

Chapter 16

Studying Individualized Transit Indicators Using a New Low-Cost Information System

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ABSTRACT

Current information systems used for data collection and to generate information on the state of the roads have two drawbacks: the first is that they have no ability to identify target-detected vehicles; the second is their high cost, which makes them expensive to cover the secondary road network, so they are usually located just on main routes. Thus, a new low-cost information system to monitor the traffic in real-time is proposed in this chapter. This system is based on scanning Bluetooth devices that are near the detection node. A large amount of data from passes of Bluetooth devices by different nodes (movements or displacements) have been collected. From this data, the frequency of appearance, average speed, or the number of devices that pass a certain site each day (on both working or non-working days) can be determined. The analysis of collected data has given statistics and indicators about the use of vehicles by the population of the monitored area. Specifically, the authors have obtained information about the total number of vehicles that each node has detected, on weekdays or holidays, information on traffic density by time range, on individual movements, the average speed on a section delimited by two consecutive nodes, and what demonstrates the power and features of the developed system.

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INTRODUCTION

Nowadays, having a system of information on traffic conditions and the use of roads is very important, not only to obtain information about traffic density, but also about repetitions of passing vehicles. This kind of information about traffic flows that occur in a certain area could allow people to optimally manage their motion decisions.

Current technologies used in traffic monitoring include pneumatic tubes, loop detectors, floating vehicles or automatic recognition systems, among others. The main disadvantage of these systems is that they are unable to identify detected vehicles, in order to obtain origin/destination matrixes. Just the number of vehicles and their type can be obtained, but they do not allow to obtain traffic flow, nor to determine whether a certain vehicle passes repeatedly. In addition, their high cost makes it unprofitable covering secondary roads with them, so they are often located on major roads. Moreover, technologies based on video image detection are very costly compared to the previous and can be sensitive to meteorological conditions.

In this work, several individualized transit indicators are studied using a new low-cost system information, with a fast deployment and highly reliable. This system provides real-time information about the traffic status on different road types and in real time (available as web services), not only to the official organisms and agencies in charge of the traffic controlling, but also to any person who requests it.

Our aim is having information about traffic using a new system based on the Bluetooth (BT) devices detection using several collecting nodes. Thus, we are able to monitor the traffic density and car journeys, identifying the vehicles when they move from one node to another inside the monitored zone. Therefore, various needs have been found:

- A versatile and autonomous data collection and monitoring device is needed.
- It is also necessary to collect traffic data in real time.
- Once the data has been collected, it has to be processed properly.
- And finally, a system that allows sharing data and information with those who make decisions about mobility is needed, both from the institutional and personal points of view.

As stated, the proposed system is based on BT device discovery. Specifically, it detects waves emitted by different technological components incorporated on vehicles (hands-free phone sets, GPS) or accessories that the users incorporate to their vehicles, as well as their mobile phones. Although not all vehicles carry a BT transmitter, nowadays increasingly more and more vehicles are equipped with them. In addition, in a very high percentage of vehicles the driver might carry a mobile with BT. In any case, as stated in (Bobject, 2013) an a priori error estimation of 8.5% of detections was obtained.

The system collects the MAC address of the device BT card as well as the exact time at which it has been detected. The MAC is an unique identifier for each device, allowing us to identify passing vehicles. Additionally, analyzing the MAC allows us to determine the manufacturer and even distinguish what type of device it is (i.e. handsfree, PC, mobile phone, etc), as detailed in (IEEE BT, 2013) and (Wikipedia OUI, 2013).

From the point of view of data privacy, it is noteworthy that the data collected cannot be associated, at least without recurring to other methods, to any vehicle since there is no information collected that enables the association of the information we collect with a specific person. Unidirectional encryption technology is used, using nonstandard characters that preclude identifying the MAC of the wireless device.

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