Design of an Automatic Seeding and Irrigation Robot

Okan AK, Olgaç OZKAN, Enes BILGIN, Işik TURKERI

Supervisior: Dr. Duygu ATCI

DEPARTMENT OF MECHATRONICS ENGINEERING

Abstract

Our aim in this project is to make a cartesian automatic seeding and irrigation robot. Our mechanism can move in X, Y and Z axes. In our project, our X and Y axis represent our soil. We have a 50 cm range of motion in the floor area. Our Z axis, on the other hand, creates our height and has a 50 cm movement area. We can do our operations within these dimensions. If the plant variety to be planted is selected within these dimensions, this machine can be used with maximum efficiency. Linear mechanism is used in our X and Y axes. In our Z axis, the four bar mechanism and the slider crank mechanism are used together. Stepper motors are used everywhere to control this system.

.

1. Introduction

Today, the human population is increasing inexorably. While hunger is not a problem in some regions, in some regions people may die from various diseases or starvation itself due to hunger. This situation shows the importance of agriculture to human beings day by day.

When we look at history, agriculture and technology have always been intertwined and as technology has developed, it has started to be used in agriculture. This situation not only reduced manpower in agriculture, but also increased productivity.

Today, technology and agriculture are so combined that they cannot be considered separately. Our project and similar projects will contribute more to the development of agriculture.

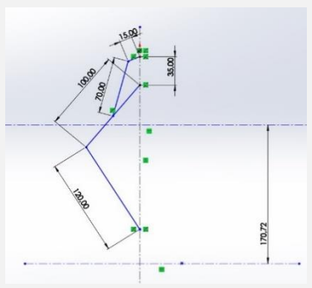
Due to the recent virus epidemic, people have become more accustomed to loneliness and nature. Our aim is to enable people to do their agricultural work in the small hobby gardens created in their homes in the village while living in the city, with the help of Wi-Fi remotely before they come to the village.

Our robot will provide convenience in the processing of hobby gardens rather than the processing of large lands and will focus on this sector. Although it has an expandable structure, necessary modifications can be made to control it remotely.

We are proud and happy to present our final project.

2. Structural Design

Although the mobility of our gripper tip is 1 DoF, its calculation is given below.



$$M = \sum f_i - \sum \lambda \quad \textbf{(1)}$$

$\sum f_i$ *:* the total DoF of all kinematic pairs in the system, $\sum \lambda$ *:* the total subspace of the, independent loops of system, *M: Mobility* [1]

$\sum f_i$ =4, λ=3, $M = 1$

Figure 1: Kinematic Representation and Mobility Calculations

3. Theoretical Calculations

Our dynamic analysis directions and outputs are indicated and shown with their dimensions. The amount of load that our gripper tip can carry and the capacity of our motor are determined accordingly.

