

CONCEPTUAL DESIGN

Saheel Mohammed

Shehryar Ali Memon

Logan Jones

Oluwatamilore Ilupeju

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Abstract

This document is meant to act as a platform for our group to make our various conceptual designs. These sketches and explanations will feature the ideas we have come up with to solve the project problem so far.

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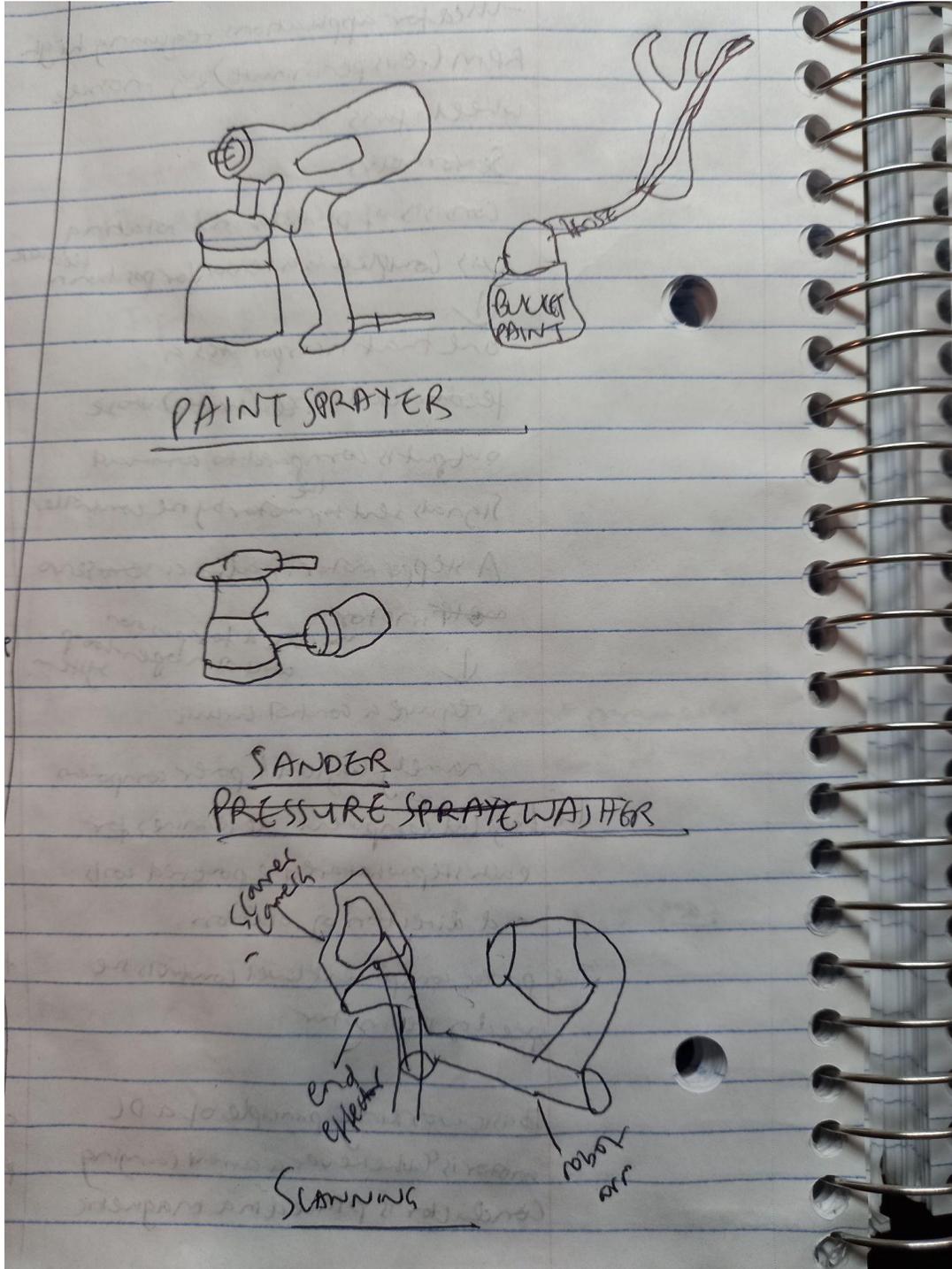
Introduction

