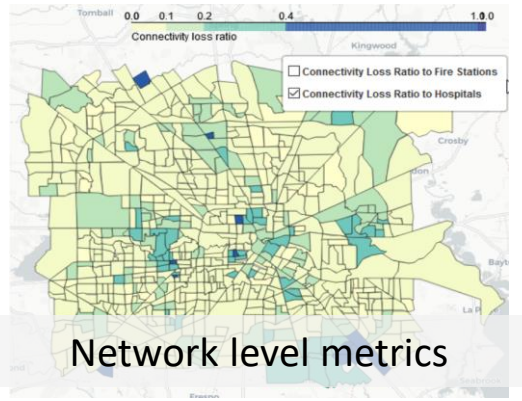


4. Data analysis pipelines and fusion



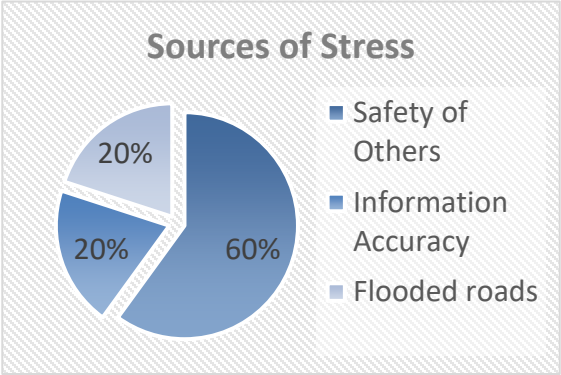
Dynamic Bayesian Networks

5. Transportation impacts



Network level metrics

6. Personnel psychological resilience and organizational functioning



7. Synthesis, dissemination and next steps

- SSSAFT needs assessment
- Pilot study synthesis
- Public webinar

SSPEED Center

- Team expansion
- Partnership and capacity building

Project Evolution

"Socially vulnerable regions are not only disproportionately impacted by natural hazards, but may suffer from limited or delayed information generation. Information equity is vital for the equitable distribution of resources and prioritization of emergency response. We collected, processed, and archived observations from different data sources in the Houston region through the planning grant. This rich data set will inform our future IRG project on identifying inequities in information generation and resulting situational awareness. Such insights can then inform our community partners on data collection needs, such as deploying new sensors or cameras, as well as our data fusion and augmentation efforts toward equitable situational awareness."

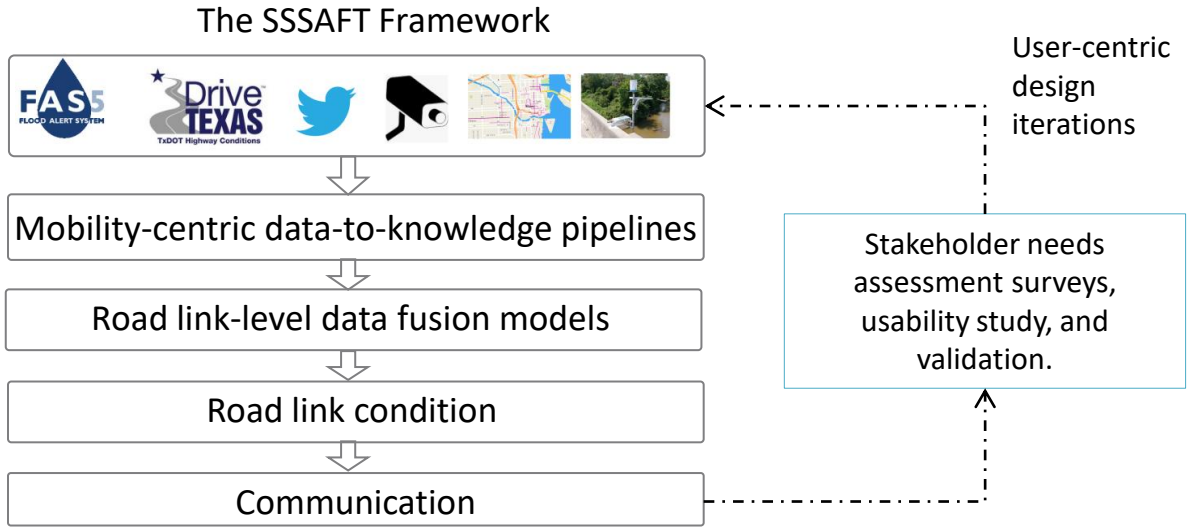
TOWARD SMART RESILIENCE: SMART SYSTEMS FOR SITUATIONAL AWARENESS OF FLOOD IMPACTS AND TRANSPORTATION ACCESS (SSSAFT) IN COMMUNITIES

1951821

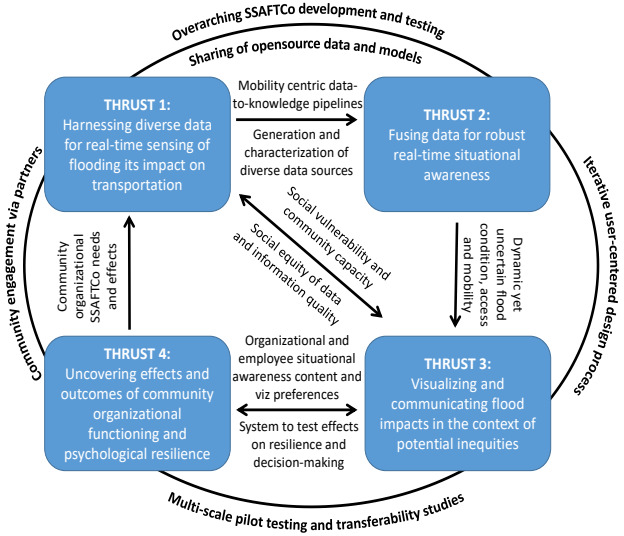
Jamie Padgett, Rice University

PG, FY2020

Visual Schematic



Project Vision



Use-Inspired Research

Context: A majority of flood-related deaths happened on roads in the US. The lack of reliable real-time information on flooding could result in delays and detours, which puts both responder and evacuees at risk. A smart situational awareness system—such as the SSSAFT framework—can reduce flood causalities and enhance community resilience.

Target community: Emergency responders and decision-makers in Houston, TX. **Community Partners:** City of Houston, TMC, and Houston TranStar.

PG Activities

- Team building, partner development and expansion, gaps analysis
- Stakeholder, advisory and partner engagement
- Public webinar via SSPEED Center
- Systematic interviews with 24 stakeholders to understand needs
- Pilot study launch

- Automated data collection in collaboration with partners
- Explore and evaluate probabilistic frameworks for data fusion

- Synthesis of pilot study findings
- Data publication, dissemination, organizational resilience requirements