Chapter 52
Employing Opportunistic Networks in Dementia Patient Monitoring

Radu-Ioan Ciobanu
University Politehnica of Bucharest, Romania

Ciprian Dobre
University Politehnica of Bucharest, Romania

ABSTRACT

By 2050, 135.5 million people will suffer from dementia worldwide. Ambient Assisted Living (AAL) technologies can help dementia patients enjoy an independent life. In particular, communication is vital to any AAL system. Opportunistic networking uses low-cost wearable devices to exchange packets at a close range in cases where there is limited or no infrastructure. In this chapter, the authors propose and describe an autonomous patient monitoring support system based on opportunistic communication. The monitored patient wears non-intrusive sensors, computing devices and actuators, forming a Body Area Network (BAN). The BAN can provide memory impairment support services for the patient and is used to construct personalized condition-monitoring patient models to evaluate against a set of potential life-threatening events. The authors present two data transfer algorithms and show that they are able to offer good hit rates while decreasing congestion and overhead when compared to other existing solutions.

1. INTRODUCTION

In recent years, mobile devices have become ever-present all around us. Ranging from simple sensors, smartphones and tablets, to high-range mobile access points, mobile devices can be found everywhere. A way of organizing these heterogeneous devices into a coherent unit that serves well-defined purposes is by creating an opportunistic network (ON) where they act as nodes. ONs are generally composed exclusively of mobile devices that wish to communicate between each other, although there may be no direct route between them at any time. Nodes in opportunistic networks are not aware of the topology of the network and of the other participating nodes. The only information they have is learned from encounters with other devices, through short-range proximity

DOI: 10.4018/978-1-4666-8756-1.ch052

Copyright © 2016, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

communication. Opportunistic networks are based on a paradigm entitled store-carry-and-forward. It implies that a node wishing to send a message to another node starts by storing the data and carrying it around the network, until it finds a suitable destination for it. Such a destination is not necessarily the message's destination, but it can also be another node that has a better chance of delivering the message to the destination than the current carrier. Thus, through collaboration and altruism, ON nodes end up delivering data even when there is no direct connectivity between two nodes.

There are many real-life use cases where opportunistic networks can or have already been employed successfully, because not only can they help ease communication in situations where two nodes may never be connected, but they can also decrease the costs of communication. This can be done, for example, by using short-range data exchanges (such as Bluetooth or WiFi Direct) instead of cellular communication (such as 3G or LTE). One of the first ever real-life applications for ONs was wildlife tracking, i.e., recording the movement and behavior of animals in their natural habitat without being intrusive. Special tags containing GPS sensors and close-range communication capabilities are attached to the animals, and fixed or mobile access points are set up in key places in the animals' habitats. Whenever two tagged animals encounter each other, information is exchanged between the devices. When a tagged animal comes in range of an access point, it uploads all available information, which may include data gathered not only from the carrier, but also from other encountered animals. Another situation where opportunistic networks have been successfully employed is in offering Internet access in limited conditions, where no infrastructure exists, such as rural areas where the deployment of Internet is not feasible or cost-effective (e.g., Indian villages). Kiosks are built in the village centers, equipped with digital storage and wireless communication devices, which interact periodically with mobile base stations mounted on buses, motorcycles or bicycles. These mobile stations collect the data from the kiosks and deliver it to Internet access points located in the larger cities, and vice versa.

Opportunistic networks are also appropriate for disaster management, when a natural disaster such as an earthquake, a tsunami or an explosion might disrupt the physical components of the network, such as switches and cables. In these situations, the cellular infrastructure cannot be used, so there is a need for ensuring more efficient and dependable solutions for the rescue missions, by using the unaffected components of the static infrastructures as nodes in an ON, along with mobile devices (such as smartphones) belonging to nearby citizens or survivors of the disaster, with the purpose of offering connectivity where otherwise there would be none, or simply decreasing congestion. Congestion problems may also appear in very crowded areas such as concerts, sporting events, amusement parks, where cellular communication is spread very thin by the large number of open connections from the same geographical location. Opportunistic networks can thus be employed to reduce the cellular communication to fewer nodes and access points, which are then able to spread the data to the other network participants.

Another situation where opportunistic networks could prove useful is in smart cities, which monitor and integrate the conditions of all their critical infrastructures (such as roads, rails, airports, power, water, etc.) in order to optimize resource usage and to plan preventive maintenance activities. By using opportunistic networks, every sensor in a smart city can be leveraged in order to have a big picture of the entire town, without the need of long-range communication capabilities. Sensors simply communicate with any device in range, which can then transport the data to access points that can communicate faster and with a longer range. Other opportunities for ONs exist, such as advertising, geographical area-based floating content, context-aware platforms or distributed social networks.

29 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage:
www.igi-global.com/chapter/employing-opportunistic-networks-in-dementia-patient-monitoring/138444

Related Content

A Two-stage Registration Method for Dental Volumetric Data and Mesh Data
(2021). *International Journal of Healthcare Information Systems and Informatics (pp. 0-0).*
www.irma-international.org/article//279341

Planning and Control and the Use of Information Technology in Mental Healthcare Organizations
I.J. Baarsand G.G. Van Merode (2010). *Health Information Systems: Concepts, Methodologies, Tools, and Applications (pp. 1066-1073).*
www.irma-international.org/chapter/planning-control-use-information-technology/49917

Factors Affecting Health Information Technology Expenditure in California Hospitals
Jinhyung Lee (2015). *International Journal of Healthcare Information Systems and Informatics (pp. 1-13).*
www.irma-international.org/article/factors-affecting-health-information-technology-expenditure-in-california-hospitals/135546

VEMH: Virtual Euro-Mediterranean Hospital for Evidence-Based Medicine in The Euro-Mediterranean Region
G. Graschew, T.A. Roelofs, S. Rakowskyand P.M. Schlag (2008). *Encyclopedia of Healthcare Information Systems (pp. 1349-1356).*
www.irma-international.org/chapter/vemh-virtual-euro-mediterranean-hospital/13083

Medical Information Extraction in European Portuguese
Liliana Ferreira, António Teixeiraand João Paulo Silva Cunha (2013). *Handbook of Research on ICTs for Human-Centered Healthcare and Social Care Services (pp. 607-626).*
www.irma-international.org/chapter/medical-information-extraction-european-portuguese/77165