# Smart Aging: Connecting Communities Using Low-Cost and Secure Sensing Technologies

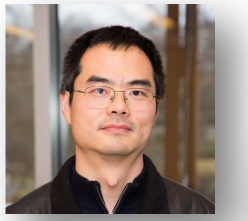
**NSF 1951880**

**Fan Ye, Stony Brook University**

**Award Type: IRG, Solicitation Year: IRG-1, FY2020**

## Principal Research Investigators

*Fan Ye, ECE Department*



*Elinor Schoenfeld, School of Medicine*

*Erez Zadok, CS Department*

*Patricia Bruckenthal, School of Nursing*

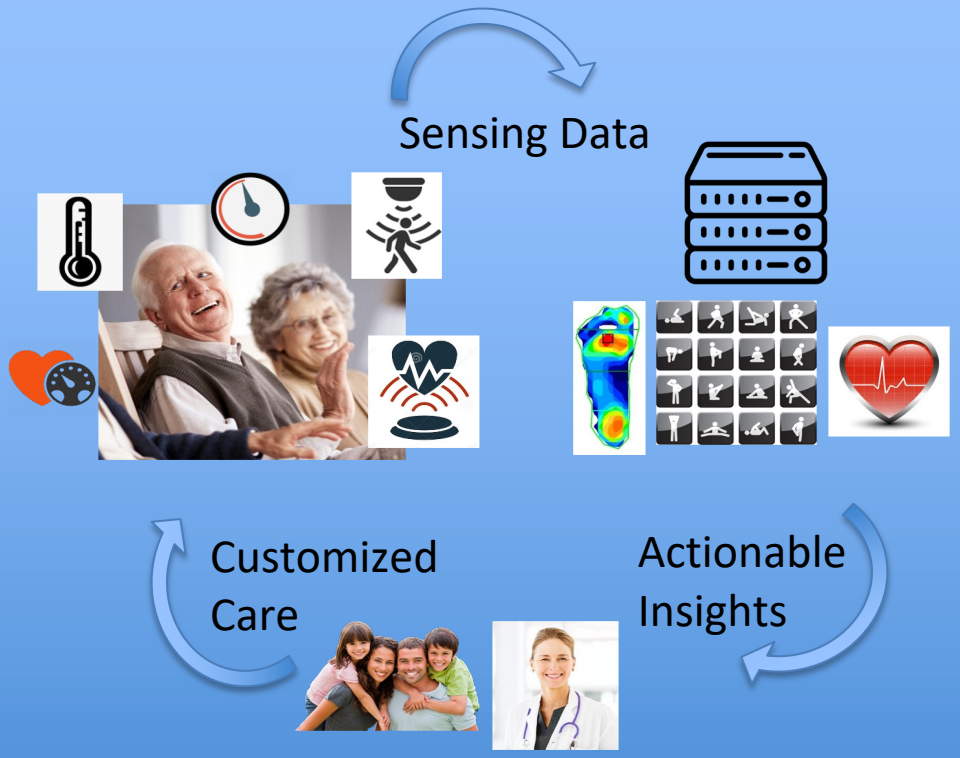
*Shelley Horwitz, School of Social Welfare*

## Community Partners (27 in total)

- Resident and Community Groups
  - The Osher Lifelong Learning Institute (OLLI)
  - Long Island State Veterans Home (LISVH)
  - San Simeon by the Sound Center for Nursing and Rehabilitation
  - Peconic Landing Retirement Community
  - Cancer Coalitions and Support Groups
- Nonprofit and Philanthropic Organizations
  - Long Island National Aging in Place Council
  - AARP New York
  - Firefly Innovations
- Health Care Providers
  - Stony Brook University Hospital (SBUH) Injury Prevention and Outreach Program, Sleep Lab, Pulmonary & Critical Care, Post-COVID Clinic, Medicine, Family Medicine, Cancer Center
  - Southampton Hospital and Eastern Long Island Hospital
  - Meeting House Lane Medical Practice
  - SUNY College of Optometry
- Government Stakeholders
  - Office for the Aging, Suffolk County and NYS, NYS Dept. of Health
  - Suffolk Cooperative Library System
  - NYS Center of Excellence on Wireless and IT Technology

# Project Overview

## Visual Schematic




## Project Vision

- Engage diverse community stakeholders (e.g., older adults, caregivers, supporting institutions and professionals) to collaboratively:
  - develop robust, secure, affordable health data sensing and analytic solutions to automate health change detection and prediction
  - design social solutions to foster greater technology adoption, effective data sharing, and quantitative measures of social determinants of health
- Enable older adults to maintain quality of life, autonomy and dignity while aging in place; alleviate the social, economic burdens on communities, stakeholders and the healthcare system; educate and train residents and providers for technology assisted aging in place

