

Eighth Annual Cyber-Physical Systems Principal Investigators' Meeting

Arlington, VA | November 13 – November 14, 2017

EAGER: Events of Interest (Eoi) Capture Using Novel Body-worn Fully-passive Wireless Sensors for S&CC

Award # 1637250. Project Duration: Jul. 2016-Jun. 2018. Institution: The University of Memphis

Bashir I. Morshed, Brook Harmon, and Mamunur Rahman

SCC Health Challenges:

- High incidence of chronic disease.
- Utilization of smart phones technology for communication of SCC Health.
- Technological barrier: inability of integrated sensors to collect clinically important physiological signals.

Proposed Objectives:

- Deliver wireless, battery free body-worn WRAP sensors (Fig. 1) to allow multi-modal clinically relevant data capture.
- Develop an open-source framework for Events of Interest (Eoi) classifiers via a smart phone app for self-monitoring and secure knowledge sharing with S&CC.
- Deploy the sensor platform in a "Living Lab" pilot study. Data will be collected and classified in real-time to generate Eois for multiple health conditions (Fig. 1).

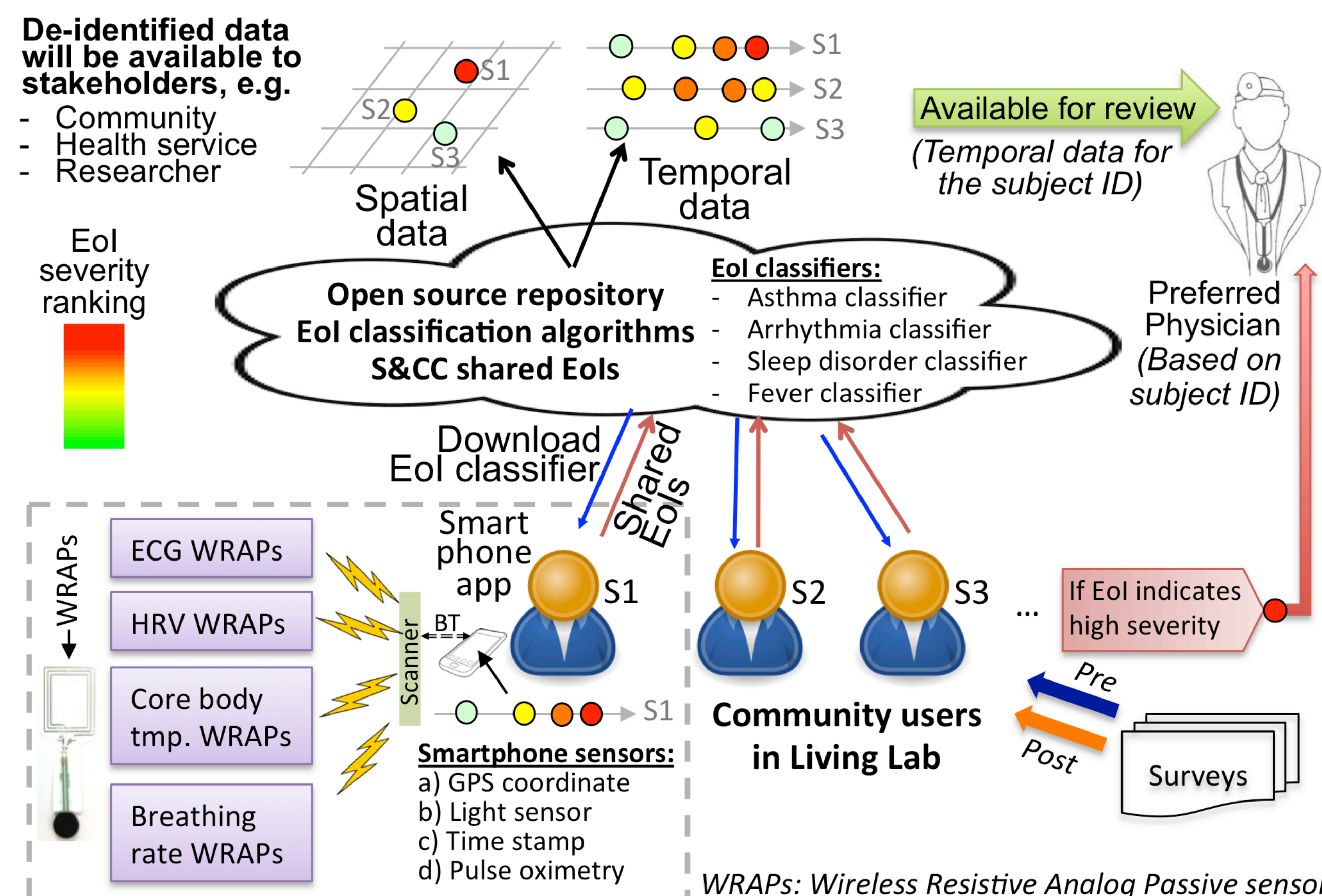


Fig. 1. Graphical representation of key aspects of the project.

Scientific Impact:

- Very low-cost, battery-less, easy-to-use disposable for clinically relevant signals.
- Eoi algorithms for in real-time accurate and sensitive classification.
- Open framework, spatio-temporal data.

Broader Impact:

- Better management of chronic disease and sharing anonymous Eois with S&CC.
- Possible reduction in frequent and unnecessary hospital visits.
- Spatio-temporal Eoi data for clinical/community decision support.

Contact: Bashir Morshed, Associate Professor, Electrical & Computer Engineering, University of Memphis. Phone: 901-678-3650. Email: bmorshed@memphis.edu

Project Progress:

WRAP sensors

Wearable scanner

Firmware

Test results

Smartphone app

SCC Health portal

Dr. Harmon at a community outreach and recruitment drive

Power Consumption

| | |
|------------------------------------|---------|
| Microcontroller board with DDS on | 94.5 mW |
| Microcontroller board with DDS off | 72.9 mW |
| Analog amplifier | 406 mW |

Table 1: Severity and Suggested prompt

| Temp. (°F) | Severity | Suggested prompt | Eoi rating | Color code for Eoi ranking |
|------------|--------------------|---|------------|----------------------------|
| 97 | Normal | | 0 | Dark green |
| 98 | Normal | | 1 | Green |
| 99 | Normal | | 2 | Light green |
| 100 | Low grade fever | Low fever | 3 | Green-yellow |
| 101 | Low grade fever | Low fever | 4 | Yellow |
| 102 | Intermediate fever | Medium fever | 5 | Yellow-orange |
| 103 | High grade fever | High fever, consult your doctor | 6 | Orange |
| 104 | High grade fever | High fever, consult your doctor | 7 | Orange-red |
| 105 | Extreme fever | Very high fever, consult your doctor immediately | 8 | Red |
| 106 | Extreme fever | Very high fever, consult your doctor immediately | 9 | Dark red |
| 107 | Medical emergency | Extremely high fever, consult your doctor immediately | 10 | Dark red-maroon |

Project website: http://www.memphis.edu/esarp/nsf_scc/index.php
SCC Memphis Web Portal: <http://sccmemphis.com/index.php>
Github (public access of app codes and sensor designs): <https://github.com/esarlab>