This document displays this teams ideas of the presumed client needs and puts them into a detailed breakdown of components. These designs are meant to show the reader the expected product. There are three main systems in our design of an end effector: scanning, repainting and sanding. Scanning system includes sub-systems such as camera and lighting systems. Repainting system includes the paint nozzle, paint bottle and the paint gun itself. Sanding system includes the sander and vaccum sub-systems. Common sub-systems such as the latch system or the wiring systems are also shown in the sketches. Images are not to scale.

Oluwatamilore Ilupeju's idea

Sketch

In the attachment below, I have included a few of my personal sketches/ideas. These sketches were borne from my imagination and improved upon a little by my teammates and the internet.



Description

Scanning

The idea portrayed in my sketch is that of a scanner camera (eg. Intel DepthSense camera) attached to the end effector which is connected to the robot arm.

Benefits

- It is an ideal way of ensuring the area to be worked upon, either for sanding or repainting, is captured in real time.

Drawbacks

Repainting

My sketch above shows a diagram of a traditional paint sprayer with a nozzle on the left. On the right, it shows a hose connected to a bucket of paint which is then passed through the end effector.

(Input on this idea by Logan Jones)

Benefits

- The paint can be transferred directly from the paint bucket to the end effector where it can be released easily to paint the wall.
- Painting can be done with speed and efficiency

Drawbacks

- There could be difficulty in moving the robot arm with a bucket of paint attached to it because of its bulkiness.
- Paint could affect the functioning of the end effector if the hose becomes faulty.

Sanding

My sketch above shows the diagram of a typical sander. In our design, sandpaper could be attached to the end effector which is then used to peel off rust on the hull of the ship with abrasion.

Benefits

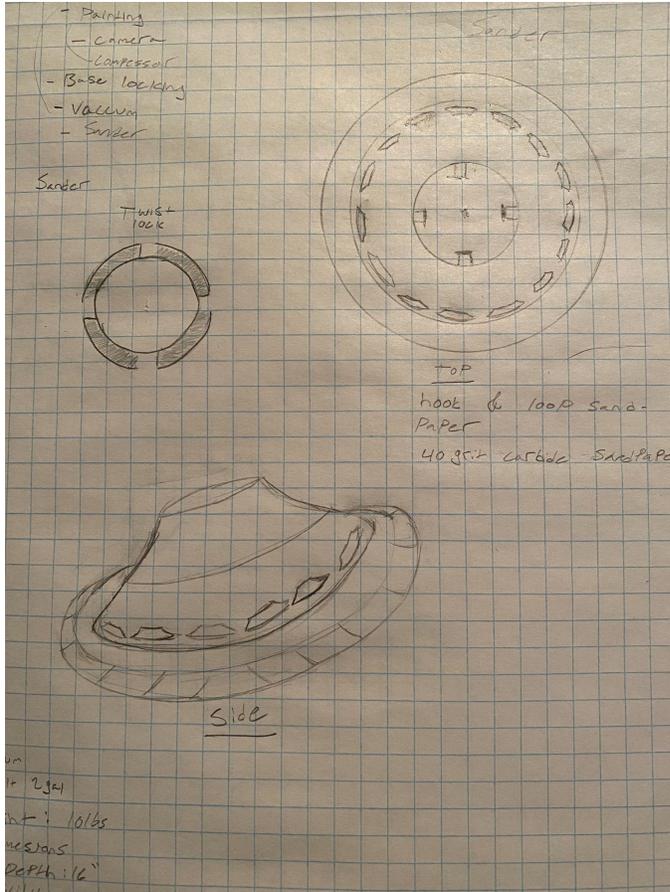
- Sandpaper is very efficient in peeling off rust
- Requires less force/pressure to carry out its duty in comparison with a pressure washer.

