Project Report

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Abstract

Work in agriculture is often hard and physically taxing for human workers. In the U.S., an agricultural worker is 20 times more likely to die from illnesses related to heat stress than the average civilian worker [5]. The use of autonomous robots will help alleviate the burden of planting, maintaining, and harvesting crops. It is also estimated that the world population will reach nine billion by the year 2050 yet the labor resources will decrease for agriculture while the population in urban areas will increase [4]. The use of automated robots can help bridge the increasing gap in limited food and labor resources that growing populations need [10]. By using deep learning, robots can identify the physical features of crops such as strawberries and distinguish them based on ripeness [9]. These crops can then be harvested by the robot and transported to a collection point. The end result produces a system capable of working farmland and providing produce while minimizing the risk to human workers.

Problem

They are many problems to overcome when designing an automated robot suitable for agriculture. One such problem is navigation over uneven or rough terrain. This presents a challenge for navigation since vegetation often hides the load-bearing surfaces used by a robot to safely execute certain actions [7]; furthermore, collisions with crops or farm animals can result in damaged produce and loss in profits [3]. Another challenge that the robot must overcome is identifying produce suitable for picking in a natural environment. Many methods employed for fruit detection have produced results lacking in accuracy and robustness [1]. This is important because consumers expected quality produce and will reject anything that is rotten or unripe. Certain methods can be used, such as BLOB analysis [2], to detect the shape and color of the product; however, natural lighting can affect how the robot interprets the data since the lighting will cause the colors to change in intensity [6]. A third problem that the robot must overcome is picking/handling the crop without damaging it. Many crops, like strawberries and tomatoes, are fragile and can be easily damaged so gentle handling during manipulation is required [8]. Consumers will also reject damaged produce just like rotten or unripe produce.

Tasks and Timeline

Tasks

- Proposal
- Preliminary Report
- Research
- Build(?)
- Final report

Timeline

Approximate dates where tasks should be completed.

- Proposal: October 10, 2022
- Preliminary Report: October 31, 2022
- Final report: December 5, 2022

Risk Management

Any potential risks are minimal since I am currently working by myself. If I encounter and issues or conflicts I will consult with the TAs or the course professor. All activities will be a theoretical write-up unless circumstances change. Robotics is completely outside of my knowledge so the proposed idea may change as well.

References

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