

Team # 8 Automated High-Throughput Acquisition of Roots Team 8

Team Members: Sarah Naylor, Johnathon Laatz, Benjamin Wheatley, Eunice Garcia

Mentors: Dave Merrick

Customer Background

Salk Institute for Biological Studies is a non-profit and biomedicine research institute in San Diego, California. Salk is currently analyzing petri dishes filled with plant roots in different conditions and temperatures. Research that is important in uncovering biological principles, crop productivity and sustainability.

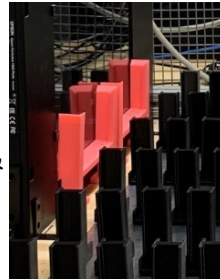
Problem Statement / Scope of Work

Salk needs an automated system that will pick up the petri dishes and scan them. This process will save money and time.

Requirements

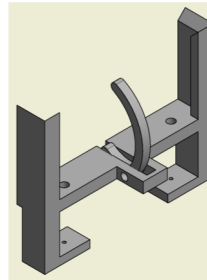
Req. #	Requirement	Description	Test to Verify
1	Automatically save image in directory with name/date	The Save file must save as the desired settings set by the user	Input a save file directory and name and save the scan
Rational and Reference The user needs to be able to find the scans in a simple matter.			
11	HMI	Must display system status	Demonstration by running process
Rational and Reference For the operator to know what step in the process is being completed			
18	Plates Per Shelf	At least 48 plates can be loaded under the gantry at one time	Measure plate density to ensure that at least 48 plates can be scanned without human interference
Rational and Reference Standard requirement by Salk			
19	Environment Temperature	System must be able to operate in an environment that ranges from 4-38 deg C	Verify that each component selected can operate in the required temperature range.
Rational and Reference Temperature requirement for roots to be in optimal condition			
24	Emergency Stop	Safety protocol: A light curtain stops the process when an object is inside of its range (either 30.48 cm or 43.18 cm depending on shelf height).	The light curtain is mounted to the shelf in the lab where the gantry resides. It is verified that if someone breaks the plane of the light curtain by putting their hand into the field that the gantry stops its process.
Rational and Reference An emergency protocol which stops the process if someone enters the operating zone			

Experimentation and Concepts



Weakness:

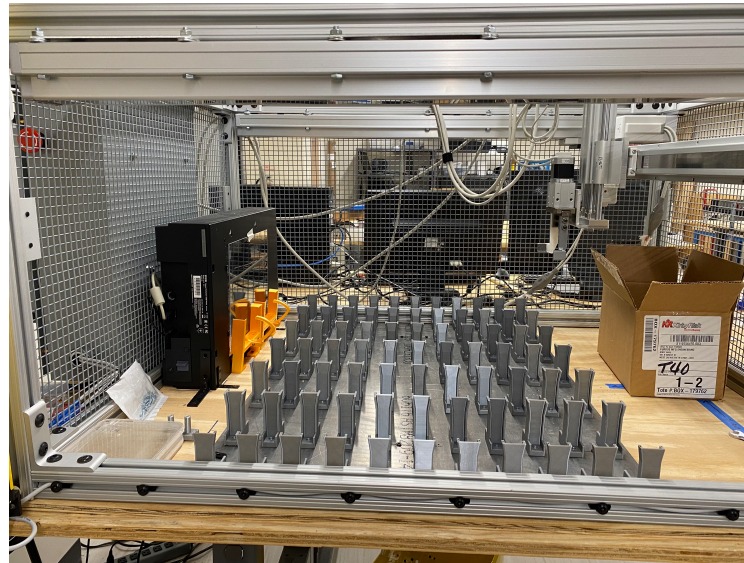
- Loose tolerance on plate & scanner
- Tight tolerance on sides



Strengths:

- Cradle springs back in position
- Perfect tolerance for plates
- Easy assemble

Final Design



FMEA

Item	Function	Requirements	Planned Failure Mode	Planned Effects of Failure	Planned Causes of Failure	Current Design Controls	Current Design Controls	Severity	Recommended Actions	Responsible	Target Completion Date	Actual Date	Effect on Safety	Priority
1	Grasper	Grasper should pick up the plate	Grasper will not pick up the plate	System will not work	Plate will not be scanned	Plate will not be scanned	Emergency stop button will be implemented	3	Grasper will not pick up the plate	Team 8	March 1	March 1	1	P, G
2	Grasper	Grasper should hold the plate	Grasper will not hold the plate	System will not work	Plate will not be scanned	Plate will not be scanned	Emergency stop button will be implemented	3	Grasper will not hold the plate	Team 8	March 1	March 1	1	P, G
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Testing

Test ID	Req. Matrix	Test Name	Specifications & Test Method	Test Description	Outcome
1	4	Calibration	Manual movements	Look at the code and ensure the gripper arm moves back to its home position at the start of operation	Calibration works and operates correctly
4	8	Plate Scan Position	Visual inspection	When plate has made it to the scanner, does the plate lean up against the scanner for a good scan	Scan is readable and clear
8	18	Plate Number	Count	Plates must be able to fit in the gantry	System scans 48 plates
10	24	E-Stop	Manual movements	Light curtain must be able to stop the machine once tripped	E-stop must be activated
11	28	Size	Measure	Gantry system must fit within specifications by measuring	Gantry dimensions fit within requirements