Drawbacks

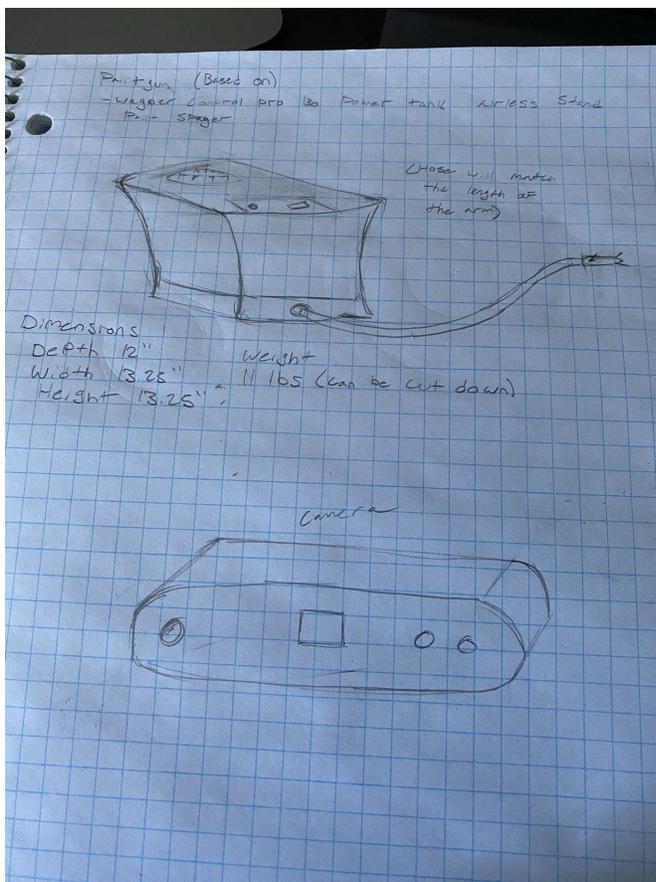
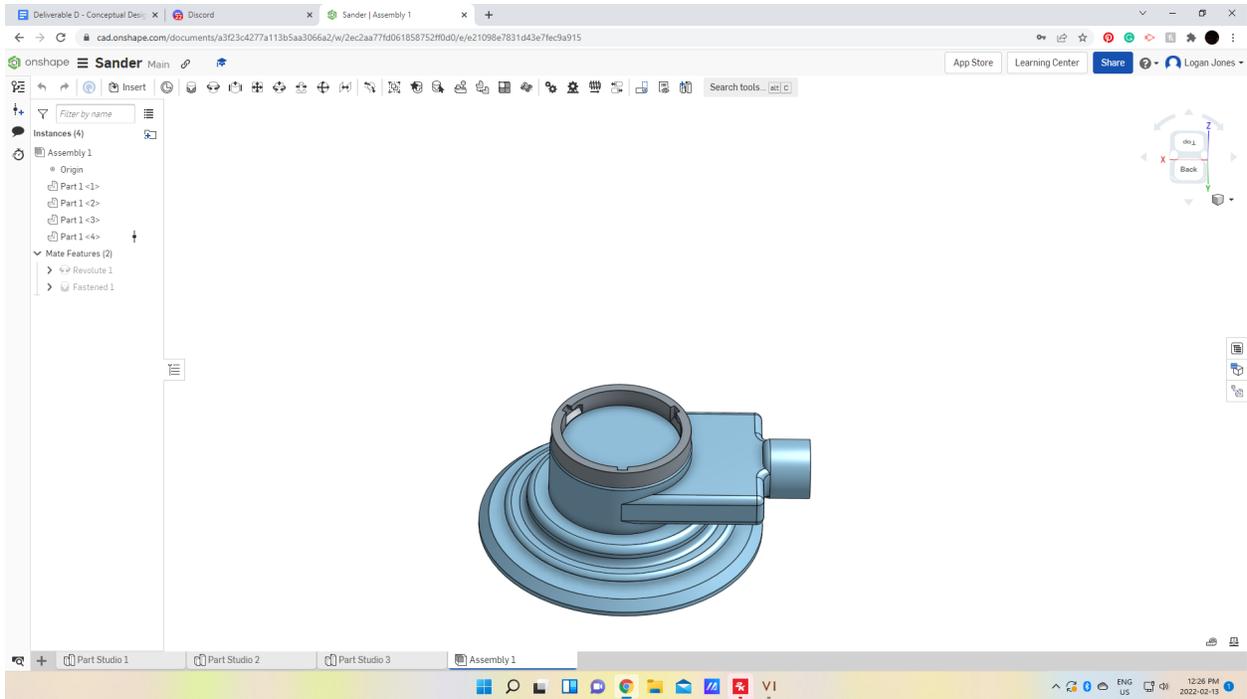
- It could take an exponential amount of time to complete depending on the size of sandpaper and the area of the hull that will be worked upon.
- Could require more manpower and effort to complete.

