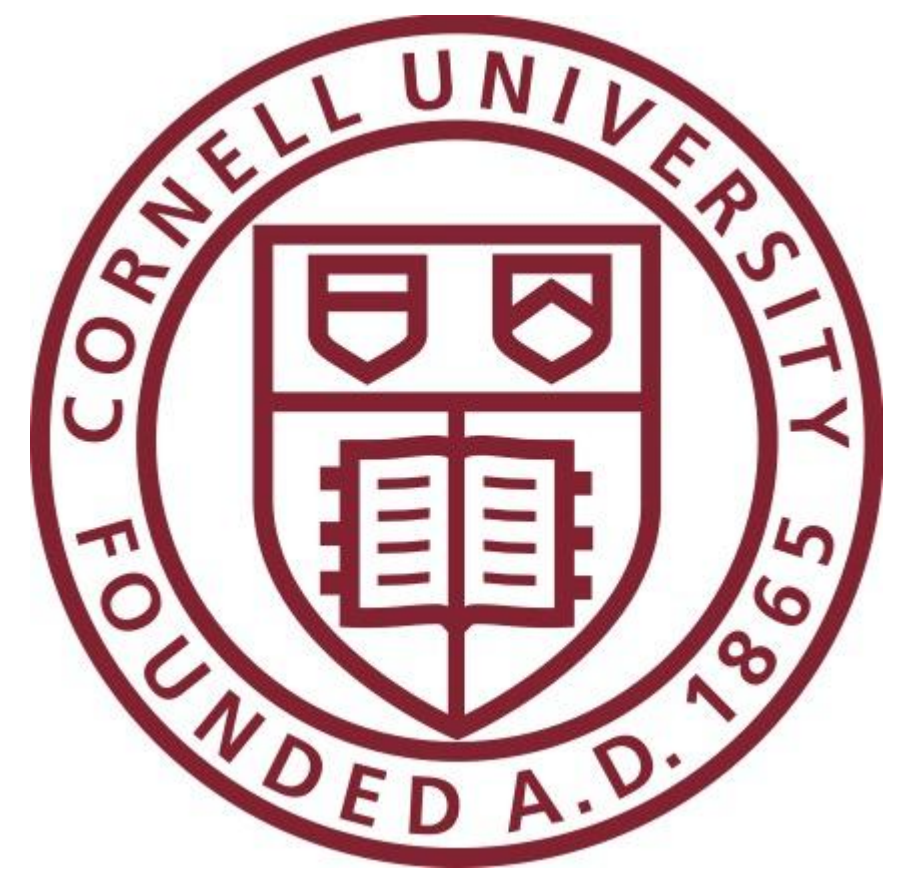




Biological & Environmental Engineering Team



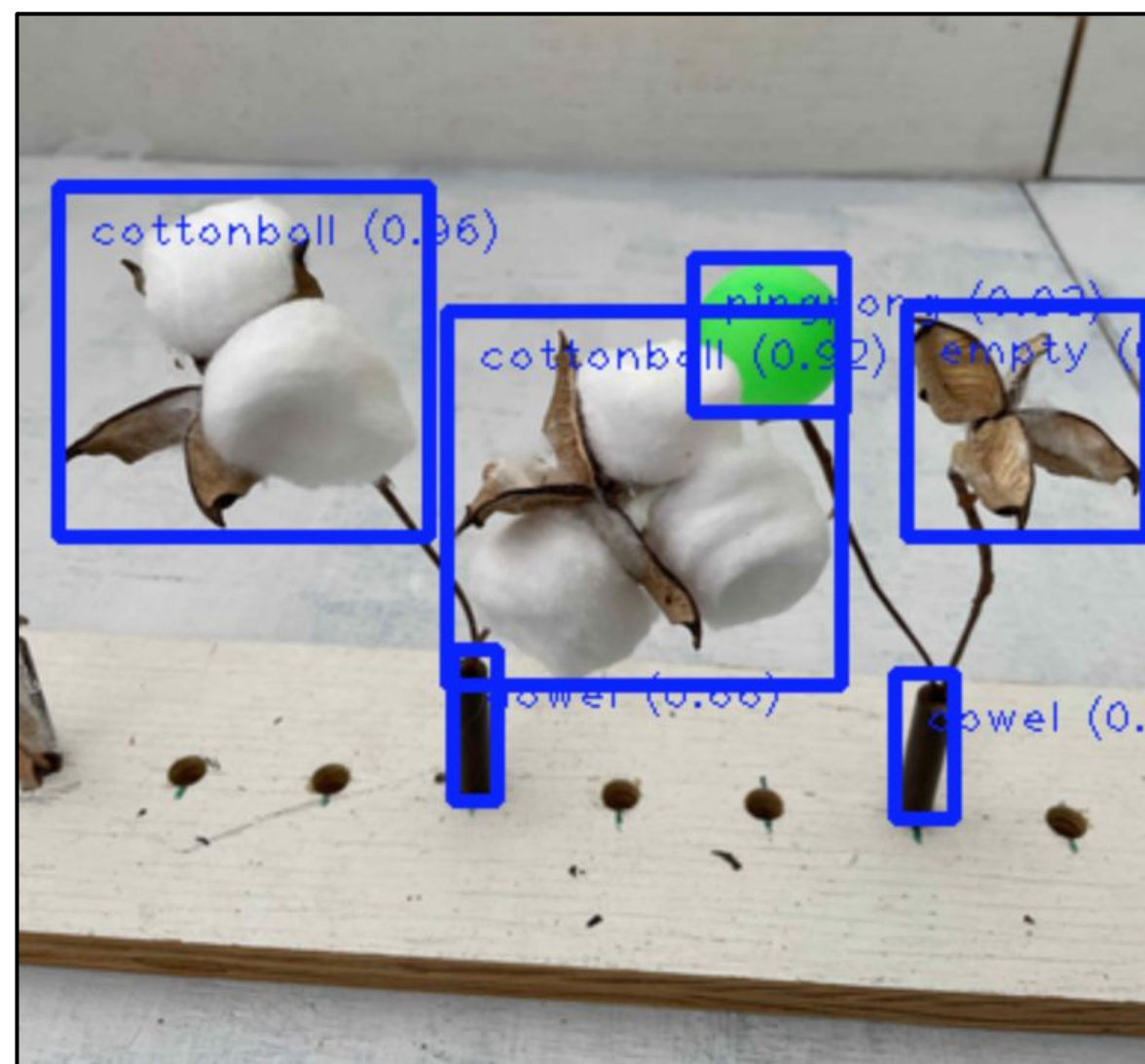
Anthony Nicolaides (Captain), Kathy Le (Captain), Janeth Manyalla, Rachel Bocian, and Nick Moffitt;
advised by Dr. Sunghwan Jung
Biological and Environmental Engineering, Cornell University, Ithaca, NY, USA

ABSTRACT Our 1 ft³ robot is designed to autonomously navigate a simulated cotton field. As the robot moves and stops intermittently alongside the rows of cotton plants, the camera on the side is used for object identification using a machine learning algorithm. The image data is then analyzed for the specific coordinates of the midpoint of the cotton plant(s), and this information is used to pick the cotton and place it within the lined container.



OVERVIEW OF ROBOT

- Arduino controls motors and receive information from sensors
- Raspberry Pi runs a machine learning algorithm and controls an arm
- Communication between Arduino and Raspberry Pi
- Machine learning model (used *TensorFlow*) for distinguishing cotton classes (cotton boll, empty husk, ping pong ball, and dowel)
- 2 LIDAR sensors (front and left)
- Image coordinate conversion to real-life dimensions



