

Introduction

Development of a Robotic Arm to Organize Books in a Library

ANALYSIS

Why?

- Worked in a library
- Better uses of time
- Love electronics and reading

How?

- Arm
- Mimics human arm
- Servo motors
- 4 Degrees of Freedom (DOF)

Electronics

- Arduino UNO
- Raspberry Pi 0 2W
- I2C Motor Driver
- 5V Power Supply

Program

- On Raspberry Pi
- Tesseract Optical Character Recognition (OCR) (Ghosh et al., 2022)
- Compares each book to the previous

- Useful with modifications
- Robotics effective solution for libraries
- Tesseract OCR works well
- Wiring & inverse kinematics excellent

FUTURE

- Linear rail
- Dewey Decimal compatibility
- Search within authors
- Re-shelve books

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Organizing library books takes a lot of time that could be used for other tasks.

I will create a device that can identify out-of-place books and remove them from the shelf.

USES

- Libraries
- Small warehouses

Methods

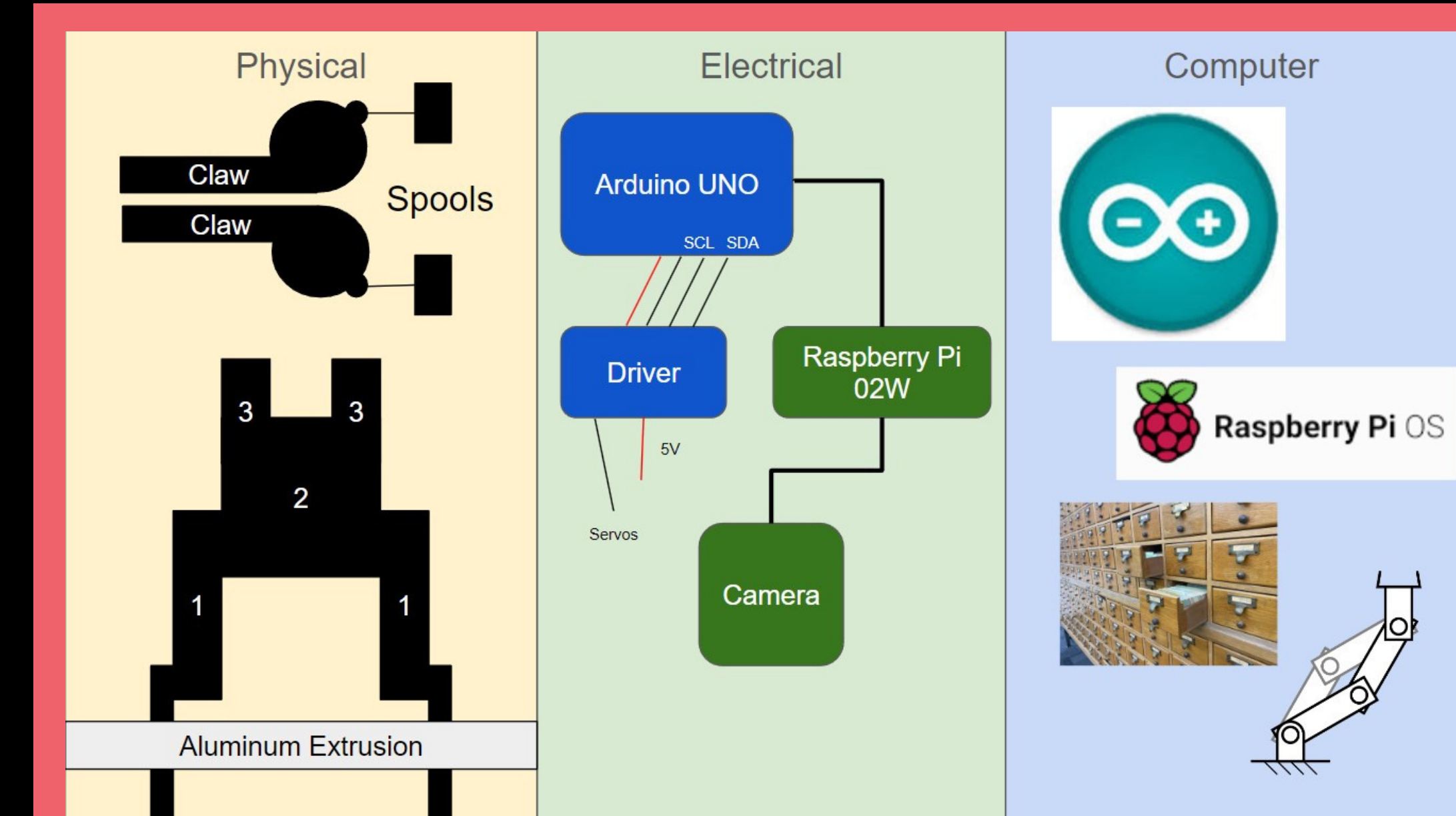
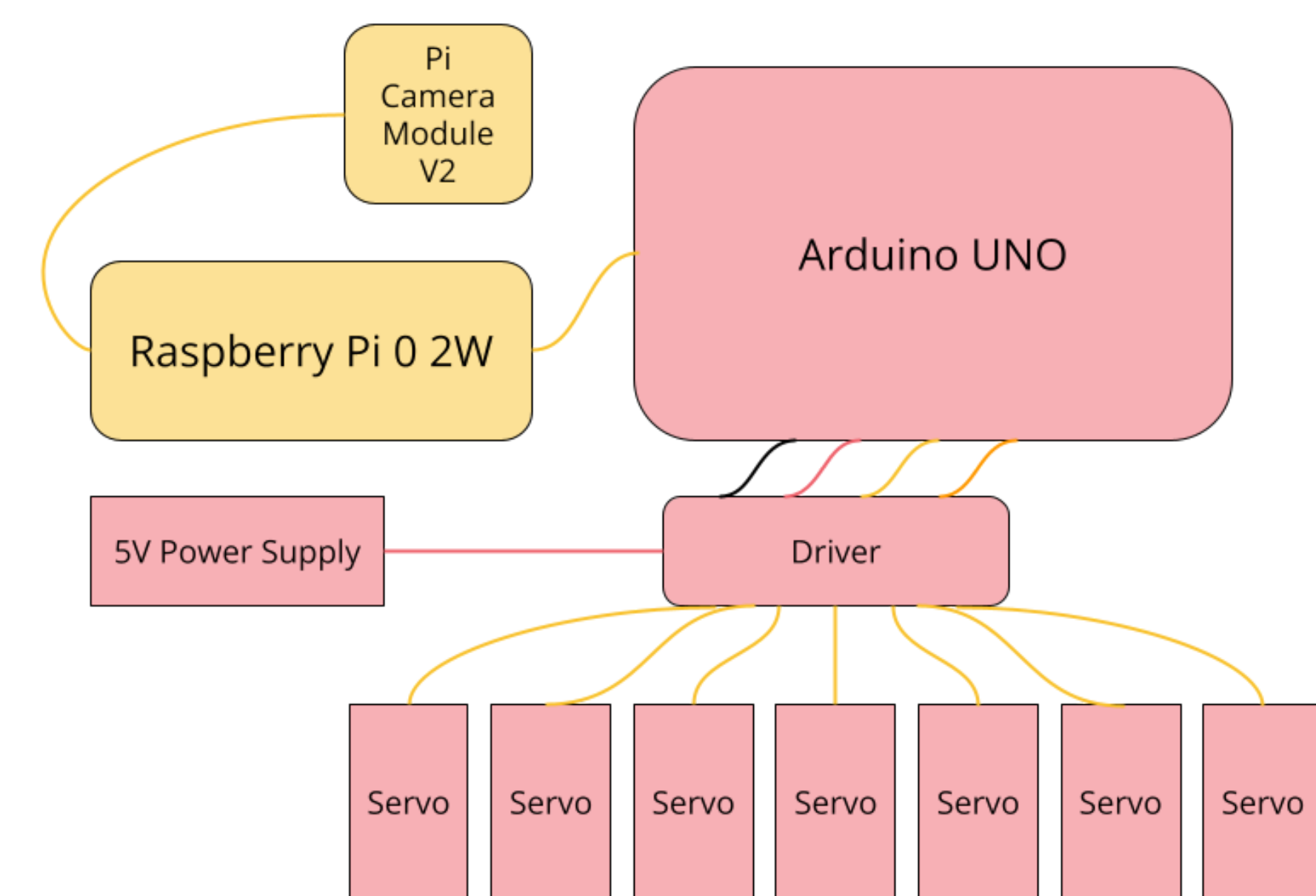


Figure 1. A general map of what each part of this device is doing.

