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CityFeel - micro climate monitoring for climate mitigation and urban design

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Abstract

While a significant part of the population is concentrated in urban areas, the influence of cityscape parameters on human heat stress remain poorly understood. Yet we agree to develop urban spaces (street, square, district ...) in a way to provide best possible quality of life. In order to do so, quantitative and qualitative references are required. To fill this gap the HES-SO[†] - hepia/leea[‡] has developed an innovative portable monitoring system that can be easily deployed in various outdoor and indoor environments. The monitoring equipment is embedded into a backpack that is carried during 'climatic urban walks' that can be reproduced at different times of the day or seasons so to yield a detailed and dynamic description of the climatic context of a portion of the city from the pedestrian point of view.

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Keywords: climate mitigation; micro climate monitoring; urban design; open data

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1. Main text

1.1. Introduction

75% of the European population is concentrated in rapidly growing urban areas. While adaptation to climate change in cities is a major challenge, “well-being” in terms of hygrothermal comfort and air quality of residents and pedestrians and the contributing effects are still poorly understood. Ongoing urban developments (streets, squares, plazas, parks, crossroads, and neighborhoods) claim to offer the best possible experience to their users (inhabitants, pedestrians). Yet, development policies are often based on subjective knowledge and lack quantitative and qualitative reference data.

Hence, climate warming and urban heat island effect have direct impact on inhabitants’ health (specially the elderly and weak), on pollution levels, on energy consumption (e.g. air conditioning), on biodiversity, etc… Due to these issues, growing attention is being paid to the management of urban spaces of all kinds. Design (ergonomics, aesthetics) is not enough; climate resilient planning will be a challenge for the next decade and will help to mitigate adverse effects of climate change. Local authorities will adapt urban planning in ways that take into account climatic and sanitary constraints, meaning that urban planners and local governments require reliable reference data to make best choices with a limited budget and time.

CityFeel aims to provide a toolbox to urban planners for climate-adapted city development. This toolbox comprises a methodology, physical tools and open data that are made available to planners and the scientific community. In-depth knowledge of the dynamics of “comfort and air quality at a pedestrian level” will have many purposes, including but not limited to urban surfaces, vegetation, traffic control, health monitoring, etc.

1.2. State of the art

Unlike reference climate stations (physical parameters) and air quality stations (chemical parameters) that are commonly used for conventional meteorological purposes or the monitoring of pollution levels, *CityFeel* measures the human perception of the immediate environment in terms of response to hygrothermics and air quality. This is why the protocol must be tied to the human metabolism and measurements must take place at pedestrian level.

Most commonly, when climate or air quality data are available for a given city, these are derived from static measurement stations. Their aim is to qualify the urban climate according to conventional classifications such as city center, suburbs, countryside. For example Geneva has three WMO grade measuring stations, (maintained by the University of Geneva and by hepia / climacity) in addition to the historical station of the Swiss Office of Meteorology at Cointrin (Geneva airport). The size and complexity of these conventional stations do not allow for extensive coverage over a given territory or even a district. Furthermore, measurements from conventional weather stations do not describe what is “felt” at pedestrian level.

Other methods consist of making use of numerical simulation models; whilst the complexity of these algorithms can be managed with increase of computing power, limitations are mainly due to the capability of physical model input description and limited resolution of the city model, as well as the scarcity of reliable data for model calibration. These models tend to have limited resolution and reliability at pedestrian level, where the feedback is most critical and also is most complex to simulate.

Drive- or walkthroughs with sensors attached to vehicles have been demonstrated over the past decades and have produced parameter profiles trough many city sections. The observation that for example ‘green’ or ‘blue’ do not always have measurable effect shows that there still is a lack of knowledge on how these indicators should be interpreted into robust ‘climatic bricks’ for urban developers and planners.

Due to the previous points we have not yet found a city with a network of long-term quality climate measurements at pedestrian level with a high density of measurement points and who’s monitoring considers human metabolism.