

**Sensing Spaces: Personal
Exposure with Different Modes of
Transport and Urban
Environments Using Wearable
Sensors**

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Abstract

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Chapter 1

Introduction

1.1 Motivation

Air pollution in large urban environments is a controversial topic nowadays and pollution sources, as well as distribution and effect on human health have been widely studied. Particulate matter (PM) represents the sum of all solid particles and liquid droplets of small sizes that are suspended in the air. It has been discovered that exposure to such particles of size less than 10 microns can be hazardous for the human body and it has been associated with increased mortality rates in areas labelled as highly polluted.

Air quality is mostly measured through stationary Air Quality Monitoring Stations (AQMS). They measure air quality at a fixed location on a certain radius with high precision. Data collected from such networks of stations distributed strategically within urban environments is used to determine exposure to pollutants and is used for checking if a specific area meets requirements set by legislation. One drawback of this approach is that monitoring a large fixed region through a stationary sensor would not always suffice to obtain accurate information about air quality and pollution sources, as parameters vary from a corner of the region to another and other external factors such as wind speed and terrain type affect the results.

One approach to solve this issue and obtain more accurate data from the environment would be to deploy low-cost mobile sensors on people, such as drivers, pedestrians and cyclists in order to obtain a more precise spatial representation of the air quality. However, these sensors have to be calibrated in correlation with the Air Quality Monitoring Stations to ensure high precision of the information gathered.

1.2 Objectives

This project mainly focuses on Mobile Exposure Monitors (MEM) developed by the Centre for Speckled Computing. These wearable devices are equipped with sensors measuring humidity, temperature and particulate matter. Data is transmitted to an An-

droid device via Bluetooth Low Energy. The project presents several study methods for detecting urban environments and personal exposure with different means of transport, based on air quality data collected with the wearable sensors. The objectives of the project are:

- Collect data at specific times on a daily basis and on a fixed route.
- Perform analysis on data gathered for various modes of transport and urban environments and research machine learning techniques to detect personal exposure on a specific mode of transport or urban environment based on temperature, humidity and particulate matter attributes.
- Build a data visualization tool for a more accurate spatial representation of data gathered and results obtained after applying statistical and machine learning methods.
- Validate measurements of sensors against a more accurate Air Quality Monitoring Station in Edinburgh.

1.3 Literature Review

1.4 Method

1.5 Structure of the Report

Chapter 2

Background

Chapter 3

Methodology

Chapter 4

Implementation

4.1 Data Visualisation Tool

Chapter 5

Conclusions

Chapter 6

Results

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