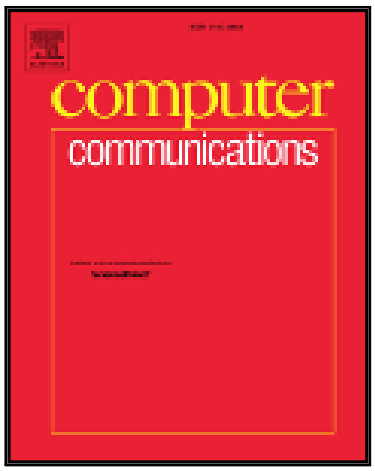

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A real IoT device deployment for E-Health applications under lightweight communication protocols, activity classifier and Edge data filtering

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Abstract

Recently the topic of health monitoring is growing in interest and several applications and devices were designed and put on the markets. This interest is promoted by an increasing enthusiasm about physical activities to improve health and wellness. In this work, we present a wearable device able to collect data from different body sensors to send them towards a cloud platform. The *Message Queuing Telemetry Transport* (MQTT) communication protocol is used to send data by customizing the messages payload and building up a customized protocol between devices and cloud. These data, are used to recognize user activity and health status sending alerts when an anomaly is detected. These results can be used to monitor performances or to investigate anomalies discovered during activities. In addiction, we propose a fuzzy-based *Human Activity Recognition* (HAR) classifier which continuously acquire data from body sensors exploiting an *Internet of Things* (IoT) architecture. In order to improve HAR, different classes of data filters have been analyzed to reduce the amount of data sent to the cloud. These filters introduce smart functionalities at the edge of the network reducing the data-flow without compromising the classifier goodness. A smart device based on embedded technologies is designed to realize the wearable device.

Keywords: *Internet of Things* (IoT), *Message Queuing Telemetry Transport* (MQTT), *Machine to Machine* (M2M), *Health-Care*, *Human Activity Recognition* (HAR), *Sensors*, *Embedded devices*

1. Introduction

The attention on keeping a good health status through the use of monitoring devices have been grown in interest exponentially. These interests regard not only medicine goals but also monitoring performances during sport challenges. Moreover, a lot of money is spent on expensive devices able to gather data about sport performances with the main goal of keeping a good health and improving life quality [1]. We focus our attention on the realization of a low cost wearable device to collect, analyse and classify data in order to monitor user health status. In a previous work [2] we already faced the HAR problem and we focused mainly on the recognition algorithm. In this work we enhance the already good results by comparing different sampling and filter policies in order to decrease the amount of data transmitted without losing useful information. Also a brief explanation of the recognition algorithm is presented along with the adopted clustering technique. The device is connected with a cloud system to make a further investigation on collected data as well as analyse them to better fit device parameters to the specific user. In this way there is a continuous parameters customization that adapts the device to the user. The smart device is composed of a three-axis accelerometer, a heart rate

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