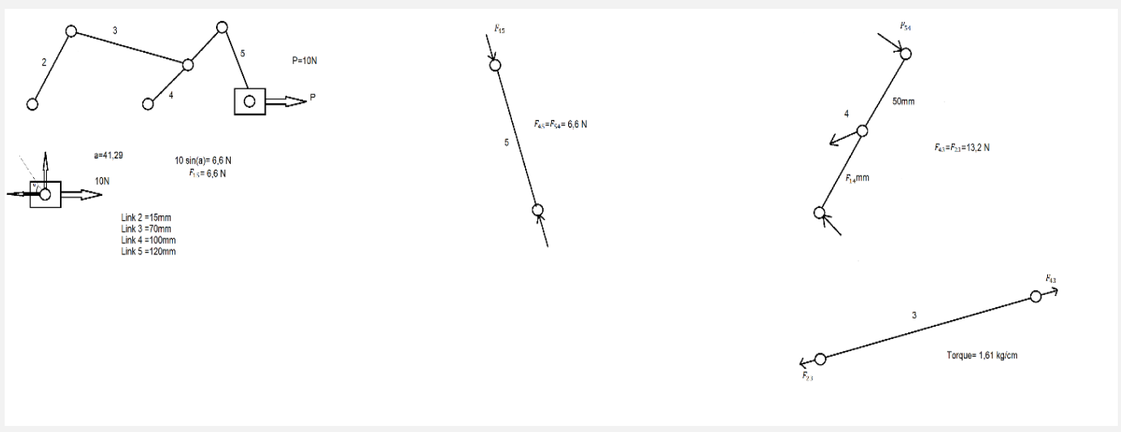
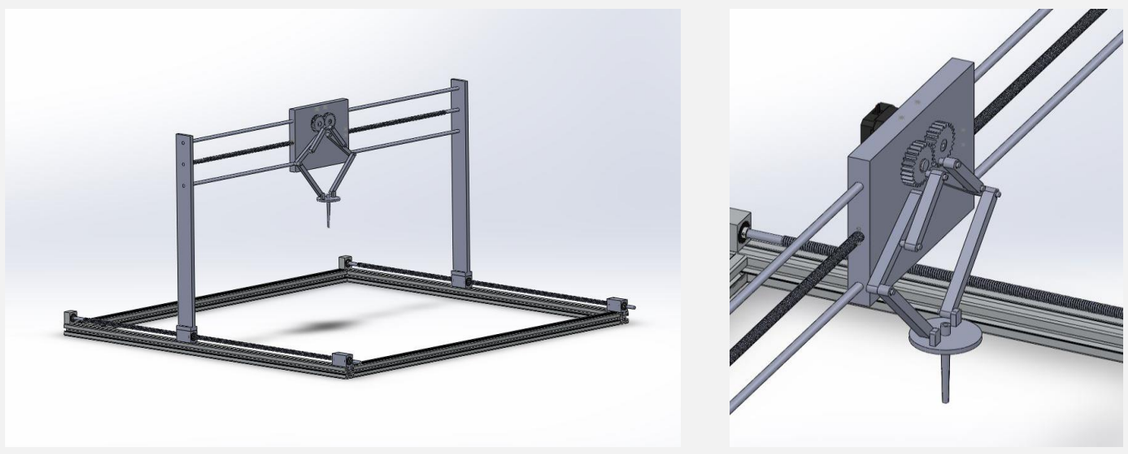


Figure 2: Dynamic Analysis

4. Experimental Setup

3D drawing of our robot and specially the drawings of the gripper design are shown.



The integrated version of our gripper tip and the gripper tip are shown in two different ways with focus.

There are two gear, six links and a vacuum tip in the gripper system.

Figure 3: Projects Solidworks Drawings

5. Conclusions

The robot we designed as a result of our mutual exchange of ideas has an important place in integrating agriculture and technology. The difficulties we overcome while designing our robot have carried us forward on the path to become a better engineer. Our project is for agricultural activity and is part of the developing field of automation and robotics in agriculture. It is an irrigation and seeding robot designed in a Cartesian shape. Various metals, electrical and electronic components and software are used in our agricultural robot. As a result of the merger of these three different fields, a wonderful mechatronic work has emerged. In this work, our consultants, who played an important role in bringing us to this level, have their efforts as well as us.

The importance of our robot, which will provide efficiency in the field of agriculture, has been understood these days, where each seed is valuable. We understand this from the incentives and supports given in the field of agriculture. That's why our robot has been designed in a way that is open to improvement. Its dimensions can be adjusted according to the desired dimensions, provided that it is efficient. It allows remote control when necessary changes are made in the control mechanism. In case of any failure, there are no expensive and unavailable parts. All items are available online.

Millions of people have worked in agriculture since history. States had to devote their limited manpower to agriculture. This situation has led to the discovery of qualified people who will grow up in fields such as science and technology, art, psychology and philosophy. This has resulted in slower progress in various sciences. Our project was produced in accordance with this stop. A human and a computer are enough for our robot to work. In the advanced version, the user does not even need to be in the same environment as the robot. The user can perform the necessary operations from a mobile application or computer while using his own time in the most efficient way.

We understand how important agricultural activities are for countries from the budgets allocated by the countries. Already, governments have understood the importance of automation in agriculture and have started to make large investments. In the future, these investments will continue to increase rapidly. With this acceleration, our agricultural robot will always be valuable both now and in the future.

References

[1] F.Freudenstein, R.Alizade, On the degree of freedom of mechanisms with variable general constraint, IV World IFToMM Congress, England,(1975).