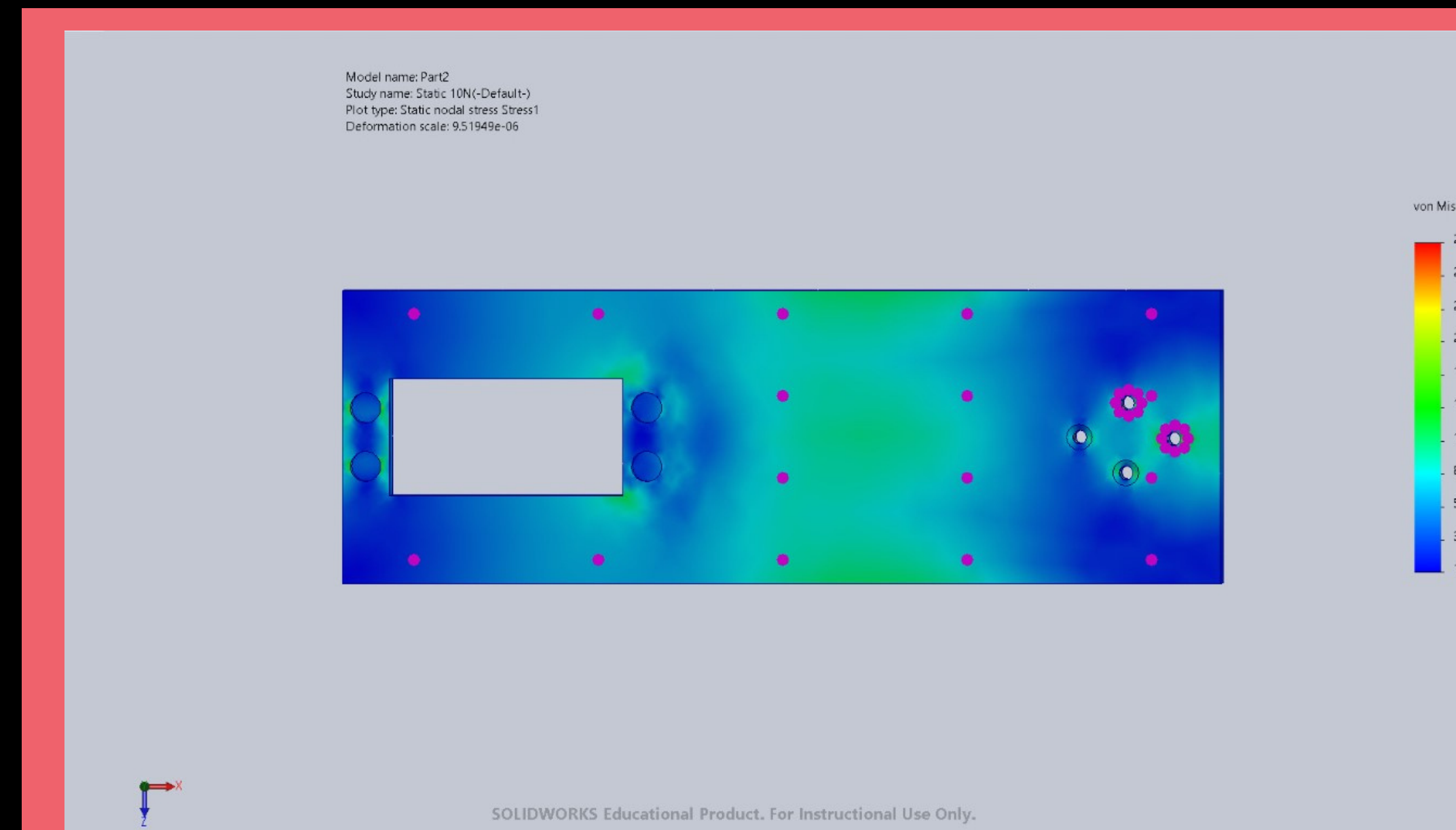


Figure 2. The stress analysis of a part, conducted in SolidWorks. The result is given in Von Mises. Because the Von Mises results were low, the part is unlikely to yield to 100N of force.