Logan Jones' idea

Sketch



Deliverable D



Description

Scanning

A camera that allows for 3 mapping of a surface

Benefits

- Allows for detailed mapping of the surface
- Lightweight

Drawbacks

- Expensive

Repainting

1.5 gallon container paint sprayer

Benefits

- Large paint container will mean the user will need to fill it less often
- The robotic paint sprayer will perform the task of painting far faster and with higher quality than its human counterpart

Drawbacks

- Container for paint will take up a large amount of room

Sanding

- Random orbit sander (6" diameter)
- Use hook and loop system for the sanding pads

Benefits

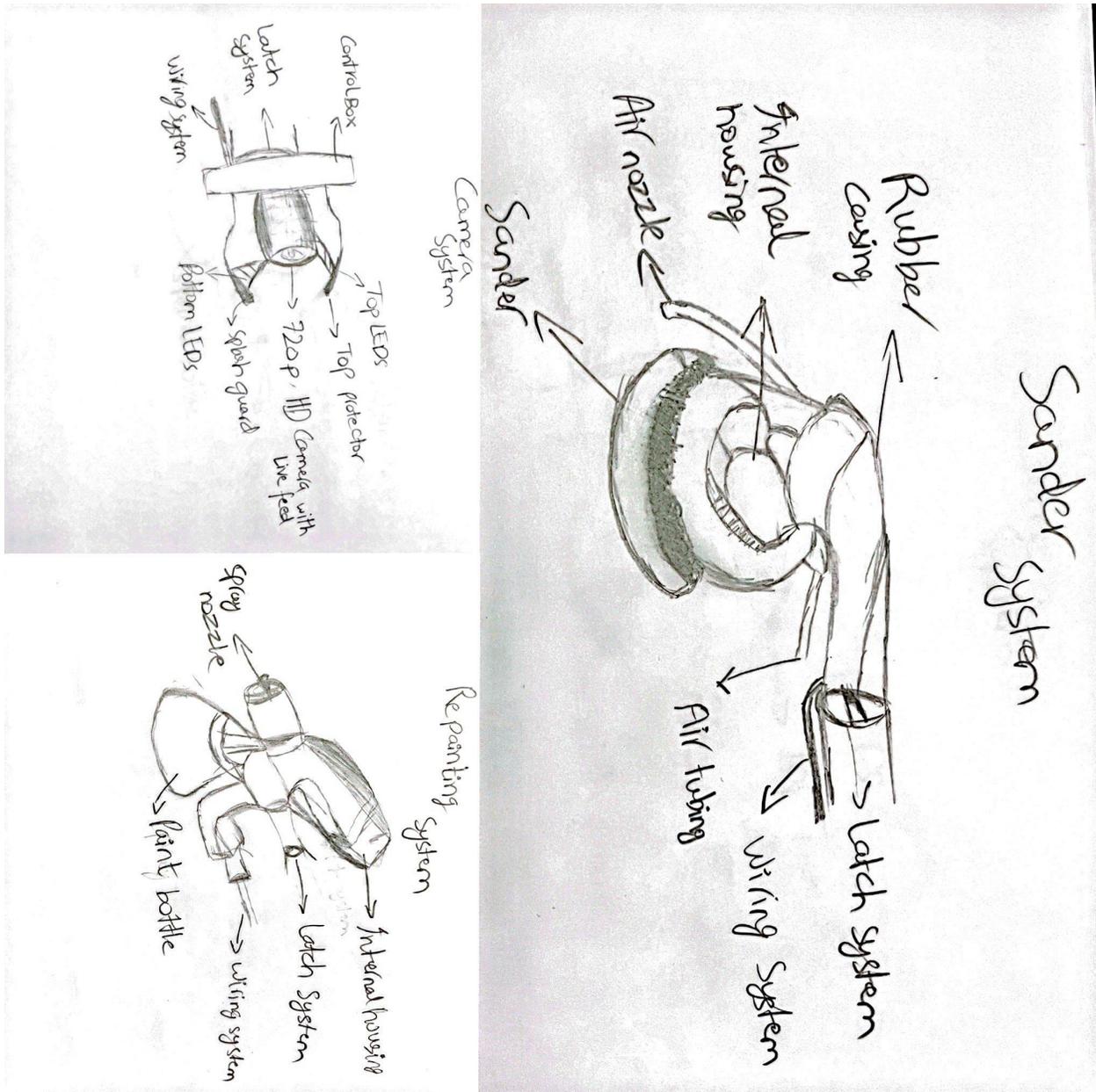
- Weighs less than pressure washers or other alternatives
- Creates less of a mess
- Fewer parts to malfunction