# Project Overview

## Use-Inspired Research

- Large and growing percentages of 65+ older adults living on Long Island, in NYC and the nation (17%, 21% and 16%) creating a “Silver Tsunami”

- >80% of older adults want to live independently at home with quality of life, autonomy and dignity, overwhelming care providers, facilities and hospitals, causing a social and economic crisis, thus motivating:
  - the need for robust, secure in-home sensing technologies to monitor older adults’ physical and mental health status
  - development and adoption of effective technologies to overcome social isolation especially since COVID onset

## Fundamental Research Contributions

- Robust, secure, affordable sensing technologies for longitudinal monitoring of vital signs, physical activities and social interactions of older adults, and analytics for detection of emergencies, early indicators of health changes in a privacy-preserving, nonintrusive manner

- Social solutions to foster positive perceptions and greater adoption of technologies, effective data representation and delivery means to stakeholders, and quantitative, data-driven measures for social determinants of health

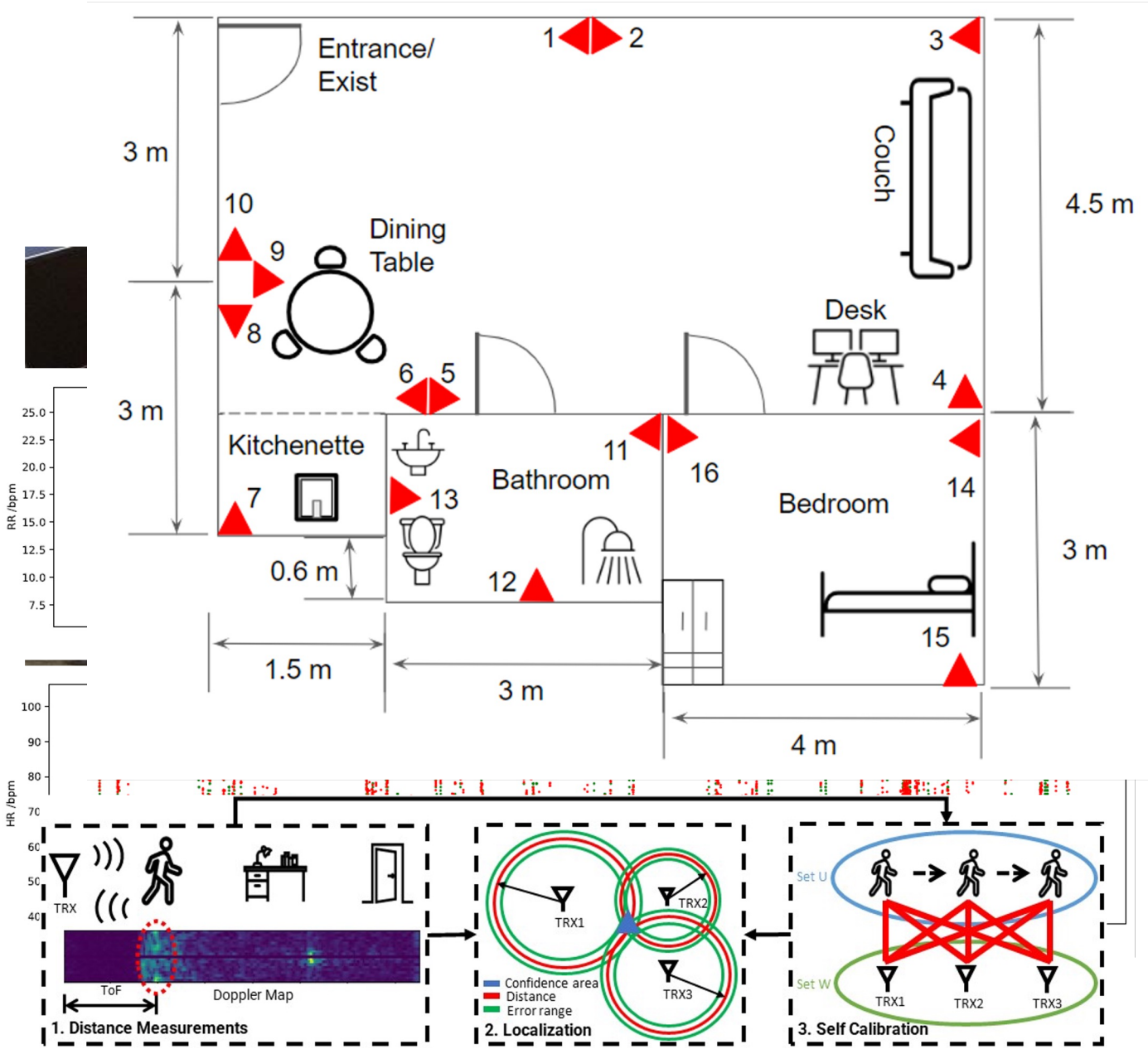
# Project Update

## Technology

- Studied radio parameters' impact on vital signs extraction quality, and found that while more power or bandwidth help improve accuracy, very surprisingly more chirps or antennas do not
- Studied the impact of sensor location, sleep posture on vital signs monitoring quality for developing data collection guidelines for over-night in home data collection
- Created a self-calibrating indoor trajectory tracking system which laymen users can easily set up with one-minute's walking, paving the way for scalable home deployment

## Social Science/Outreach

- Obtained 87 completed surveys and conducted 8 discussion groups with 77 older adults to understand challenges for technology adoption especially since COVID onset
- Refined/incorporated a vignette to engage older adults in a discussion of aging in place challenges/tech solutions
- Expanding outreach, working with health care providers and community stakeholders to engage more diverse populations
- Joining an SBU initiative to develop a multidisciplinary multi-pillar center for aging in place on Long Island
- Community and academic presentations (LISVH, graduate SSW and SON courses)
- Continue to recruit students from multiple disciplines to work on the project



# Project Evolution

*We learned from surveys, discussion groups with older adults and health care providers that:*

1. *Our older adult participants:*
    - *started using more/improved technology than before COVID - challenges of social isolation and shopping*
    - *become more receptive to the idea of using technology to support aging in place, and more interested in technology use as caregivers, especially in emergency situations (e.g., falls, stroke)*
    - *survey findings are similar with increasing national trends of technology adoption since COVID (e.g., smartphone, tablet)*
2. *Our providers were supportive of a role for continuous physiologic data collection to support aging in place but concerned about the burden of utilizing these extra data on patient care*
3. *Security and privacy continued to be a concern across discussion groups; wary of the potential privacy and security implications under diverse, highly dynamic needs*
