



# Physiological Sensors & Cognitive Measurements

Nicole Trappe, Micheal Ostertag, Jasmine Simmons, Rishikanth Chandrasekaran, Anwesan Pal, Massimiliano Menarini, Tajana Šimunić Rosing

UC San Diego

Our objective is to utilize environmental and physiological sensors to record the daily habits, interactions, and health of participants to determine states of cognitive decline. Under a central data aggregator, all the sensors will be integrated, and the data collected, stored, and encrypted.



## PLAYSTATION EYE

- Speech can play an important role in indicating levels of dementia through the use of speech patterns, pauses, fillers, and tone
- In-home noises such as water flowing or cabinets opening will recognize activities and daily habits



## AIRBEAM & CITYSENSE: AIR QUALITY

- The quality of the air—the levels of CO<sub>2</sub> and particles contained—can affect mental processes, general health, and the microbiome



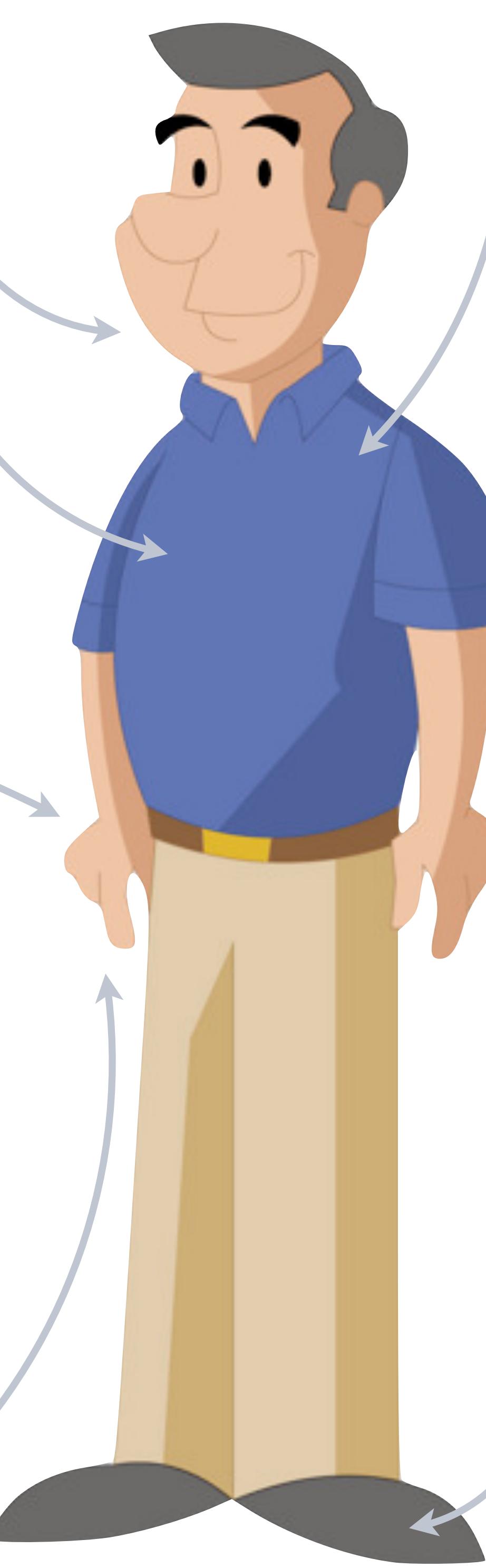
## HUAWEI WATCH

- Android Wear OS compatible Smartwatch
- Records step count, sleep cycles, heart rate using Photoplethysmography, and accelerometer data as a person gestures in the XYZ axis
- The watch information will be integrated with the Beacon RSSI triangulation to enhance accuracy of indoor localization
- Tracks activity which is essential to maintaining proper levels of neurotransmitters for optimal mental health as well as physical fitness



