Physiological Monitoring for Childhood Asthma

SenSIP Algorithms and Devices REU

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ABSTRACT

- Create a wearable device to connect patient's physiological response and the environment
- Accomplished by creating a Human-in-the-loop Cyber Physical System (HiLCPS)
- Determine how multiple devices' position and distance correlate
- Integrated health care device enables patients to identify stressors and manage treatment
- Data enables correlation of symptoms with environmental markers
- Treatment plan tracked and optimized

PROBLEM STATEMENT

The goal of this project is to create a Human-in-the-loop Cyber Physical System (HiLCPS) that would combine environment and physiologically data to provide continuous patient-specific data to user and healthcare provider. The data will be crowd-sourced to generate a high-resolution pollutant map. STEM learning and environmental consciousness will be gained through pilot studies with K-12 students.

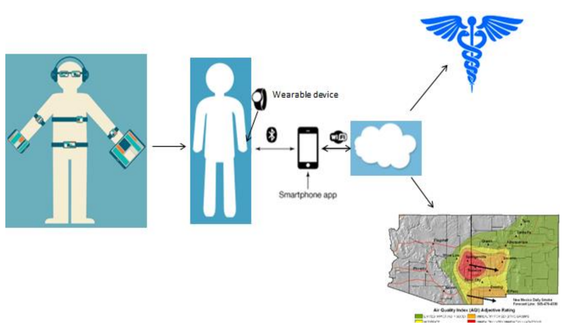

Figure 1: Diagram of how the wearable device will share data with patients, healthcare providers, and environmental maps

METHODS

A.) 4 Device Dust Distance Experiement
- Battery packs
- Distances of 100cm, 200cm, 300cm, 400cm, 500cm, 700cm, 900cm, 1100cm, 1300cm
- At a marked distance a person with powered chalk on hands, clapped rapidly three times.
- 3 trials at each distance
- 1 minute increments of rest were taken between each rapid clap

B.) Distance Sensitivity Experiment
- Battery packs
- Distances of 100cm, 200cm, 300cm, 400cm, 500cm, 700cm, 900cm, 1100cm, 1300cm
- At a marked distance a person with powered chalk on hands, clapped rapidly three times.
- 1 trial at each distance
- 4 minute increments of rest were taken between each rapid clap

C.) Shuffle Sensitivity Experiment
- 2 devices powered by battery packs
- 10 meter distance measured
- 50cm increments marked (0m-10m)
- Point source at 5m
- Person with 1 device at opposite end of marked 10m
- Every 60s person moved to mark towards point source
- Devices cross paths at 5m and continued to opposite end of measured 10m

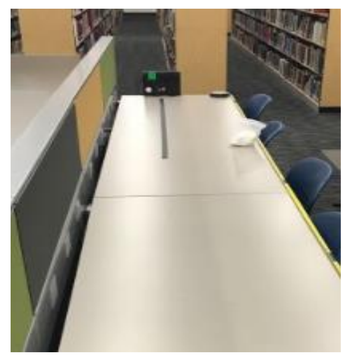

Figure 2: Set-up of experiment A

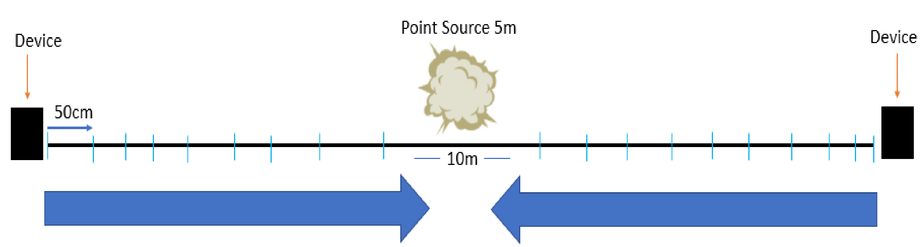

Figure 4: Experiment C set-up

RESULTS AND DISCUSSION

A.) 4 Device Dust Distance Experiment
- Multiple logger files, therefore multiple power cycles
- Conclusion: unstable power source, used battery packs in farther experiment

B.) Distance Sensitivity Experiment
- Added real time clock and increase sampling time
- Conclusion: Cleared peaks in all devices
- Impact: Devices can be correlated
- No real time clock
- Conclusion: points on different devices could not be correlated.

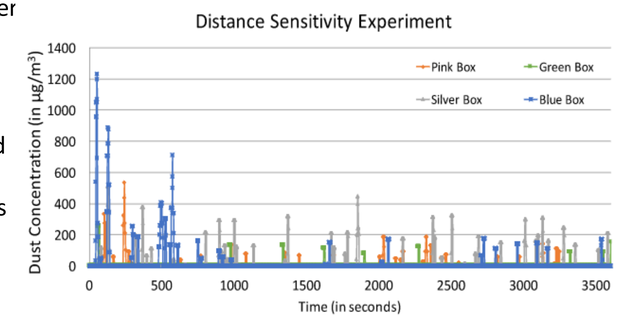

Figure 4: shows the moving average of the experiment B

C.) Shuffle Sensitivity Experiment
- Results: Grey device picked up data before blue.
- Impact: lag time: downstream draft because the sensors used are not instantaneous, devices can be correlated around a point source

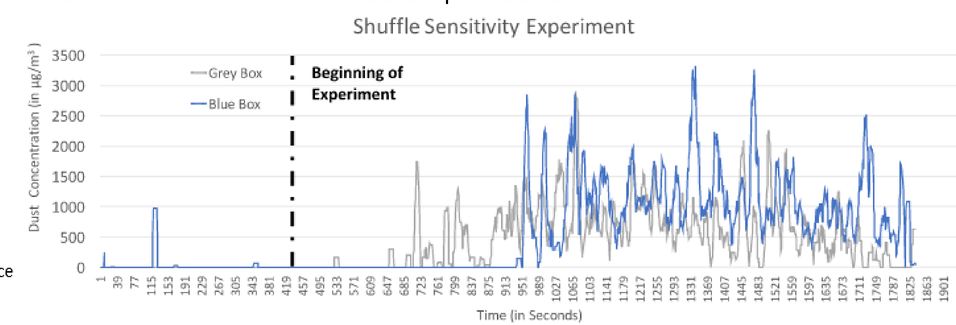

Figure 5: shows the moving average of the experiment C

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