Drawbacks

- Amount of sanding pads is finite.
- Creates dust
- Will take longer to clean an area of rust than a pressure washer
- Sanding pads will need to be swapped out

Shehryar Ali Memon's idea

Sketch



Description

Scanning

A live feed capable 720p camera, attached to the robotic arm with built in swappable LEDs. Dimensions: 5 inch camera, 7 inch guards, 2 inch diameter, 7x3 inch control box.

Benefits

- LEDs can be replaced.
- Up to 6 LEDs
- Built in LEDs takes less space
- Workable in dark and small spaces
- Detachable
- Top and bottom guards shield from water and soft blows

Drawbacks

- Around 10 lbs
- No focusing element

Repainting

A remotely workable paint gun.

Dimensions: 10x5x14 inch paint gun, 8 Oz paint bottle.

Benefits

- Charged spray nozzle allows for a decent coverage of paint
- Convenient wiring placement
- Inexpensive bottles
- No “trigger” necessary
- Waterproof housing

Drawbacks

- Expensive
- Big and heavy – 8-10 lbs
- Inconvenient bottle placement
- Paint tube can get clogged due to paint chunks

Sanding

Orbital Sander with built in blower

Dimensions: 6 inch diameter, 10x5x5 inch housing.

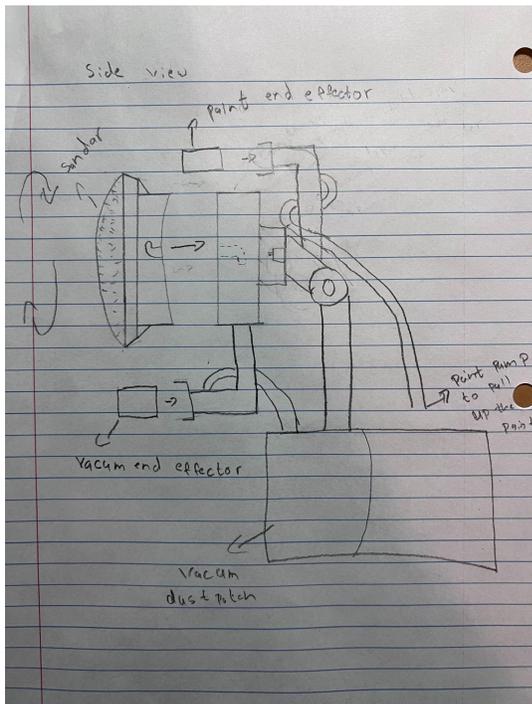
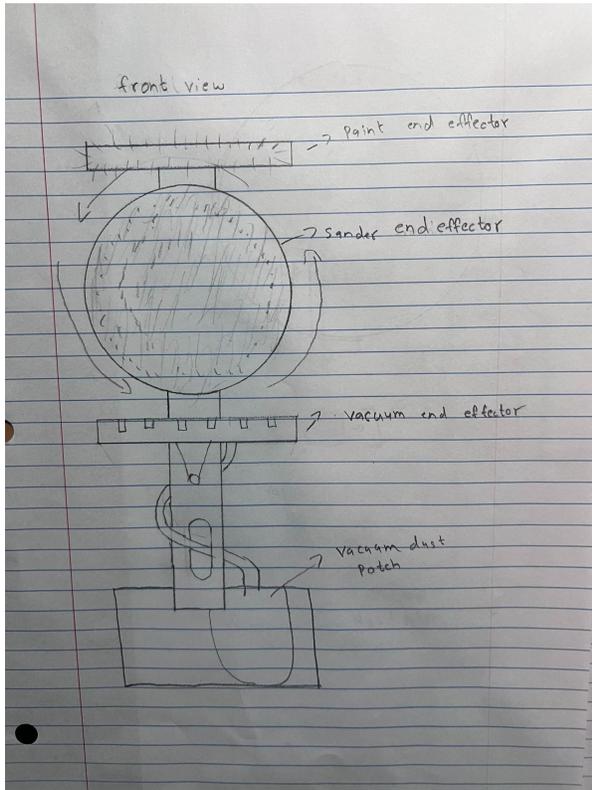
Benefits

- Turned on/off remotely
- Effective rust displacement
- Light – Below 5 lbs

Drawbacks

- Blower is bad for the environment and user
- Moderately expensive
- Can damage other parts if moved too quickly
- Frequent replacement of sanding disks

Saheel Mohammed's idea



Description

Scanning

Depth sensor will sense after a centimeter is taken off to insure no more than what needs to be taken off will be taken off

