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Exploring of the consequences of human resources multitasking in industrial automation projects: a tool to mitigate impacts

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Abstract

Each industrial automation project includes tasks strongly depend on human factor many of which may belong to the critical path or chain of the project. Multitasking affects significantly human productivity. This reduction in productivity has as a direct result the delay of the primary task which may cause an overall delay to the project with cost and time overruns. A project should be seen in a global environment that of the company, where resources are shared among its portfolio of projects. Although multitasking might have negative results, it is something that cannot be eliminated, but it can be mitigated by project managers.

This work presents the effects of multitasking in human productivity, especially when the tasks are complex, like PLC/SCADA software development. Using the Analytical Hierarchy Process (AHP) method, a simple tool is created to be used by project managers, in order to assist them in decision making. Criteria that influence these decisions are referenced and their priority vectors are proposed. Also, some real examples are given.

A project manager faces a complex situation when they asked to decide allocation of resources and priorities among different projects. Parameters that are difficult to predict in real situations may have a significant role in the decision making process.

There are a lot of published works based on AHP applications in different fields, but there is a gap in the field of industrial automation projects and the related project manager's decision making. This study focuses on these decision making process which determines which tasks should be paused or not for a better allocation of resources, taking into account the global environment of a technical company. The tool can be implemented with changing criteria and priority vectors to adapt to different type of projects. Future research could identify additional criteria and sub-criteria with different priority vectors, depending on different project specifications.

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Keywords: Multitasking; Task switching; Industrial automation projects; Project performance; Project manager decision making; AHP; Project management tool;

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1. Introduction

Nowadays, the practice of multitasking is considered by many as a title of honor. Many studies have largely investigate the multitasking effects on human productivity and conclusions are mostly negative [6], [7]. One of the areas directly affected by the impact of multitasking on human productivity is the software development area [15], [16]. An important part of industrial automation projects is related to software development, so the multitasking is a key factor that can decisively impact the duration and cost of these projects.

Given that the daily stimuli in humans is many, multitasking is very difficult to be avoided. The aim is to minimize the multitasking to mitigate the impacts on the duration and cost of projects, but also to serve the broader needs of a portfolio of projects within a technical company.

The decisions required to get from the project manager are often very difficult and influence greatly the performance of the project. Often called upon to decide whether or not the interruption of critical operations of a project, in order to accommodate other requirements of the company. The paper focuses on decision making by managers using the theory of Multi Criteria Decision Making (MCDM) and specifically the Analytical Hierarchy Process (AHP) method. About 150 works have been published based on AHP including applications in different fields such as planning, selecting a best alternative, resource allocations, resolving conflict, optimization [3].

Through AHP method, it is created a simple and user friendly tool that can be useful in taking crucial decisions during an industrial automation project. Criteria that influence these decisions are referenced and their priority vectors are given, in accordance with relevant experience in managing such projects. Finally, some real examples are given.

Future research could identify additional criteria with different priority vectors depending on the project specifications.

2. Multitasking

Multitasking term first appeared in 1965 in the IBM publication, which described the potential of the IBM System/360 [1]. In Computer Science, multitasking is a concept of performing multiple tasks over a certain period of time by executing them concurrently. The first processors CPUs manufactured with one core, which was responsible for all of the software processing and its interface with the hardware. In fact, the core of the CPU processor can’t perform more than one task simultaneously, but alternates the task execution. The speed with which the execution of the works alternated is so fast that gives the impression that the work is carried out simultaneously.

The multitasking cost of the CPU is the extra time required for saving and restoring the state of intermittent operations. This cost is called "context switching cost" and varies depending on the workload at different accesses to the memory and for different architectures [2].

2.1. Human multitasking

The concept of human multitasking began with the development of computer science. Human multitasking is the practice of some people while making many tasks in parallel, as do the CPU processors. Some cases of human multitasking is driving and simultaneous speaking on the mobile phone, answering an e-mail during a meeting, reading a magazine during cooking. According to Kenyon & Lyons (2007) [4], the human multitasking is the ability of execution or a combination of two or more tasks simultaneously or in parallel.

Nowadays there is a myth, especially in the business world, which says that the human multitasking increases the productivity and effectiveness of people. Also, technology colossus trying to propagate the world the ideal image of the superman who deals with many things simultaneously and effectively (smart phones applications, SMS, social media, on-line news, the internet research, etc.).

Everyone in daily live executes two or more parallel operations to gain some time. Unfortunately, it is impossible to focus simultaneously on all jobs. It has been scientifically proven that only 2.5% of people can make effective multitasking [5]. The vast majority of people can’t respond to that. In fact, when man thinks he makes multitasking, what actually does is to successively switch the execution of two or more operations. Obviously, the cost in time is greater than the corresponding time cost of the CPU core.