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Title: Supported Learning in STEAM and PBL Methodology; Using 3D CAD Software for the Mechanical Design of Sumo Robot

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Introduction

La creación del diseño mecánico, sustentado en las reglas de participación para la competencia Robomatrix, se realizó mediante la aplicación de conocimientos, habilidades, herramientas y técnicas aplicables a la metodología basada en las disciplinas: ciencia, tecnología, ingeniería, arte y matemáticas (STEAM), con el enfoque de resolución de problemáticas a través del Aprendizaje Basado en Proyectos (ABP) y el uso de software de diseño tipo CAD; además de recursos físicos, materiales, equipos, software, licencias etc.

Introduction

For his educational practice, the teachers seeks to ensure that students learning is effective, motivating and meaningful, promoting the formation of technical, natural and social competencies, allowing the development of systemic thinking, promoting the realization of all dimensions of the educational process (Ruiz and Sánchez, 2011, Bers, Seddinghin and Sullivan, 2013; Sánchez Tendero, Cózar Gutiérrez, and González Calero Somoza, 2019)

Introduction

Benefits have been observed in the ability to solve problems (Siago, Arnau and González-Calero, 2018), teamwork and spatial skills (González-Calero, Cózar, Merino and Villena, 2018), among others.

Robotics has great potential as a multidisciplinary tool, enabling students to have a practical experience of the scientific method, through the construction of prototypes, which allow a holistic vision in the learning processes and pose the challenge of integrating the virtual with the objects themselves (Niño and Fernández, 2019; Jiménez Castro, Cerdas González, 2014).

The **objective** of this work was to ensure that the students of the 3rd quadrimester, during the process of creating a robot, taking into account only its design and structure, develop their potential for creativity, critical thinking, problem solving, communication and collaboration (STEAM), increasing motivation, enjoyment and commitment to your professional career.

Methodology

Considering as inputs, for Project management, the application of knowledge, skills, tools and techniques to meet the established requirements, in methodology based on the following specific disciplines: science, technology, engineering, art and mathematics (STEAM); in addition to physical resources: materials, equipment, software, licenses, etc. Taking into account for the construction of the sumo robot, the approach to problem solving through tools such as Project Based Learning (PBL), for creating the design supported by the rules of participation for the Robomatrix competition, seeking to encourage students to development of creativity, analysis, design and production skills following the Sumo Regulation .

Methodology

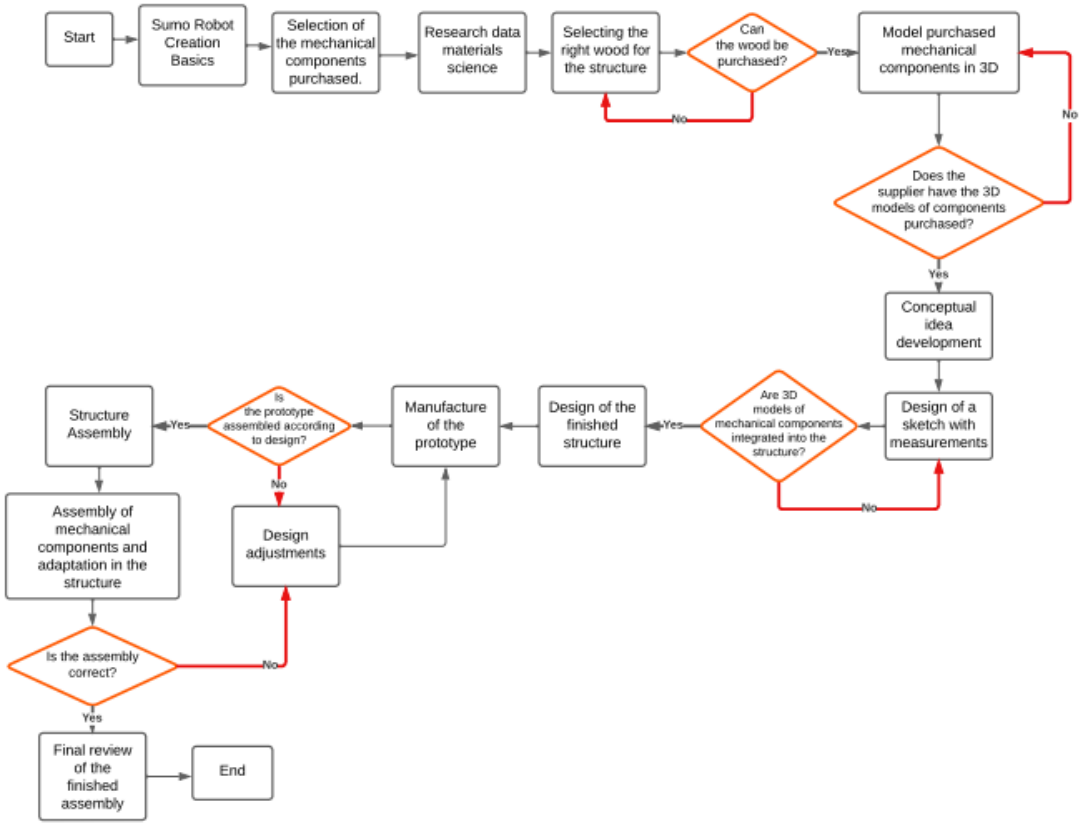

Figure 1: Structure or Breakdown of the process

Remember that Sumo Robot are similar in their physical appearance to a toy car measuring no more than 30 cm wide by 30 cm long and weighing no more than 1.5 kg in the case of the Light Sumo Robot, in the case of the Heavy Sumo Robot 3 kg. All feature are based on C.E.R. specifications, 2012.

