Group project for the course of

Mechanical Design for Mechatronics

Prof.: Rustighi Emiliano

Technical report
TITOLO

Bontempelli Elia
Rizzardi Alessandro

Dalle Vedove Matteo
Zambotti Beatrice

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Contents

1 Product design specification

The goal of our project is to create our implementation of the *CyberOrto* [1] made by *Mindshub*, an non-lucrative association based in Ala (Trentino). The goal of this robot is to automatically handle an amateur vegetable garden by performing this 3 principle actions:

i) planting the seeds of the desired plant in a location decided by the user using a web interface;

ii) constantly provide water to the vegetable;

iii) extirpate undesired plants.

By talking with the association that worked (and is still improving) on the product we acknowledged the following requirements (mainly related to the functionality of the product) that the structure has to satisfy:

i) the arm appendix must suits an interface that allows to have an interchangeable set of tools (like the one use to plow the terrain);

ii) the arm appendix should accommodate a small pipe in order to irrigate the vegetables; in particular this has to be connected to an external reservoir (with no dimension specified if it's position is fixed) or by using an internal reservoir on the moving structure of at least $4l$ (that can periodically be refilled) if it's not possible to directly attach the arm to the main reservoir;

iii) the minimum accepted working area of the robot is a rectangle of dimension $4m \times 3m$; the robot should be design keeping in mind the possibility to increase the working area by expanding it over one edge (for example having the possibility to work on a $8m \times 3m$ terrain);

iv) the structure can house the electronic control unit of the robot that's remotely connected to the server using wireless connection and by doing so should accommodate a battery the allows the robot to work for at least **number of hours of uninterrupted work**. The power consumption of the structure should be minimized if possible (at the actual state the prototype consumes $40W$ and has a **quantità batteria** weighting $6.3kg$);

v) regarding the accuracy of the movement of the system the allowed backlash on the working point should always be less then $1cm$ with the control technique implemented and the goal is to have maximum $5mm$ of deviation from the nominal value;

vi) the structure should be mainly composed of standard components and should be as cheap as possible in order to make it affordable for everyone.

Loads and operating conditions   The structure should be able to perform all it's operation while being safe and fully functional. For the design and the verification of the structure the loads related to wind can be neglected due to the presence of an anemometer that's mounted on the robot and ensures that the robot works only on a sufficiently safe environment.

The heavier operation performed by the robot is the extirpation that's done by plowing the soil with a rotating element **AGGIUNGERE UNA BREVE DESCRIZIONE**. Considering the actual mounted motor to perform this operation the torque that has to be transmitted to the plower is of $T_{\mathrm{plower}} = N \cdot m$ **CHIEDERE DATO**.

A   Appendix

B Bibliography and references

[1] MindsHub Association. *Progetto CyberOrto*. URL: https://mindshub.it/progetto-cyberorto/.

C   Latex Crash Course

Così io scrivo normalmente e posso fare un testo; per andare a capo semplicemente posso fare così
come potete vedere

Lasciando una riga vuota di codice ho creato un nuovo paragrafo. Se voglio scrivere un parametro matematico in linea di testo basta che faccio $f_l(x) = 10N$, mentre se voglio un'equazione bella centrata:

$$f_{x,max}(t) = \int_{-\infty}^{\frac{\pi}{2}} e^{-t^2} \, dt \tag{1}$$

Se invece non voglio avere il numero per l'equazione basta fare

$$f(x,y) = \cos(x)\sin(y)$$

Adesso faccio un'equazione per usare i riferimenti:

$$f(x) = e^x \tag{2}$$

Quella appena scritta è l'equazione 2 e si trova a pagina 5.

Elenchi puntati   Con questo comando posso creare un nuovo paragrafo con un certo titolo e farvi vedere come fare gli elenchi puntati:

- il primo punto;

- il secondo punto

L'elenco numerato si fa invece scrivendo

1. il primo punto;

2. il secondo punto

Per scrivere in corsivo basta fare *così, usando il comando "textit"* mentre **per il grassetto utilizzo "textbf"**. Volendo ***posso anche usarli insieme***.