Networked situational awareness subject to constraints imposed by community perceptions of trust and privacy: preliminary study

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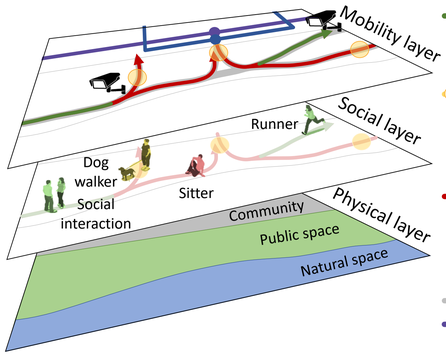
Introduction

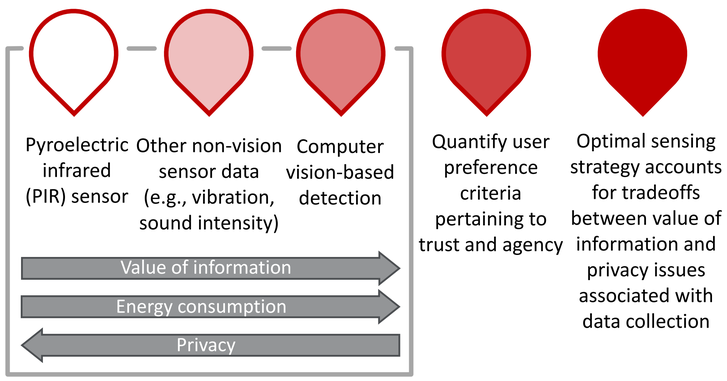
Situationally-Aware Social Infrastructure Systems

- There exists a need to quantify the use and benefits of social infrastructure while preserving user privacy
- Solutions that can obtain full information normally invade users' privacy (e.g., cameras)
- Privacy-preserving solutions are anonymous, but include a great deal of uncertainties (e.g., pyroelectric infrared)
- Solutions should minimize reliance on privacy-invasive sensing where resident preference criteria pertaining to trust and agency constrain domain of solutions



: **Full information** Activity trajectory known; existence of event known; activity classified
: **Partial information** Activity trajectory unknown; existence of event known; activity not classified
: **No information** Activity trajectory unknown; existence of event unknown; activity not classified
: Active transportation
: Public transportation

Fig. 1. Sensing approach influences value of information and level of privacy.



Objectives

Increasing Information Gained from PIR Sensor

- Detect the direction of travel by integrating multiple pairs of PIR sensors
- Detect the velocity of travel by 1) empirically determining relationship between output signal and human action and 2) empirically determining detection range
- Detect multiple people passing simultaneously
- Design full prototype that will be used in Mellon Park

Methods and Results

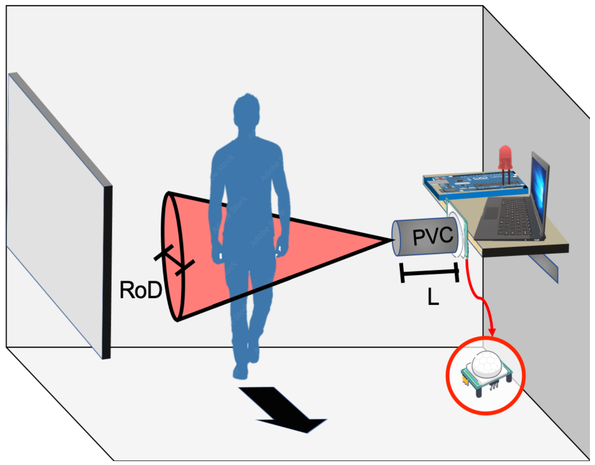


Fig. 2. Experimental setup.

RoD: Range of detection

L: Length of pipe

: Whiteboard to mark RoD

: LED to signal human action detected in detection range

: Serial monitor to record Time Duration at High State (TDHS) of PIR sensor

: Arduino UNO

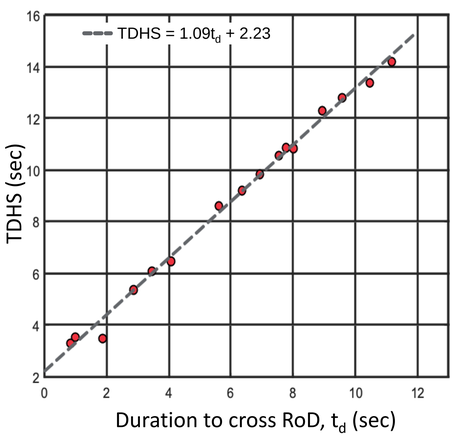


Fig. 3. Relationship between output signal and human action.

