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MOBILE PLATFORM FOR INDOOR USE

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Abstract: *The following paper presents the development process and the building of a mockup for a mobile platform for indoor use. The purpose of the platform is to be able safely navigate inside specific indoor places, to be able to transport various objects safely. For the design process, specific tools and techniques of competitive engineering were used. The construction of the mockup involved largely CAD and CAM software.*

Key words: *Modular, robot, maneuverability, mobile platform, competitive engineering.*

1. INTRODUCTION

Since ancient times man has tried to build mechanisms to mimic as closely the behavior of living things or mechanisms to facilitate his work in certain areas.

Increasing volume of non-industrial activities, particularly in the tertiary sector, the provision of services on the one hand, a slight saturation of the market of industrial applications of robots on the other hand, particularly noticeable. In countries with a developed economy has led the development of robotic applications in the activities mentioned. This development was favored by the possibilities of application of technical solutions developed for industrial robots in building robots for non-industrial applications.

2. ROBOTS

The robot is currently the intersection of the top results in a number of areas: mechanical, automation, computers and drives. These congruent branches of science and technology so different are due to the complexity of the robot, both in terms of mechanical architecture and in terms of system management. Itself, the robot is a natural result of evolution of automated machine tools, machines with program control and automated manufacturing lines. When rigidity and inflexibility has not matched their current productivity and quality requirements, and the man tried to execute direct action, direct the processes of gaining a role of supervision and control. Mobile robotics is just beginning to show its true potential. [1]

Many robots have been designed, tested and successfully implemented in our everyday life, so a much larger number of mobile robots will appear in the near future. A large number of mobile robots are already used today, from simple operations such as vacuuming in private homes, but also very complex and dangerous operations, American army UAV's. Experts estimate that the field of mobile robotics is one that will experience major changes in the next few years. In order to achieve the desired results, scientists will also need to achieve better results in other areas, which are strongly interconnected with mobile robotics.

3. DEVELOPMENT

3.1. Competitive product development

Today we could have over 100 different methods to develop competitive products. Typically, we use engineering to stage competitive development of complex products such as equipment in mechatronics, industrial complexes or public goods. In the case of simple products, competitive engineering must use only appropriate measure.

The first step in developing a competitive product is to visually develop the product. This phase is strictly a creative one; very few new ideas will become final products. A simple

technique commonly used to formulate ideas for a new concept or a vision is brainstorming.

The second step has to create detailed segmentation of the market potential. This is a very important step because it provides a better product customization, usually leads to better results.

The third phase focuses on identifying customer needs and expectations in accordance with our product. One of the best techniques used to identify needs and expectations is the so-called method VOCT (voice of customer). The methods used to support this process must be very precise, because, usually, customers have difficulty expressing what they really want. The next step is to sort by reformulating and systemizing needs. Methods such as Mind-Map or morphological diagrams are often used to achieve the desired results. The next step includes an analysis of potential conflicts of needs.

If a potential conflict is identified we should eliminate that need and use innovative techniques to resolve that conflict. In order to do this we use TRIZ method. In the same phase we will establish a ranking of needs. Classification can be achieved by applying different techniques. It can be done after a market research for a particular industry or application on a target group, and using, for example, the AHP method. The next step is to define and analyze Key Performance Characteristics associated with that product.

Next step is to define the key features of the product and their interconnections. This involves planning functions, making the product architecture, planning modules and interfaces, making product design, design a prototype to allow further testing and evaluation and optimization of the final results.

To develop a good product, in our case a mobile platform equipped with caterpillar tracks, we only need to complete certain steps in order to achieve the desired result. In line with this, measures that will be completed in terms of competitive engineering are [2][5]:

• VOCT I and II; • AHP; • QFD I, II, III;
• TRIZ; • FMEA.

Analytic hierarchy process is a method used for weighing and comparison of elements, practical ideas and concepts previously collected. AHP is a structured technique that deals with complex decisions, rather than prescribing a correct decision. AHP helps decision makers find the one that best suits their needs and understanding of the problem. After applying the AHP method we need to determine the importance of each customer's need. The four most important elements are:

• Safety of operation
• To be mobile
• Be easy to control
• To be able to carry objects

In this sense, all four needs are important but most important is the need to be mobile, with a rate of 5.4%, very close to occupied first. Need the third most important customer is ease of operation, accumulating a rate of 5.0%. On the 4th place we find the need to transport objects with a rate of 4.6%.