ARM DESIGN

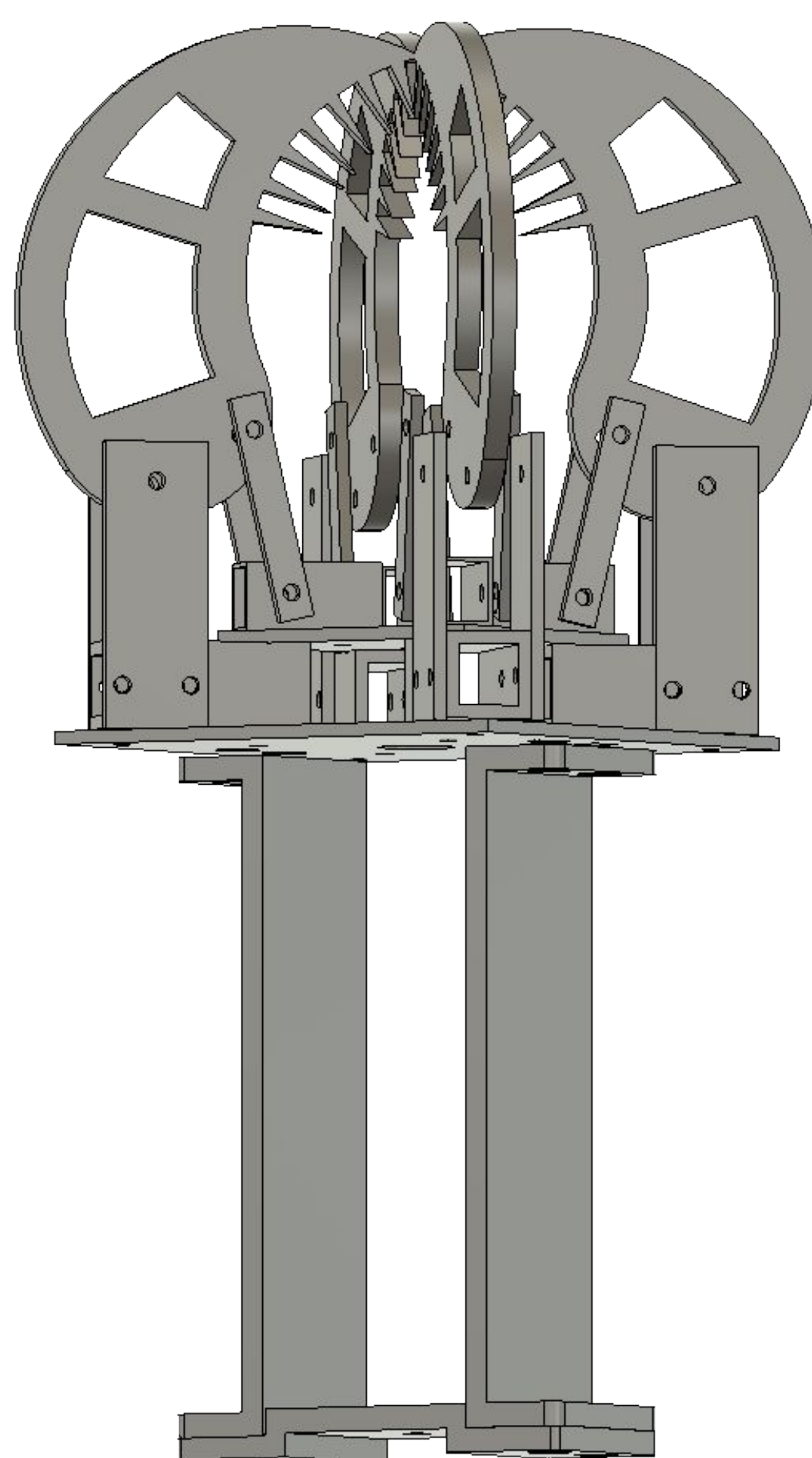


Our arm is designed to move with 5 degrees of freedom. Servo motors on the arm allow the claw to reach a designated point in space using an inverse kinematic map; the “origin” of the system is where the arm base connects to the robot.

PARTS AND BUDGET

Computational Parts	N0.	Unit price
Arduino Mega 2560	1	\$34.44
Raspberry Pi 4B 2GB	1	\$116.90
Other Parts		
Arducam 5MP Camera for Raspberry Pi	1	\$9.99
12V 2 Channel Relay Module	1	\$3.98
HiLetgo Adafruit Motor Shield	1	\$6.99
NIMH 12V Battery	1	\$52.93
VGE 5V Battery	1	\$25.95
TF Luna LiDar Sensor	2	\$27.99
Electric Micro Linear Actuator 12V - 1.2” Stroke	1	\$32.99
Stepper Motors (17HS13-0404S)	4	\$12.50
Disservo Digital Servo Motors (20 kg or 30 kg)	4	\$15.99

COTTON-PICKING MECHANISM



Claw Design

The claws with their needle-like teeth are designed to delicately pick cotton without damaging the husk. It smoothly releases cotton in a bucket following transport.

Claw Motion

The claw mechanism is generated by a micro linear actuator, which is regulated by a relay module in conjunction with Arduino. Hence, the linear motion will make the claws open or close.