INTERNATIONAL WORKSHOP ADITIVE MANUFACTURING

1ST INTERNATIONAL CONGRESS ON ADDITIVE MANUFACTURING

BOOK OF ABSTRACTS

IWAM 22

ipb INSTITUTO POLITÉCNICO DE BRAGANÇA

SEPTEMBER 30, 2022

1ST INTERNATIONAL CONGRESS

ON

ADDITIVE MANUFACTURING

BOOK OF ABSTRACTS

IWAM 22

Bragança - Portugal

September 2022

EDITORS

João Rocha, Instituto Politécnico de Bragança, Portugal
João Eduardo Ribeiro, Instituto Politécnico de Bragança, Portugal
Jorge Santos, Instituto Politécnico de Bragança, Portugal
Rui A. Lima, Universidade do Minho, Portugal

Instituto Politécnico de Bragança 2022

Campus de Santa Apolónia

5300-253 Bragança - Portugal

ISBN: 978-972-745-310-8

http://hdl.handle.net/10198/23947

Book cover: Jorge Santos, Instituto Politécnico de Bragança

Technical Support: Clarisse Pais, Instituto Politécnico de Bragança

WELCOME

Additive manufacturing technologies are playing a decisive role in the laboratory environment, making a significant difference in STEAM education. Students use additive manufacturing to create physical models, topographic maps, biology artifacts, artwork, all types of engineering prototypes and solving mathematics challenges. By bringing additive manufacturing capabilities to the classroom, educators can raise interest in STEAM, introduce new concepts and capabilities, and help set the future for more skilled STEAM professionals.

The IWAM 2022 Organizing Committee,

João Rocha

João E. Ribeiro

Jorge Santos

Rui Lima

COMMITTEES

ORGANIZING COMMITTEE

João Rocha, Instituto Politécnico de Bragança, Portugal

João Eduardo Ribeiro, Instituto Politécnico de Bragança, Portugal

Jorge Santos, Instituto Politécnico de Bragança, Portugal

Rui A. Lima, Universidade do Minho, Portugal

INTERNATIONAL SCIENTIFIC COMMITTEE

João Eduardo Ribeiro, Instituto Politécnico de Bragança, Portugal

João Rocha, Instituto Politécnico de Bragança, Portugal

Isabel Lopes, Instituto Politécnico de Bragança, Portugal

Rui A. Lima, Universidade do Minho, Portugal

Diana Pinho, International Iberian Nanotechnology Laboratory, Portugal

Viviane Teleginski, Universidade Tecnológica Federal do Paraná, Brazil

Ana Moita, Academia Militar / IN+(IST), Portugal

Helder Puga, Universidade do Minho, Portugal

Eleonora Santecchia, Università Politecnica delle Marche, Italy

Borja F. Villar, Centro tecnológico CARTIF, Spain

Alvaro Prieto, Centro tecnológico CARTIF, Spain

Jolanta Pileckiene, Vilnius College of Technologies and Design, VTDK, Lithuania

Teresa Guarda, Faculty of Systems and Telecommunications, UPSE, Ecuador

Paula Vaz, Instituto Politécnico de Bragança, Portugal

Lidia Sánchez González, University of Leon, Spain

Manuel Rodríguez Martín, University of Salamanca, Spain

Romeu Rony Cavalcante da Costa, Federal Technological University of Paraná, Brazil

Renato Goulart Jasinevicius, Escola de Engenharia de São Carlos - USP, Brazil

Fátima Vaz, IST, Universidade de Lisboa, Portugal

Delfim Soares, Universidade do Minho, Portugal

José Gonçalves, Instituto Politécnico de Bragança, Portugal

Flora Silva, Instituto Politécnico de Bragança, Portugal

Paula M. Barros, Instituto Politécnico de Bragança, Portugal

TABLE OF CONTENTS

Electronic solution with joysticks for laparoscopic equipment

A. Costa[1,2] *, C. Filho[1,2], João Rocha[2]
[1]Universidade Evangélica de Goiás, FACEG, 76380-000 Goianésia, Brasil
[2]Instituto Politécnico de Bragança, 5300-253, Bragança, Portugal
(*) ***Email :*** **fernandes10carlos14121999@gmail.com; cesar.ramos6955@gmail.com; jrocha@ipb.pt.**

ABSTRACT

It is noted in many studies health problems related to musculature in surgeons who handle laparoscopic instruments. Many attempts of new models for handles of these equipment's have already been proposed in an effort to combat this ergonomic problem in this type of instrument.

The developed work aimed to develop an electronic solution for laparoscopic instruments in order to provide greater comfort to surgeons in the area. As a complement, a handle was manufactured to illustrate the system after downscaling for the surgeon to handle. Also, as a complement, a manual laser measuring plate was developed for future tests with the system attached to the handle. During the elaboration of the work was involved in the process the use of an Arduino Uno board among other electronic components, besides the design of parts in software, the use of 3d printing and laser cutting. The results obtained after the assembly of the electronic mechanism showed that it is possible to obtain the necessary movements for a surgical tool through an electronic drive, avoiding musculoskeletal injuries in surgeons who handle this equipment due to less repetitive efforts during operations.

