Mobile Applications in Data Acquisition for Production Planning and Control: Analysis, Implementation, and Evaluation

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ABSTRACT

The evolution of technologies, coupled with the constant and fast growth of mobile communication network structures, has promoted the development of technological solutions in different business sectors, particularly in manufacturing companies. To help the companies to become and/or remain more competitive, management and production planning requires progressively more prompt and effective decisions, in order to increase the productivity and reduce production costs. This article presents a mobile application, developed for an Android platform that was implemented and tested in a Portuguese company. This application allows the recording and storage of data, with the main objective of supporting the production planning and control. In addition to the development, implementation and testing of the application, a study of the usability impact of the application in the company was also performed. This was done not only by covering the production process optimization, but also as the feasibility of its use by human resources.

KEYWORDS

Android, Data Registry, Human Resource Management, Mobile Applications, Planning and Production Control

1. INTRODUCTION

In most of the companies, a sustainable manufacturing is achieved through an efficient production planning and control (PPC), which is only possible with a reasonable set of data based on products and especially on the production (Reuter et al., 2017). This data originates from different sources, but a significant part of the one required for PPC functions comes from the tasks that occur on the shop floor.

In order to automate and streamline the data collection process to meet the needs of the PPC, several companies are looking for solutions from Information and Communication Technologies (ICT) (Nyhuis and Wiendahl, 2009; Trentesaux, Borangiu, and Thomas, 2016; Xu and Chen, 2016). However, most of the technological solutions on the market, while responding to most PPC requirements, fail to obtain data on the daily tasks on the shop floor. In the manufacturing context, the tasks are strongly connected with the shop floor, thus a high traceability of production processes...
at the task level is of high importance to enable efficient PPC processes (Reuter et al., 2017). Task data, such as task time, task stop causes, and so on, are essential for workstation balancing, which in turn has an impact on the PPC.

It should be noted that some of these ICTs already available on the market that acquire data from the shop floor, are based on barcode systems and radio-frequency identification (RFID) (Jones and Chung 2011; Reuter et al., 2017). Nevertheless, there is data that is difficult to obtain with these technological solutions, as it is dependent on day-to-day tasks.

On the other hand, the increasing developments in the area of mobile network communication infrastructures (Freire and Painho 2014; Homann et al. 2014; Homann, Wittges, and Krcmar 2013), combined with the advances of new ICT, have enabled companies to have access to process automation tools and information flows from day-to-day activities, based on mobile applications solutions. In the manufacturing sector, although this type of applications is a recurring solution for stock control and inventory management, it is being used to acquire data from the daily activities that occur on the shop floor more frequently. This alleviates the need to install data terminals which are normally inflexible as they require the users to move to the physical points where they are located.

The present paper emerges from this context, and proposes a technological solution that allows the registration of data generated on the shop floor by collaborators that work there, using mobile applications, to contribute towards information quality improvement in PPC. This work presents a mobile application developed for a specific Portuguese company. The application was specifically developed regarding its manufacturing process and surroundings in order to acquire the required data in several different points of the production system. Although it is a dedicated application, it could be replicated to similar scenarios in similar production systems, where the objective is the real time data acquisition for production control. As far as we know, there is no published literature related to this type of mobile applications, where the main purpose is to support the immediate registry of data, resulting from the daily activities that occur on the shop floor, in order to collect the appropriate data for balancing and sequencing the assembly lines and be able to control and plan the daily production.

This work was structured into four major sections. The second section addresses some fundamentals related to the role of Information Systems (SI) in general and mobile applications in particular within industrial contexts. The next section describes the development of a mobile application to support the PPC within a Portuguese company – conceptually and technologically – ending with an analysis of the impact within the organization – functional and operational. Finally, in the last section the conclusions and future works are presented.

2. INFORMATION SYSTEMS AND MOBILE APPLICATIONS IN THE CONTEXT OF MANUFACTURING COMPANIES

Nowadays, with increasing competition and volatile market demands, manufacturing companies face the challenge of having to produce more, with higher levels of quality, while at the same time rationalizing costs, particularly in the production area (Kakouris and Polychronopoulos, 2013). To respond to those challenges, it is important to plan and control the production (PPC), with access to daily data that is produced in the shop floor being necessary (Nyhuis and Wiendahl, 2009).

Given the importance of this data in PPC, there are already several manufacturing companies that are looking for mechanisms to capture relevant data in the regarding their manufacturing surroundings – more specifically using data acquisition point technologies (Reuter et al., 2017).

On the other hand, the evolution that marked the last decades in the field of technological developments, allowed companies to have easy access to a set of tools for automation and production control, as well as resources and the associated equipment management. In fact, this development has been happening for several technological generations, from the simplest Inventory Control Packages in the early 1960s, to some production planning tools called Manufacturing Resource Planning (MRPs) (Cecelja, 2002) and the most recent and well-known integrated Enterprise Resource
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