Comparative Analysis and Evaluation of the Visualisation of Wireless Sensor Data

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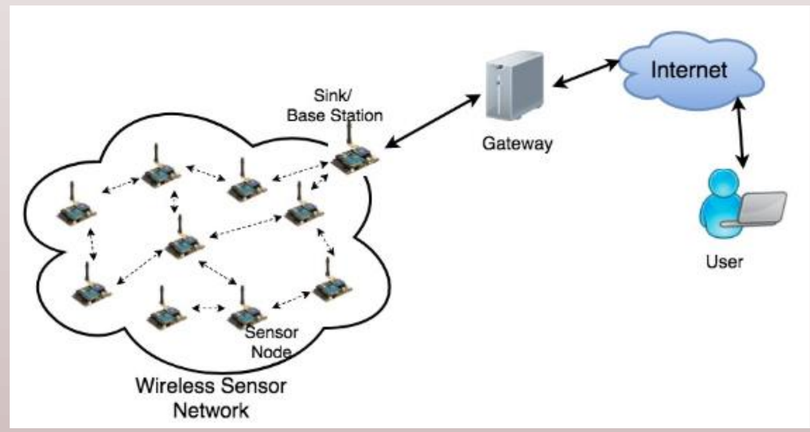
Introduction

A wireless sensor is a device that provides service in the form of an electronical signal. They are used to detect and collect various data types, such as Light, image, pressure, temperature, and location, from a physical or environmental space. They typically work under low requirements of power, resulting in little to no on-board processing and tend to be specifically designed to their required task and environment.

A Wireless Sensor Network (WSN) consists of many wireless sensors, referred to as nodes, that gather and communicate recordings and information between each node and a sink node, or base station, where the data can be processed before being sent via a gateway and internet to the user.

Figure 1: An illustration of WSN architecture



Application of WSN can be split between two categories, Monitoring and Tracking, and can be found across the following sectors: environmental, industrial, agricultural, healthcare and military. Due to their wide range of applications, WSN's are becoming an intrinsic component in the emerging field that is the Internet of Things (IoT).

Research Objective

The objective of this research will be to investigate existing literature around WSN and the Monitoring Platforms (WSN-MP) that are currently employed in WSN visualisation, with the intention of providing an analysis of currently used WSN-MP and the creation of a WSN visualisation model for use with WSN data.

Dataset

Currently looking into datasets from agricultural and environmental sectors. Completion of the Literature Review will assist in the selection of the best dataset(s) to facilitate the analysis of the selected research objective.

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Literature Review

Previous research has mostly focused on WSN infrastructure standardisation and resource constraints, with the redundancy and efficiency of nodes, and security protocols being among the main points of focus.

WSN's tend to be ad-hoc and built specifically to a required task, resulting in many WSN's being inflexible or incapable in monitoring or tracking additional non-homogenous data.

The data from numerous WSN will tend towards heterogony, resulting in the use of more than one visualisation tool to interpret and abstract the WSN data.

New WSN's will require appropriate and compatible monitoring platforms to integrate into a shared ecosystem with IOT technologies.

Methodology

Establish a state of the art across the breath of WSN literature with an in-depth analysis in the area of WSN Visualisation.

Develop a concept for an off the shelf visualisation model WSN-MP, that potentially uses machine learning (ML) and python to assist in WSN visualisation of heterogenous data for end users.

Develop and trial a test model on 2/3 varying and heterogenous types of WSN/IOT data using the Institute of technologies Hadoop cluster.

Compare results against state of the art identified from literature.

Get qualitative feedback from users on the test model

Technologies

python™ jupyter APACHE hadoop Altair Apache Zeppelin RStudio scikit learn

Next Steps

Implement the proposed visualisation model for testing on real world deployments.

Incorporation of the visualisation tool with existing infrastructure modelling to improve, debugging, security, topology mapping and abstraction of WSN.

Provide WSN engineers an easy to use and readily accessible online visualisation tool for WSN/IOT data

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