Proceedings IRF2018: 6th International Conference Integrity-Reliability-Failure
Lisbon/Portugal 22-26 July 2018. Editors J.F. Silva Gomes and S.A. Meguid
Publ. INEGI/FEUP (2018); ISBN: 978-989-20-8313-1

PAPER REF: 7278

TGK DYNAMIC ANALYSIS OF A HUMANOID RESCUE ROBOT

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ABSTRACT
Safety is the main focus in any rescue or recovery operation; however, due to this operations being done by human beings, a compromise with the efficiency should be considered [1]. This Project creates an alternative option in order to solve this compromise; through the creation of an automated humanoid. This is capable of completing rescue missions or particular activities that can facilitate the work in the part of the human rescue squads, which involve high risk factors due to the environment. Such rescue activities can be totally left to the automated humanoid TGK 1.1 or can be divided and segregated so as to be complemented by human and automated workers grouped in teams [2], in this project a dynamic study of the joints of a leg is presented, likewise we will see the feedback of the batteries with solar cells.

Keywords: human, robotic, prosthesis, industry.

INTRODUCTION
Human-Robot Interaction (HRI) is a field of study dedicated to understanding, designing, and evaluating robotic systems for use by or with humans. Interaction, by definition, requires communication between robots and humans. Communication between a human and a robot may take several forms, but these forms are largely influenced by whether the human and the robot are in close proximity to each other or not. Thus, communication and, therefore, interaction can be separated into two general categories:

- Remote interaction: Humans and robots are not collocated and are separated spatially or temporally (for example, the Mars Rovers are separated from earth both in space and time).
- Proximate interaction: Humans and robots are collocated (for example, service robots may be in the same room as humans).

In the current environment of rescue activities, a main concern for those involved is mainly how these can be done without putting the victims, workers or their resources at risk. To solve this dilemma the use of a humanoid automaton is proposed and a design based on pertinent goals; such as deployment time, ease of manufacturing, adaptability; is created. To achieve this, the involvement of diverse disciplines is necessary and complementary. The final design involves extremes of standardization and modularity as well as efficient use of energy and self-sustained systems of recharge.

RESULTS AND CONCLUSIONS
The design focuses on two main points: ease to fabricate and extended continuous deployment on the field. In order to achieve the first point, prefabricated and standardized parts have been used in almost the entirety of the system. This allows to generating an entire

automated worker without the need of generating unique or use hard-to-obtain pieces. Additionally to the use of these “easy to use” parts, a modular design has been used in order to further achieve the saving of time and resources in the building of one or multiple copies of the worker simultaneously. A consequence of the hard focus in standardization of the parts and the modular nature of the fabrication is the ease with which upgrades can be generated and installed in the humanoid, as long as the power source is able to manage it, it can be installed and used in the activities done by the worker.

The second point: extended deployment time is solved through two complementary systems. The first of these is a bank of high capacity rechargeable batteries. These batteries are the main power source to the actuators and processors. The capacity of the bank is the main limiter for the deployment time of most automated assisted worker used on the field. To circumvent this ever-present design and use problem, a second system is installed. Through the use of alternative mean of generating energy, the batteries can be filled at the same time the machine is in use. The design allows for an ever increasing ability to be upgraded as so do the energy generating part of the power systems. The base installation makes use of solar panels which feed usable power to the batteries [3] during both working and resting periods as long as there is visible light. This simple addition reduces, if not eliminates the need for independent times to recharge the power sources.

Driving the processes of the worker and to continue with the “as-standard-as-possible” design is an off-the-shelf Programmable Logic Controller (PLC). This piece of software is currently used in almost all branches of industry, which makes it both relatively cheap and readily available [4]. The ease to program this kind of controller is testament in its previously mentioned widespread use in the industry, mainly in those activities that require a heavy focus on repetition and isolation from human agents.

The entire design achieves that which has been set to it, and permits to any user to generate a worker and design and create upgrades without the need for heavy handed considerations of availability of materials or compatibility issues, be it with the attachment to the current body or to its control in the part of the processor, likewise, over time it is expected to incorporate some part of this robot to a person, for example some prosthesis.

ACKNOWLEDGMENTS

The authors gratefully acknowledge the Prodep by your support in this project, same as Instituto Tecnológico de San Luis Potosí.

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