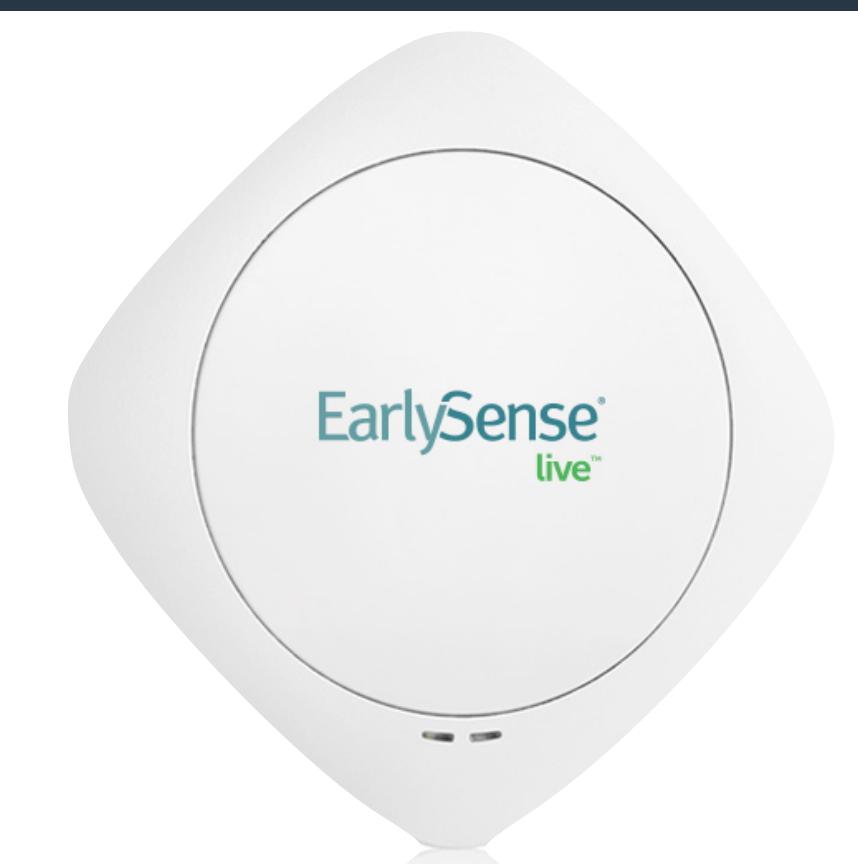
## ESTIMOTE: BLUETOOTH BEACONS

- These track the motion and activity of individuals offering an insight into daily habits



## EARLYSENSE: SLEEP TRACKER

- Sleep is key to cognitive functioning, therefore, we must analyze the quality, consistency, and duration
- We will record sleep cycles (NREM, REM, Light, Deep), movement (if sleep was restless), heart rate and respiration (if stable, or interrupted via stressors)
- Analyzes reflections of low-power, high-frequency RF signals from sensors placed under a mattress
- Records ambient conditions (e.g., temperature, air quality), movement, heart rate, and breathing rate



## MC10 BIOSTAMP

- Measures heart rate, activity posture, EMG, ECG, respiratory rate, step count, skin temperature, fall detection
- Detailed analysis of muscle movements (e.g., posture, jitter) may indicate levels of stress and stability
- ECG can identify dysfunctions or inconsistencies in heart rate
- Consists of four electrodes, battery, gyroscope, accelerometer, Bluetooth radio, and memory
- Gyroscope offers XYZ axis range of motion



## YUNMAI COLOR BLUETOOTH

- Measures weight, BMI, BMR, bone density, heart rate, water volume (level of dehydration), BMR, visceral fat
- A key component is the measurement of dehydration can be a confounding variable
- The scale also indicates the physiological strength and wellness through bone, fat, and muscle mass



Comprehensive Analysis	
BMI	28.8 >
Body Fat	25.6% >
Muscle	49.8% >
Water	54.0% >
Protein	16.4% >
Visceral Fat	3 >
Bone Mass	4.5% >
BMR	1919 >
Body Age	21 >

## **ABSTRACT**

Cognitive decline has become one of the most mentioned topics in the realm of aging. As we continue to live longer and have a desire to remain in our own homes, it has become paramount to track and monitor the onset of cognitive issues such as Dementia and Alzheimers. Our project utilizes both physiological and environmental sensors to track the daily habits, activities, interactions, and health of our participants without infringing on their privacy and routine. This data is used to determine the progression of cognitive decline and how best to address it.