The method used next is Quality Function Deployment (QFD). It was first developed in Japan. The focus is to help planners to transform user requirements into design specifications, to help focus on new product features in terms of market segments. QFD also helps to transform customer needs from client voice to engineered features. It prioritizes each feature of the product while simultaneously establishing objectives for the product development.

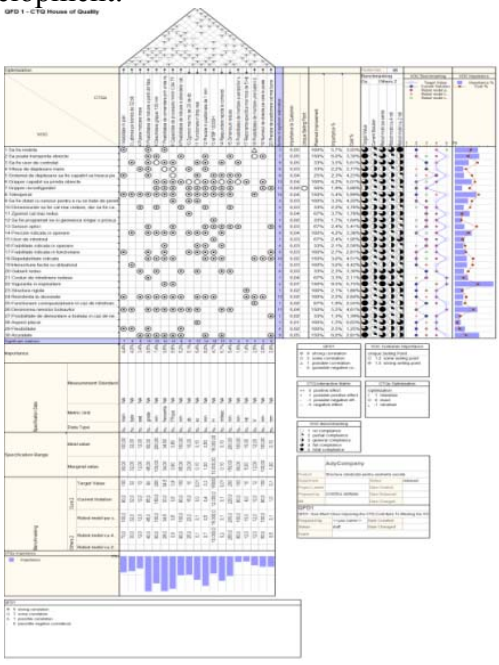

Fig. 1. Export view of QFD completed (Phase I) method performed in the QFD Qualica software.

The first QFD (Fig.1) has 3 main parts, the first column on the left is where we find the client needs extracted from the VOCT method; the second part is the top of the matrix (if the writing is rotated 90 degrees so that is vertical) so-called CTQ also extracted from VOCT method and the third part is called roof.

By successively applying the QFD method in conjunction with other tools the concept of the product is developed form customer requirements into technical characteristics, product functions, product subsystems and finally individual parts.

In the following figure are presented the target costs of the identified components [3] of the mobile platform, to be achieved:

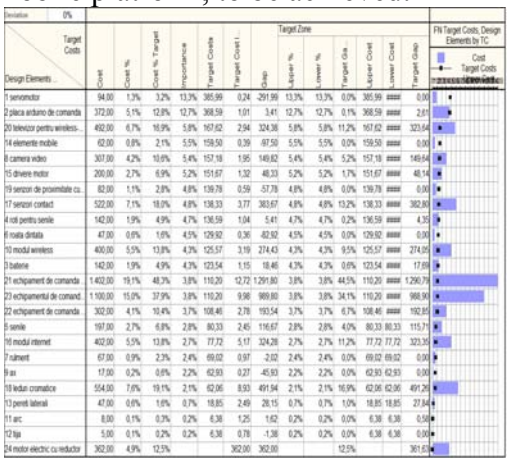

Fig. 2. Cost of parts

The following Fig. illustrates the positioning results based on manufacturing cost of the design elements used for the platform.

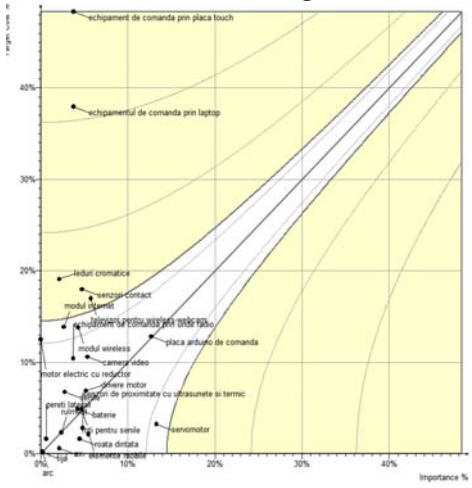

Fig. 3. Part importance vs. Part cost weight

It can be seen from the previous figure that the Touch Screen and Computer Control elements do not meet the customer expectations, thus they will not be implemented in the final concept.

3.2 Mobile platform design

The design was created using CATIA modeling software. Fig. 4 shows a isometric view of the final assembly.

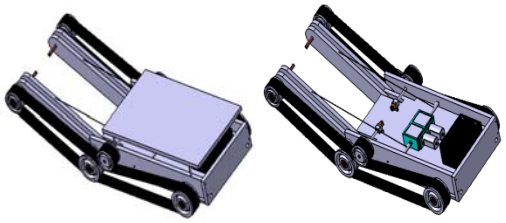

Fig. 4. 3D model assembly

In an exploded view, we can see all the elements of the model and their location within the assembly of the mobile platform.

