

# From Data to Decisions: Understanding Pedestrian Flow with WiFi Scanner Data

Mohamed Shamroukh<sup>\*1,2</sup>, Asya Natapov<sup>1</sup> and Taimaz Larimian<sup>1</sup>

<sup>1</sup> School of Architecture, Building & Civil Engineering, Loughborough University, UK.

<sup>2</sup> Department of Geography and GIS, South Valley University, Qena, Egypt.

**Corresponding author\*:** Mohamed Shamroukh, School of Architecture, Building and Civil Engineering, Loughborough University, Sir Frank Gibb Building, West Park, Leicestershire LE11 3TU, UK.  
Email: M.shamroukh@lboro.ac.uk

## Abstract

Understanding pedestrian movement is crucial for designing walkable and accessible urban environments. Traditional data collection methods, such as manual counts and surveys, often provide limited spatial and temporal coverage, leading to an incomplete representation of pedestrian activity. This study examines WiFi scanner data as a scalable and automated alternative for analysing pedestrian flow in urban areas.

WiFi scanners detect anonymised signals from mobile devices, providing a privacy-conscious method for estimating pedestrian presence. This study validates WiFi-derived data against manual counts to assess its accuracy and reliability. Additionally, integrating this data with urban and environmental factors through geospatial analysis generates detailed pedestrian flow maps, capturing variations in movement patterns over time and across different locations.

The findings demonstrate that WiFi scanner data effectively represents pedestrian activity by distinguishing between peak and off-peak periods and identifying areas of high and low foot traffic. This approach provides continuous, detailed insights that support data-driven urban planning. These results can help policymakers enhance pedestrian infrastructure, improve accessibility, and create more inclusive urban spaces.

**Keywords:** Urban Mobility, Pedestrian Flow, WiFi Sensing, Spatial Analysis, Smart Cities.

## References:

- Huang, B., Mao, G., Qin, Y., Wei, Y., 2021. Pedestrian Flow Estimation through Passive WiFi Sensing. IEEE Trans Mob Comput 20, 1529–1542. <https://doi.org/10.1109/TMC.2019.2959610>
- Saltarin-Molino, M.A., Moros-Daza, A., Camacho-Sanchez, C., 2023. Taking steps forward: Innovative evaluation of pedestrian infrastructure through a multivariate analysis. Case Stud Transp Policy 14. <https://doi.org/10.1016/j.cstp.2023.101091>
- Varsha, T.C., Sajja, S., Ramya Aruna Siri, B., Prasad, G.H., Kashyap Tejo Sai, E., 2023. Pedestrian behaviour analysis at intersection in Vijayawada for road user safety and infrastructure design, in: IOP Conference Series: Earth and Environmental Science. Institute of Physics. <https://doi.org/10.1088/1755-1315/1280/1/012048>

## Biography



**Mohamed Shamroukh** is a Doctoral Researcher in Urban Planning at the School of Architecture, Building and Civil Engineering, Loughborough University. His research focuses on modelling urban environments to promote sustainable, pedestrian-friendly cities. ORCID <https://orcid.org/0000-0002-1005-2600>.



**Asya Natapov** is an Associate Professor of Urban Planning and Design at the School of Architecture, Building and Civil Engineering, Loughborough University. Her research focuses on analyzing and modelling visual perception, navigation, and wayfinding in urban environments. ORCID <https://orcid.org/0000-0001-7654-1864>.



**Taimaz Larimian** is an Associate Professor of Urban Planning and Design at the School of Architecture, Building and Civil Engineering, Loughborough University. Her research focuses on social sustainability, sustainable urban form, urban security, and city branding. ORCID <https://orcid.org/0000-0001-5346-2303>.