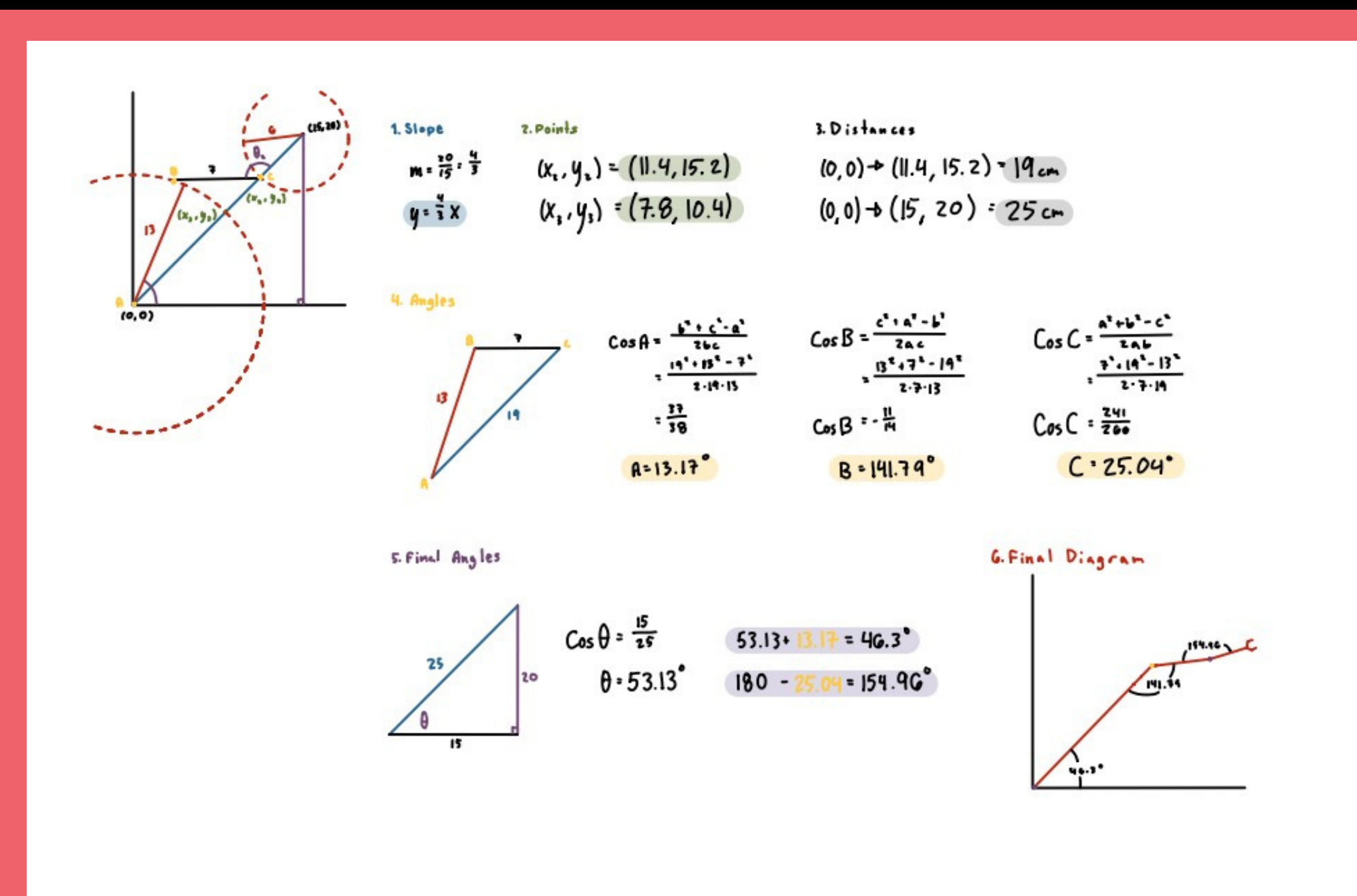


Figure 3. Inverse kinematics for picking up a book.