Benefits

- Workable in dark and small spaces
- Lightweight

Drawbacks

- Expensive
- Can be affected by rust particles
- There is no focusing element

Repainting

Is a separate end effector that spares at a rate of 100 psi, with another hose

Benefits

- Creates less of a mess
- Need another employee to change out the end effectors

Drawbacks

- Way to heavy
- Expensive
- Paint tube can get clogged
- Too many end effectors

Sanding

A typical sander is seen in the diagram above. Sandpaper may be connected to the end effector in our concept, and abrasion might be utilized to scrape rust off the ship's hull.

Benefits

- Ovel housing so maxis surfacarea
- Creates less of a mess than presser washing

Drawbacks

- Way to heavy
- Expensive
- Paint tube can get clogged
- Too many end effectors

Final Solution

Description

We're going to use Logan's idea for the random orbit sander with the built-in vacuum for the sanding system. For the scanning system, we are going to use the camera system as seen in Shehryar's sketches coupled with the depth sensor mentioned by Saheel. For the repainting system, we are going to use a paint gun as seen in Shehryar's, Logan's and Tami's sketches, however rather than a paint bottle, we are going to use a paint tank as the base for our arm, along with an attached vacuum dustbag. The hoses for the vacuum are going to run along the end-effector of the robotic arm. The paint tank allows for the paint gun to be lighter and also gives more space for the movement of the gun. To ensure even coverage of paint and an even removal of rust, we'll use a pivot system on our end effectors.

