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FACULTAD DE INGENIERÍA

Escuela Académico Profesional de Ingeniería Mecatrónica

Tesis

Design of a Self-Sustaining Robot for the Monitoring of Carrot Crop Plants

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Para optar el Título Profesional de
Ingeniero Mecatrónico

Huancayo, 2024

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FECHA	:	20 de Mayo de 2024

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Título:
Design of a self-sutaining robot for the monitoring of carrot crop plants

URL / DOI:
https://doi.org/10.1109/ICoSR57188.2022.00036

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Design of a self-sustaining robot for the monitoring of carrot crop plants

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Abstract— **Foodborne diseases are those that originate from the consumption of raw or spoiled food and this can affect the health of people who consume it, as it may contain viruses, parasites, bacteria and other diseases. In this project, the design of the system was carried out of an intelligent self-sustaining robot for the monitoring of carrot cultivation plants with the purpose of to analyze the images it captures in real time, through three cameras, in order to be able to identify possible plants infected by bacteria or parasites, so that they have finally been removed by the staff, in order not to infect the other plants, also for color recognition of the plant, a code was made in Python applying the use of the OpenCV artificial vision library, on the other hand, in order to stimulate the robot's trajectory, a module (GPS) was implemented, then the robot's route was made using the simulator CoppeliaSim where the trajectory distance that will go through the robot and the detection of lateral ranges so that the robot goes through the center and not present difficulties when performing a task.**

Keywords—Robot, Monitoring, Library, System, Parasites.

I. INTRODUCTION

In the world, 1 in 10 people become ill from consuming contaminated food, causing a total of 420 thousand of deaths per year [1]. Currently, TSEs are one of the main health problems worldwide. According to the World Health Organization (WHO), thousands of cases of diseases are transmitted through food TSEs [2]. In the food industry, various chemicals are used to prevent contamination between foods during processing and production. Many of these substances can cause intoxication and illness in the consumer [3]. Therefore, the following problem arises, what will be the new method or intelligent design to improve the quality control of crop plants? I Previous research proposed a plant identification system using artificial intelligence and vision algorithms implemented in a Jetson nano the system performs a visual inspection to verify the status of each crop plant using artificial vision techniques for which it was programmed in a minicomputer called Jetson nano, which works with an SSD algorithm, based on neural networks which allow the classification of objects and image processing at high speed [4]. In similar research, a robot was designed to detect crop diseases utilizing multispectral images, where the robot is controlled by remote control to inspect crops using remote sensing, where the main objective was to detect asymptomatic infected plants employing three reflex cameras [5].

Unlike existing antecedents, this research proposes the design of an economical self-sustaining robot for the monitoring of carrot crop plants, which will have a GPS for trajectory monitoring to analyze the parameters in real-time and identify possible plants infected with candidates liberibacter, it will also have an artificial vision system, which will consist of two five-band multispectral cameras, an image transmitter and a computer where the results obtained will be interpreted.

II. MATERIALS AND METHODS

T The methodology implemented in this mechatronic work is the union of the VDI 2206 guideline, this choice is because this project aims to develop a mechatronic product that contains the three disciplines engineering (mechanical engineering, electrical engineering and computer engineering) [6].

The design encompasses three systems to run a selfsustaining robot and monitoring. The first is mechanical, which includes the support and structure of the machine allowing the stability and protection of the electronic components. The second is the mechatronic system, where the connections of the components of the self-sustaining robot will be made, allowing good operation. The third system is the control system, where a Python code was created with the use of the OpenCV library, to simulate the path of the robot, the CoppeliaSim simulator was used, which allows programming the distance that will recognize the sides so that the robot can make the path through the center.

A. Carrot morphology and taxonomy

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B. Pest and diseases

Carrots are one of the most cultivated vegetables in the world. Its consumption has become widespread, as it is currently available in the market throughout the year. On the other hand, carrot plants showing in Fig. 1 the symptoms caused by viruses and phytoplasmas of the Carrot complex, dwarf variegated: a) curling. b) yellowing. c) bruising. d) rosette + curling [8].

Fig. 1. Taken from Molecular identification of viruses infecting phytoplasma in carrot crops in Peru, p.20. in carrot cultivation in Peru, p.20.

Existing types of pests and diseases that occur in carrots:

- Carrot fly: Larvae penetrate the root, where they practice sinuous galleries, especially on the outside, which will later be the origin of rots.