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PIONEER: open wireless sensor network for smart environmental monitoring of remote areas

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Atmospheric observatories in the remote areas represent the primary infrastructure for the state-of-the-art meteorological and climate research and play a crucial role in Climate Change comprehension. However, the World Meteorological Organization Global Atmosphere Watch (WMO-GAW) states in their 2018 final report that “the fate of the next generation of monitoring stations will be dramatically modified by the breakthroughs of new low-cost sensor (LCS) technologies.”. The development and improvement of low-cost technologies are proving notable applications and today LCSs are already playing a crucial role in fields such as model or emission validation and spatial variability of pollution[1]. Upcoming earth observation programmes, applications, services and support in citizen inclusion in earth monitoring are pushing the European Union (EU) in funding R&D to assess low-cost technologies, thus making the introduction of basic and applied research imperative.
PIONEER* aims at establishing a low-cost wireless sensor network (LCS-WSN) for the study of transboundary transport phenomena of air pollutants. Given its highly relevance for the Earth climate, ecosystems, and human health, primary endeavor will be directed towards the study of tropospheric ozone to obtain quantitative, reproducible in-situ measurements. Tropospheric ozone is one of the most important atmospheric gases involved in photochemical reactions[2], it plays a central role in the radiative budget of the atmosphere and it is the third greenhouse gas in the troposphere[3]. Also, surface ozone is a dangerous secondary pollutant causing harm to human health and ecosystems[4]. Since the troposphere is a very complex system the goal is to develop and deploy a reliable LCS-WSN, along the trail Munich-Venice, to be used by scientists as well as citizen engineers in remote areas, where the needs of reliable dense spatial data to model the transport phenomena and Climate Change effects is decisive.
PIONEER will exploit the existing open source technologies and commercial low-cost sensors to provide a LCS-WSN systems for long term climate data collection, a cloud-assisted database for time series collection and management, a web portal for uploading, displaying, performing statistical analysis and downloading records and metadata in a fully open access fashion, a

comprehensive open source repository with tools, guidelines and application developed. The software will be open-source and released under copyleft license, thus allowing the complete reproducibility of all the developed devices and tools.

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