Chapter 4
TEEM:
Technology–Enhanced Emergency Management for Supporting Data Communication During Patient Transportation

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ABSTRACT

In this article, the authors describe a client-server architecture, designed for supporting data recording and transmission during emergency patient transportation by ambulance. The clients are a set of mobile apps, interfaced to the monitoring devices in the ambulance, that automatically send all the recorded data to a server at the destination center. One additional app enables the travelling personnel to input and transmit further significant patient data, or comments. At the destination center, the specialist physician logs onto the server, receives the data in real time, and is allowed to plot/analyze them, assessing the patient's situation, and possibly sending

immediate feedback to the operators in the ambulance. The system is currently under evaluation at the Neonatal Intensive Care Unit (NICU) of Alessandria Children Hospital, Italy. The system, by allowing real time data communication, is able to provide clear advantages from the organizational and economical viewpoint.

1. INTRODUCTION

Patients experiencing a medical emergency (e.g., stroke patients, pre-term born babies, or accident victims) are normally taken to the closest hospital structure. Peripheral hospitals might be insufficiently equipped, in terms of human or instrumental resources. In these situations, patients need to be stabilized, and then carried to a larger and more suitable health care center (i.e., a "hub" center), where specialized physicians, as well as more advanced diagnostic/therapeutic devices, are available.

During patient transportation by ambulance, a specialist physician (e.g., a neurologist) is typically not present; paramedics and/or emergency medicine doctors usually provide assistance. The travelling personnel continuously monitors the patient by means of proper devices available on the ambulance (such as a saturation meter, or a blood pressure monitor). However, the monitored data, at least in Italy, are not automatically recorded. Therefore, they cannot be inspected/analyzed a posteriori. Moreover, they are not accessible in real time by the specialist physician at the hub center. At most, the travelling personnel register a few key values on a paper log, and provide them to the specialist physician as soon as the ambulance arrives. However, information is necessarily partial and incomplete, and the specialist needs to re-asses the patient condition before starting the proper treatment.

In this paper, we propose a technological support to data communication and data access, during patient transportation by ambulance. Our approach is organized as a client-server architecture, where different mobile apps, running on smartphones/tablets in the ambulance, act as clients, and send monitoring data to a server, residing at the hub center.

The architecture is composed of one different app for each monitoring device in the ambulance (e.g., the saturation meter), plus an additional app to send further data. The device apps have a very simple interface, just allowing the user to activate the connection to the server. Typically, the devices record a set of monitoring parameters in the form of time series, with a device-dependent sampling frequency; each app is adapted in order to be interfaced to a specific device. The additional app, meant to be manually adopted by the travelling personnel, has a more complete interface, which allows to introduce relevant patient data, not recorded by the machines (e.g., temperature), as well as comments and notes. This app also receives possible feedback from the specialist at the hub center.

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