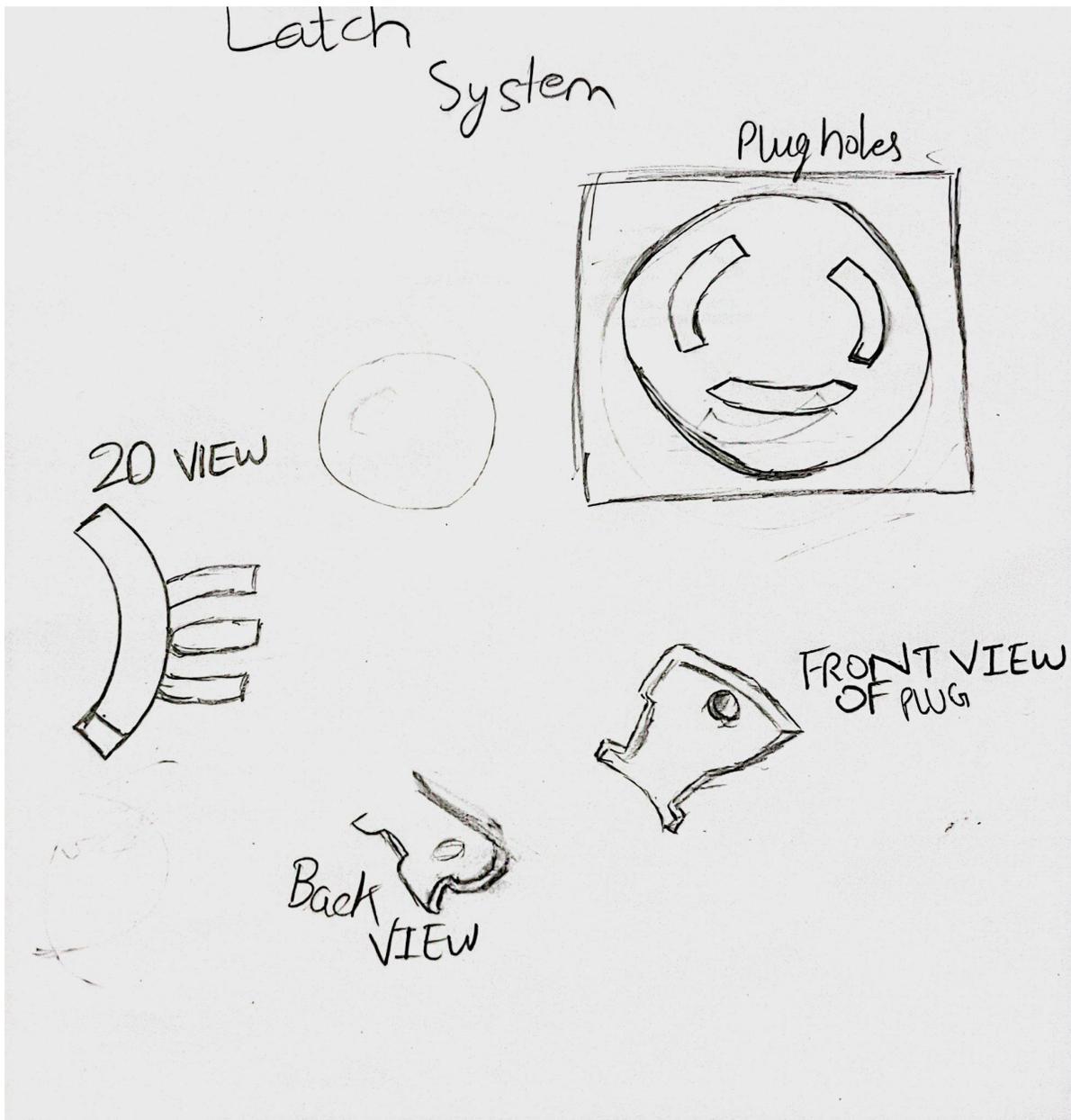
Benefits

- Paint gun weighs below 5 lbs
- Camera system usable under extreme conditions
- Vacuum system coupled with the sander makes for effective removal of rust
- Dustbag and paint tank acting as the base of the arm improves stability and helps with the height of the robot
- The pivot system helps with even coverage
- Depth sensor coupled with camera gives the user along with the computer enough data to work effectively

Drawbacks

- Relatively expensive solution
- Sanding pads need to be frequently changed
- Dustbag needs to be replaced often
- Regular Maintenance required
- User needs to be aware during scanning

Appendix



The end effector will use a two way latch system to connect the arm to the attachments i.e. the scanning, sanding and scanning systems.

References

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Wrike Snapshot:

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