Chapter 3
Traffic:
An Intelligent System for Detecting Traffic Events Based on Ontologies

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ABSTRACT

Traffic event detection is a multidisciplinary field that includes information retrieval, automatic, big data, etc. The absence of tools that integrate the detection of traffic events with the annotation, grouping, and location of events on transport routes led to the conception and implementation of this intelligent system based on ontologies for the management of streams, which facilitates the grouping of traffic data. As a result of the application of the system, it was possible to identify the speed events of a road in real-time and validate its efficiency through clustering algorithms.

INTRODUCTION

Prediction of traffic events has been one of the research fields in the development of smart cities. Sensors are one of the most important data sources available for these purposes. Thanks to the semantic

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web and Internet *of Things* (IoT) applications, sensor data can be published and reused, interpreted and integrated into public service applications. The Open Geospatial Consortium (OGC) provides standards for the management of sensor networks and provides a means to annotate their observations. However, these standards are not integrated or aligned with the W3C (*World Wide Web Consortium),* Semantic Web and linked data technologies Linked Data (2005). With the development of the IoT (Trialog, 2021), smart cities and buildings, the data produced by sensors are stored and increasingly used by citizens. With this data, multiple information can be recovered, the detection of traffic events has become a multidisciplinary field that includes information recovery, automatic, big data, etc. Although the current conception of traffic event detection has a strategic nature, it has not yet had a parallel development to the possibilities offered for storing information in RDF. If we truly want to move towards development with this strategic approach, it will be necessary to first develop tools that automatically assist users in detecting these events. These reasons alone determine the need to develop tools that allow applications to be made for end users in this area.

Currently, methods and techniques have been developed for each of the areas of the semantic web in isolation and there are few tools that integrate them for the development of research in this field. For this reason, a computational solution is required that allows, at least, the integration of semantic web techniques in the detection of traffic events. Based on the above, the general objective of this work is established to develop a tool that facilitates the detection of traffic events and that integrates elements of Artificial Intelligence and the Semantic Web (Villazon et al, 2020) in its conception.

DEVELOPMENT

Next, the architecture of the Traffic system is introduced, describing its components, the communication between these components and with other domain definitions and finally, how to semantically query the annotated data using the SPARQL language will be exemplified.

Ontologies

An ontology refers to a document or file that formally defines the relationships between terms. A typical ontology is composed of:

- A taxonomy that defines all classes of objects and the relationships established between them; For example: an address can be defined as a type of location.

- A set of inference rules that allows applications to make decisions based on the provided classes, without the need to understand the provided information. For example, an ontology can express the following rule: if a city code is associated with a state code, and an address uses that city code, then that address code has the associated state code.

Then ontologies allow establishing semantic relationships between the elements of their taxonomy and also making logical deductions by manipulating that information combined with the set of predetermined rules and in this way inferring logical conclusions about the data.

There are ontologies for different areas, particularly in the IoT area, the Time, SSN, SOSA (2018) ontologies (Janowicz, Krzysztof et al., 2021) among others are commonly used (Ortiz et al, 2006) . For the development of the Traffic system, the management of a new ontology called Traffic Store [1]was