Results

Staged work breakdown structure:

It began with the establishment of collaborative teams, followed by the Acquisition and Design of components, to end with Manufacturing and functional testing.

Project Planning:

The following Gantt chart shows the stages and times required for its development

Project Management Plan:

Project structure, mechanical modeling and incorporation of parts and/or components.

Manufacturing and assembly testing:

They assembled the manufactured parts according to the design made to carry out functional tests.

Process Pictogram

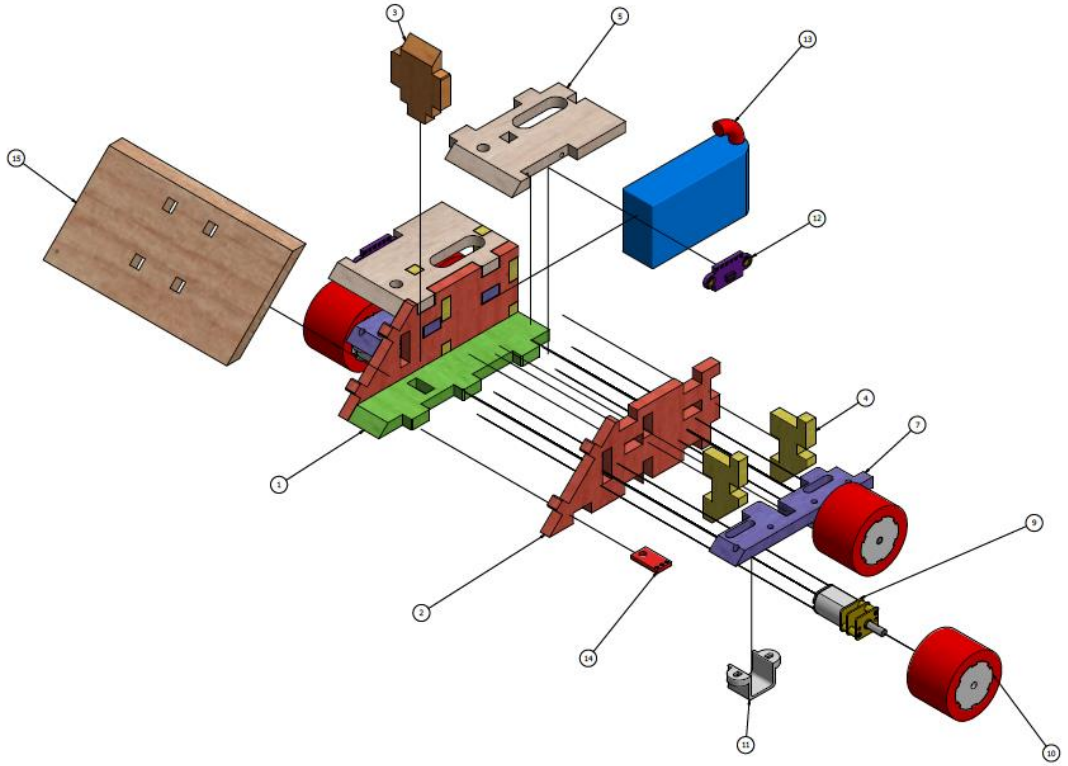

Figure 2: Exploded view of the prototype or Project

Source: Self Made

Results

The manufacturing of the robot was carried out as part of the academic recreational activities in support of teaching work. On the other hand, it is worth highlighting the importance of the development of skills such as practice and creativity, which allows them to enhance their profesional skills analysis, design and productions through the STEAM methodology, taking into account the interrelation of the knowledge acquired by the student during their academic stay and the use of CAD-type design software, as part of the commitment to face academic challenges that seem attractive to them, with the appropriate resources and guided by the teacher and motivated to achieve their academic goals.

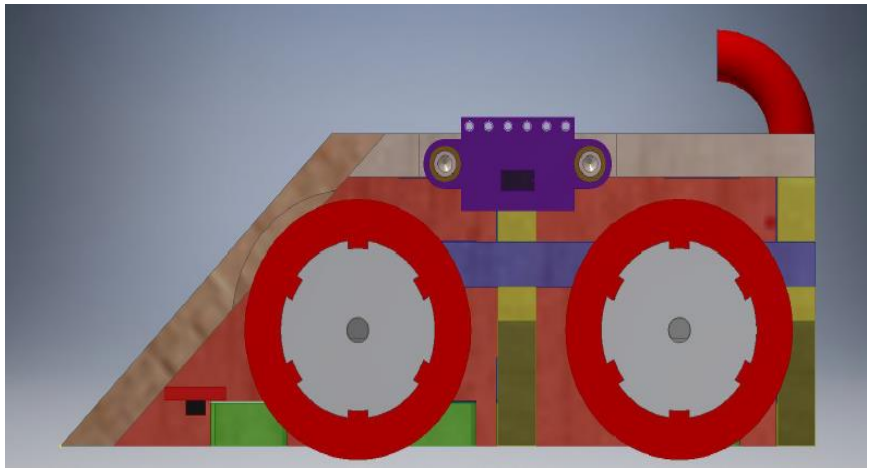

Figure 3: Right side view of Sumo Robot assembly

Source: Self Made

Conclusions

It was developed from the mechanical design of the structure of a Sumo Robot using STEAM methodology and mechatronic engineering.

It was evident that the development of experiences in the área of robotics has allowed the participating students to improve by a percentage greater than 18% mainly due to the development of responsibility and social leadership, so that students in the first quadrimesters advance in topics of higher levels, being a competitive advantage for them, when carrying out consistent courses.

Conclusions

As future lines of research, it is proposed to evaluate various forms of work that involve the convergence between digital technologies and the hardware itself delving into precision improvement processes in mechatronic engineering at the same time.

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