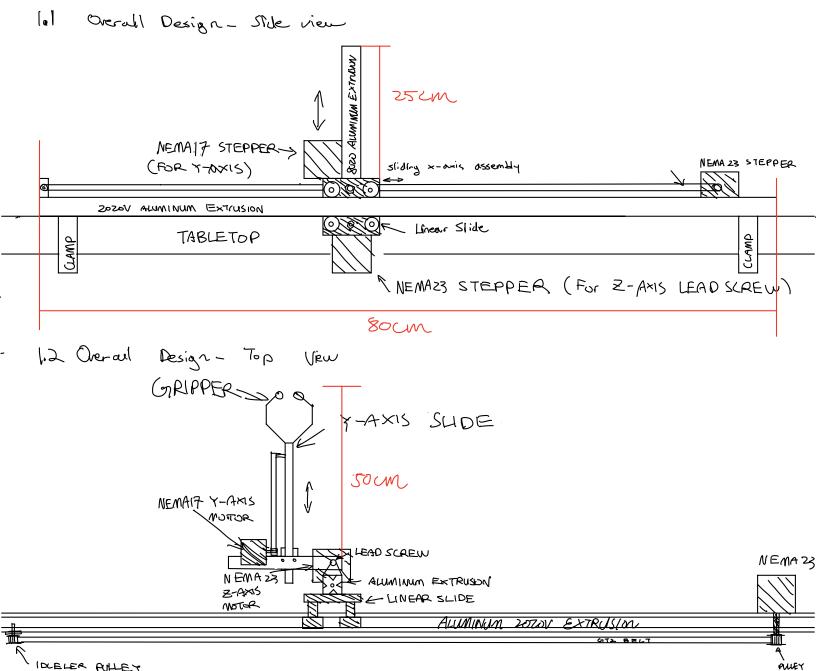
RUBUT ARM PRELIMINARY DESIGN

I considered building a robot arm composed of rotational joints -- much like a human's arm. However, after considering our use case requirements, I decided that a Cartesian design -- similar to a 3D printer, is more appropriate. Doing precise motional control required by our use case in a rotational joint design is difficult because angular error is easily amplified over a long distance: 2mm repeatability at the gripper over an 50cm long arm requires $\arctan(2/500) = 0.22$ degrees repeatability. The typical stepper motor has a 1.8 degree resolution. Even if we geared it, the gearing mechanism would also need to be low backlash, which is difficult to achieve. On the other hand, a cartesian mechanism can benefit from a pulley mechanism, which is zero backlash.



2.1 Giripper Uksign face-sensitive resistors 12 cm - Polyurethume Docks 3D Antited Gripping 10cm -General DC mater + tersional spring manting bracket 00 2.2 Variable Force autput Design E torsional spring pinion mates with gripper sprocket Bull Dearing - 3D Arinted Casing Torsiona «Unen there is no force on the gripper, the spring has no effect, spring Þc MOTOR and the mechanism works us if the motor was nigidly tixed to the motor, erook · When the gripper makes contact, force at the point of contact is proportional to torque in the spring. Tarque in the spring is in turn proportional to how fur

the motor has turned after contact.

gripping force contact initiated Motor position With this design, we can control force relatively easily by just transing the motor. user force command + force error PID MOTOR gripper POSITION CONTROL Porce sensity pesistor