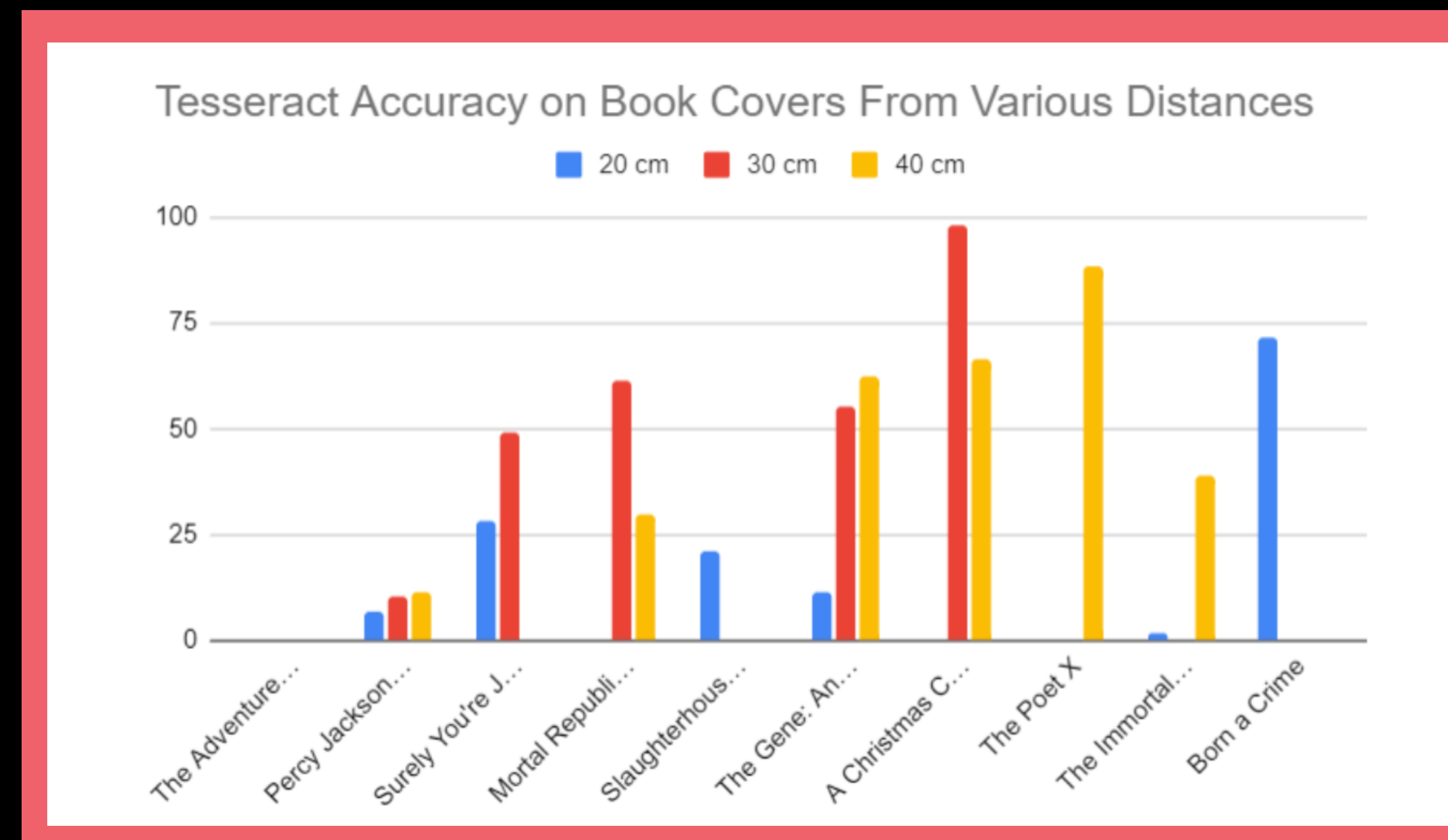


Figure 4. Tesseract run on the same book covers from 20, 30, and 40 cm.

	Robotic Arm	Shelf Scanner	Hand Scanner
Ease of Set-Up	Weight: 0.14		
	Score 6	Score 8	Score 8
Ease of Use	Weight: 0.17		
	Score 7	Score 4	Score 5
Accuracy	Weight: 0.17		
	Score 8	Score 9	Score 9
User Input (Min)	Weight: 0.10		
	Score 9	Score 4	Score 0
Price	Weight: 0.17		
	Score 7	Score 7	Score 7
Safety	Weight: 0.25		
	Score 8	Score 8	Score 10
Total	45	40	39
Weighted Total	7.48	6.92	7.19

Figure 6. A decision matrix showing the merits of different approaches.

Figure 5. The wiring model that controls the robot.

The Arduino UNO is connected to the driver through the GND, 5V, SCL, and SDA pins to transmit data and power the chip on the board. The driver is powered by an adjustable power supply set to 5V. The Arduino and Raspberry Pi communicate via a serial connection and the raspberry pi is connected to the camera through a ribbon cable.

WORKS CITED

Please see main page. Works cited included here and on reverse side in real trifold.