INTRODUCTION

As technology advances in the world, it also tends to reach the medical field. Surgeries have become less and less invasive thanks to this. Laparoscopic surgeries are being performed more and more because of their great advantages in terms of performance by the surgeon and recovery by the patient. In general, it is a method of surgery that can replace the vast majority of general surgeries performed in the region of the pelvic and abdominal cavity **(Saudecuf, 2015)**. The whole procedure is done by the display where the image of the internal part of the patient is shown with the aid of a camera that can pass through the small incisions made. In general, laparoscopic procedures last at least 1 hour **(Tung, 2015)**. However, the laparoscopic instruments used still have a great need of development in design. Together with the length of surgery and the primary problematic development of these tools, today there are great complaints from those who handle them. It is reported that the design of the handle affects the posture of the upper extremities of the surgeon's body, which causes discomfort and fatigue (**ER, 1997)**, besides the need for repetition of the task with the high pressure exerted on the fingertips and prolonged uncomfortable positions caused by the current models that contribute to biomechanical discomfort and possible injury to the surgeon **(LACOMBE, 2003)**.

This work intends to develop, through the elaboration of circuit in Arduino and actuators programmed in C++ language besides the manufacture of an adequate mechanism, an electronic solution for laparoscopic equipments able to fill the lack of comfort and safety existing in current models and increasing the chance of injury prevention in those who handle them.

RESULTS

The circuit, shown in figure 1, was assembled with an Arduino board, a joystick and two servomotors to obtain the proposed movements for the laparoscopic tool. The C++ code responsible for the movement commands was adapted during several attempts and tests in order to obtain the best action angulation of the servomotors and the correct actuation of each servomotor for each axis requested in the joystick. The mechanism system fixation step was carried out with several adaptations related to servomotor clearances, being also necessary the design in SolidWorks and printing of specific 3d parts for the system. The final result of the assembly is shown in figure 2. An experimental handle, which is shown in figure 3, was also developed in SolidWorks software and printed in 3d for the purpose of illustration of how the system would look like after the downgrade for official use.

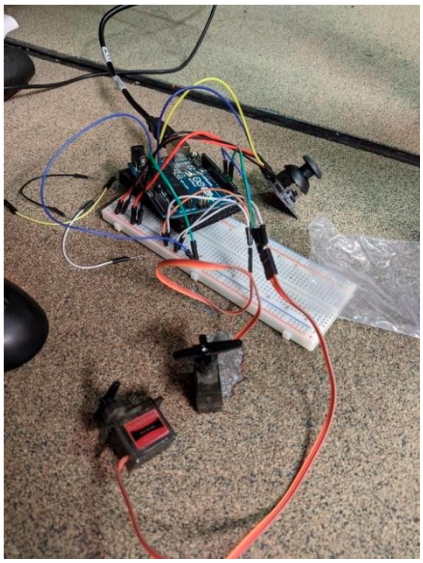

Figure 1- Assembled circuit

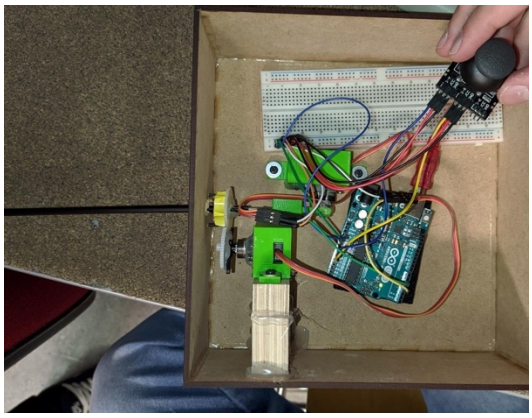

Figure 2- Experimental setup

Figure 3- Experimental handle.

CONCLUSIONS

After the execution of all the idealization, design, assembly and tests of the system, besides the analysis of the results obtained at the end, the objective was reached in demonstrating that it is possible to develop laparoscopic instruments accompanied by an assistant electronic solution with the intention of minimizing risks of injuries of laparoscopy surgeons. For future works it is of utmost importance that the prototype goes through a downscale so that it can be used effectively.

ACKNOWLEDGMENTS

Thanks to the work supervisor João Rocha and Professor Jorge Santos for the support and support in the idealization and realization of the work. It is also necessary to thank the college Uni Evangélica and the Polytechnic Institute of Bragança that provided support with its infrastructure in their laboratories, especially the FabLab.

REFERENCES

[1] Saudecuf, " Laparoscopia - Cirurgia Minimamente Invasiva," 2015. [Online]. Available: https://www.saudecuf.pt/unidades/santarem/areas-clinicas/..

[2] K. S. R. D. E. e. a. Tung, "The effect of ergonomic laparoscopic tool handle design on performance and efficiency," *Surg Endosc,* pp. vol. 29, pp. 2500-2505, 2015.

[3] M. C. J. R. D. S. ER, "Force response of the fingertip pulp to repeated compression—Effects of loading rate, loading angle and anthropometry," 1997.

[4] E. D. F. e. D. LACOMBE, "Estado atual da cirurgia híbrida colo-retal," *Rev bras vídeo-cir,* pp. v. 1, p. 29-37, 2003.