

myCityMeter: Helping Older Adults Manage the Environmental Risk Factors for Cognitive Impairment

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Problem

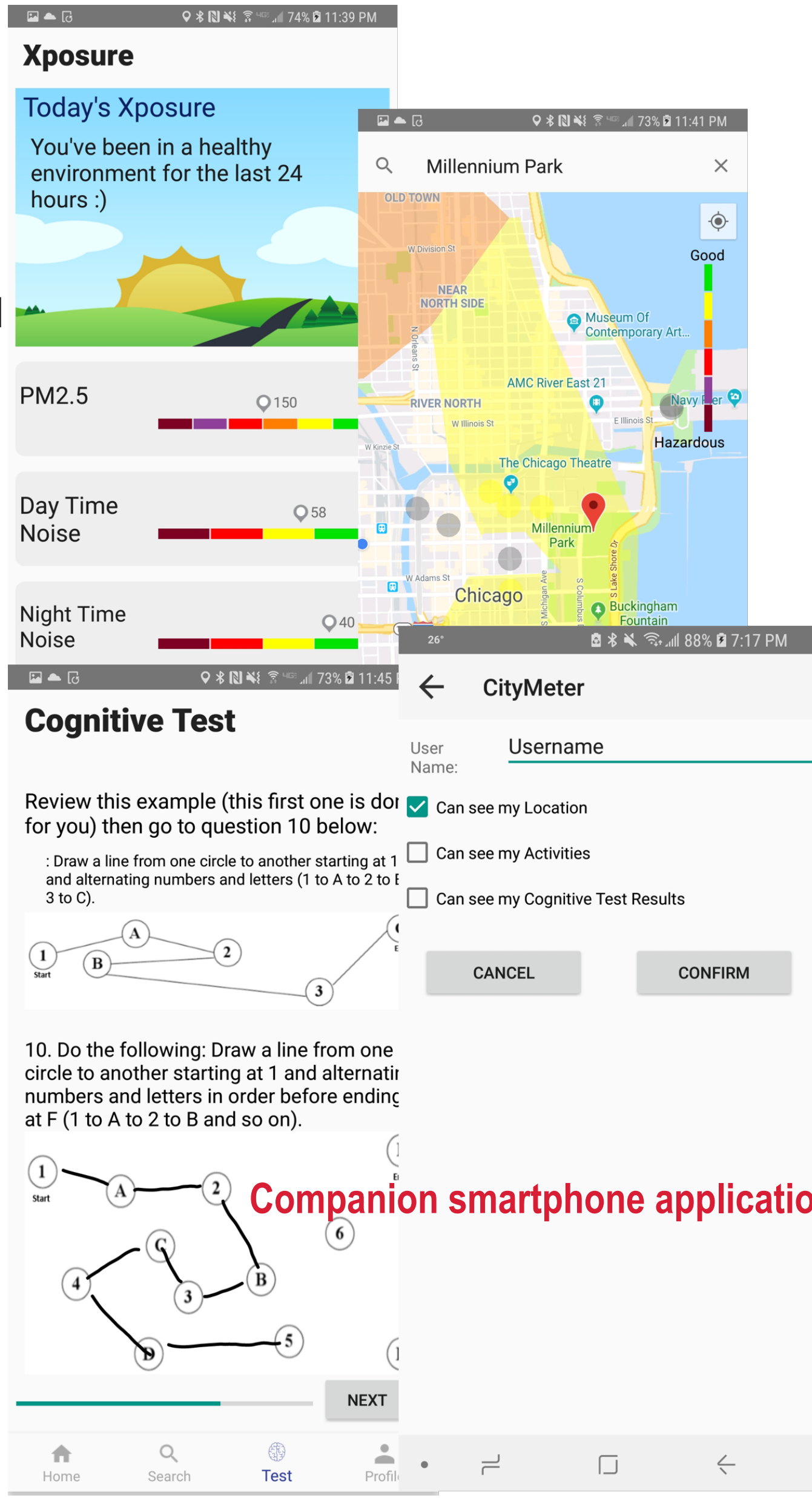
- Exposure to urban pollution is linked to many health risks, particularly affecting the aging population. For instance, long-term exposures to air pollution (PM_{2.5}) and ambient noise are reported to be positively associated with mild-cognitive impairment (MCI).
- MCI is a precursor to dementia. It is estimated that by 2020, 42.7–48.1 million people worldwide will suffer from dementia.
- Ubiquitous computing offers the promise of estimating pollution exposures. But personally tracking pollution exposures is challenging—especially by older adults.
- First, wearable environmental sensors are low-cost but suboptimal; sensitive to interference due to people’s daily life activities, e.g., skin or textile emissions.
- Second, measurements from central-site monitors, the gold standard, are accurate but lack spatial and temporal resolution, e.g., one reading in 6 days
- Third, current wearable pollution monitoring tools are primarily designed for citizen scientists—lacking the design requirements to support at-risk communities.

Approach



Results

- An off-the-shelf particle concentration sensor, Plantower PMS 5003, is mounted on the Pi, which uses a laser scattering principle to measure PM_{2.5}. The phone records ambient noise and transforms it with A-weighting [dB(A)].
- Pi sends readings to AWS when Wi-Fi is available; else to the phone via Bluetooth which then transmits the data to the server via LTE. If both Wi-Fi and Bluetooth are unavailable, readings are stored locally in the Pi. Each reading is geotagged (using the phone’s GPS) and timestamped.
- To complement wearable sensing, we collect noise and PM_{2.5} data from Chicago’s Array of Things (AoT) urban sensing nodes (~100) and US EPA monitoring stations (4).
- The middleware of myCityMeter is hosted in an AWS cloud which gets data from AoT and EPA and communicates with the mobile client app using a RESTful API.
- The phone app allows users to look up current pollution and their daily and yearly pollution exposures—PM_{2.5}, day-time and night-time noise—at both current and a future location.
- Actions to avoid pollution exposure are suggested. The Self-administered Gerocognitive Examination (SAGE) is provided to journal cognitive performances.
- Users can add their caregivers and provide different permissions, such as to score and monitor their cognitive tests or access their current location.



- 1 **Multi-resolution environmental sensing**
myCityMeter uses a set of neighborhood-level stationary and personal mobile sensors
- 2 **Monitoring personal pollution exposure**
myCityMeter helps users to monitor long-term air and noise pollution exposures
- 3 **Journaling cognitive functions**
myCityMeter allows users to journal cognitive performances to help diagnose MCI