    - *Our sensor data has a fundamentally different nature compared to EMR or smartwatch data (apple, fitbit); no rules/regulations/policies exist now on how to manage personally collected sensor data, thus a need to explore and study what policies and regulations will be appropriate*

*We decided to:*

- *Add more focused questions and expand discussion group outreach to incorporate different perspectives, including older adults managing chronic diseases, caregivers, home healthcare providers and to ensure input from BIPOC populations*
- *Conduct a thorough exercise detailing and classifying data and needs based upon data sensitivity levels, and bring in a security policy expert to achieve both usability and security/privacy under high dynamism*

# Evaluating Project Impact on Communities

*Our sensor system is still under development. To help facilitate development we have been working to expand our community dialogue and footprint on the needs/benefits of sensor monitoring, increasing awareness of people to technology use to assist aging in place, and already obtained positive responses from our discussion groups (e.g., some discussion group participants who already wanted to use our sensors).*

*We have given lectures to future practitioners (doctoral, nursing, social welfare students) so that they gain awareness and familiarity in sensor use to assist with aging in place. We have provided a summary of strengths and weaknesses of market available products, and insights into new ones we are developing. This knowledge is invaluable for practitioners caring for older adults.*

*Quote from a community-based homecare practitioner: "I'm excited about the potential for using this technology for my patients to help them stay at home, and also thrilled this is happening in my community."*

# Anticipated Outcomes & Success Measures for Next Year

- Initial data collection using a simulated home environment and further improvements on sensing systems
  - Continue to test system reliability and performance in the special “Home of the Future Lab” with multiple radio and depth sensors deployed covering different functional areas (e.g., living room, bedroom)
  - Conduct staged data collection experiments with human subjects, starting from research team member themselves, then possibly older adults with different needs in health conditions and care
  - Further improve the data quality and accuracy in the sensing hardware, software, algorithms and systems for different sensing modalities

- A comprehensive understanding of methods, perspectives on sensing technology adoption by multiple stakeholder groups, and increased visibility of the project
  - Explore methods and processes for technology adoption to include sensor data and discoveries into the overall patient care workflow with older adults, physicians, nurses, social workers, professional and family caregivers
  - Continue discussions with individual and provider stakeholders identifying their feelings for and concerns about home sensing to achieve knowledge saturation on diverse perspectives
  - Broaden community outreach to increase visibility and study recognition in communities with large older adult populations, by expanding participation and collaboration with major institutional initiatives
- Invite students from different disciplines to join our research group for more diversified backgrounds and experiences