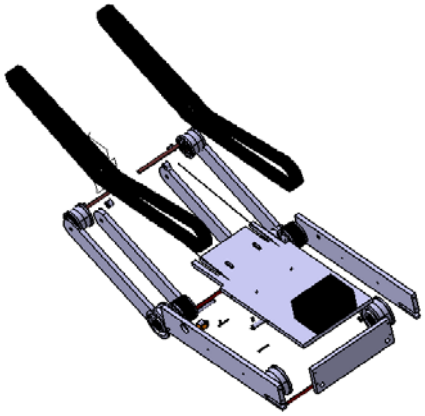

Fig. 5. Exploded view of the assembly

The plastic casing has been made out of individual parts. These parts were machine using the 3-axis Fawoo 700S-CNC equipment. The material consists of 10mm white Komatex and was cut using a 3 mm end mill, as seen in Fig. 6. Also in the figure, there are the tool characteristics and the process's parameters:

- Tool step-over: 1.5 mm;
- Tool step-down: 2 mm;
- Feed rate: 600 mm/min;
- Plunge rate: 600 mm/min;
- Spindle speed: 8.000 rpm;

Fig. 6. A 3 mm end mill tool and process parameters

After choosing the correct parameters, using a CAM software, we generate the machining tool path for the individual parts, as in Fig. 7.

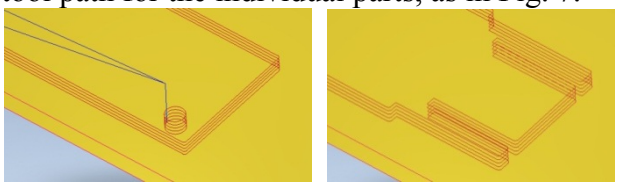

Fig. 7. Generated tool path for the chasing components

The machine's own software imports the generated tool path and starts working into the work piece (Fig. 8).

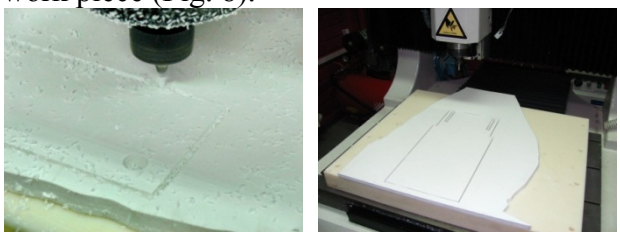

Fig. 8. CNC machining of the plastic components;

After the machining of the casing and the purchase of the mechanical and electronic parts, the physical product was build (Fig. 9)

The final product was made after exact specification and the real size model looks and acts as simulated in CAD environment.

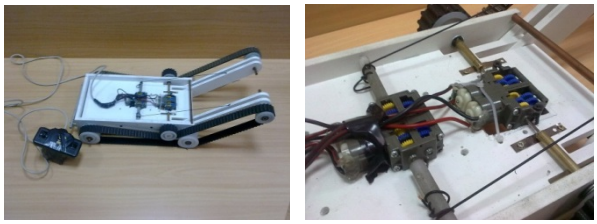

Fig. 9. Final real size model

4. Final remarks

Robots have an important role in all our lives. Areas of use are varied. From transportation, assistance, entertainment and ending with aerospace and space exploration. The development of technology will lead to more sophisticated robots, so that human life will experience a significant improvement. If the predictions made by Hans Moravec are confirmed, then the robots will be capable of simulating knowledge and thoughts. Given the rapid progress in the development of robots, this could happen even sooner than expected by the specialists.

A series of conferences in robotics that showed extraordinary achievements for beneficiate in terms of technology and information. Therefore, current robots are able to work in environments inaccessible to humans, independently carrying out a series of technological operations with high precision.

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PLARFORMA MOBILĂ DE UZ DOMESTIC

Abstract: Lucrarea de faţă prezintă procesul de conceptualizare şi de realizare a machete unei platform mobile pentru uz casnic. Platforma terbuie să fie capabilă să navigheze cu succes în interiorul unei reşedinţe casnice şi să poată transporta în siguranţă diverse obiecte. Pentru partea de concept s-au utilizat tehnici şi metode specifice ingineriei competitive. Pentru construcţia de machete s-au utilizat diverse mijloace printer care pachete software dedicate pentru CAD şi CAM.

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