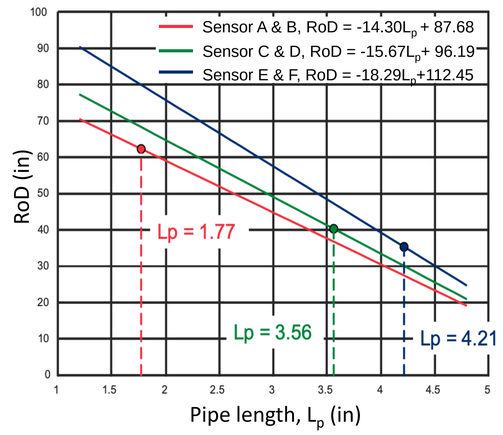
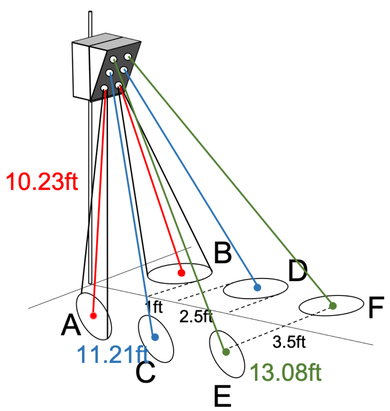
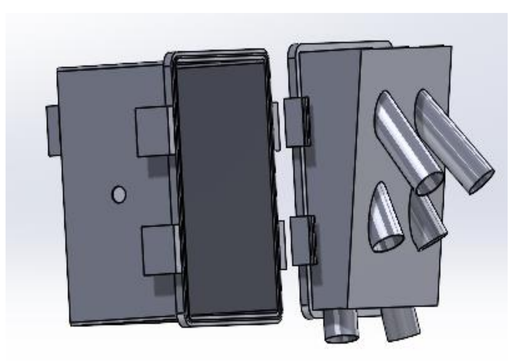


Fig. 4. Determination of pipe length.



(a)



(b)

Fig. 5. (a) Detection range of proposed system, and (b) final design enabling detection of multiple humans, including speed and direction.

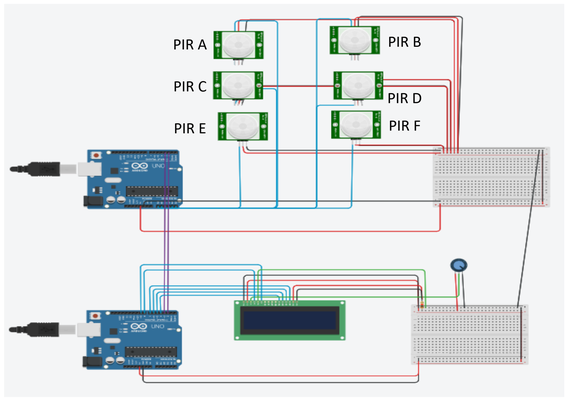


Fig. 6. System prototype reflecting hardware.

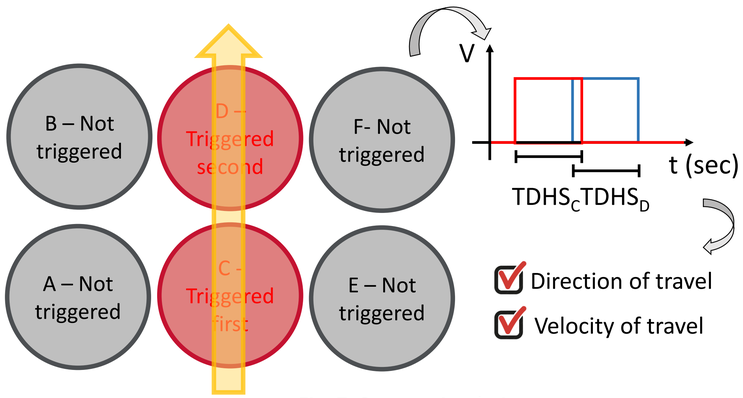


Fig. 7. System simulation.

Final Week and Future Work

Integration with *Urbano*

- Low power
- Energy harvesting
- Diverse communication interfaces
- Flexible sensing interface
- Integrated with robust cloud-based infrastructure

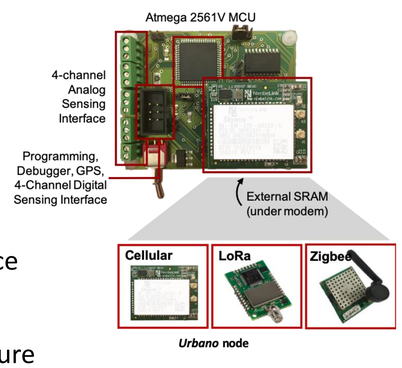


Fig. 8. *Urbano* node.

Acknowledgement

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