Terminator

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Background

- Background of the project -

Engineering design is a process of using different mathematical and engineering tools and different ways of thinking to create a plan which has multiple steps to solve a real world problem. In this our senior design project we have decided to tackle children's productivity. Our group looked at a series of models and broke our design process into multiple steps to see what fit our final goal. This design solution is the culmination of those different processes from the problem statement and specifying different design models and their constraints to our final model.

Dissatisfied conditions/situations

- For safety the laser was replaced with a handler which holds the pen/pencil used to draw out the tic-tac-toe game
- The initial weight of the device's design was a bit too large as such the weight had to be cut down to 3.87 kg to ensure portability.
- The dimensions were reduced to 535mmx637mmx184mm also to ensure portability.

Customer's Point of View

The customers are children from the ages of 8-18 who are looking for a productive way to spend their time. The customer would want a design that is portable and very user-friendly.

Problem Formulation

- Problem statement:

  The need of today's generation is that children are always on their phone or don't have someone to play with, which led us to create a robot that plays tic-tac-toe, so that they can be productive and not be on their phones the whole day.

Design Requirements

Items	**Quantity**
AC Input Voltage	100 - 240V
Weight of the final product	The net weight is 3.87 kg and the gross weight is 4.475 kg.
Python Google Collab	No in-built libraries(brute force)
Arduino, Laserbot	1 arduino and 1 laserbot will be used
Motors	2 Motors will be used
Online documentation of Tic-Tac-Toe Strategy	Varies documents that were used
Physical Dimensions and Maximum Working Speed	535mmx637mmx184mm are the dimensions and the speed would be 200mm/s.

Constraint of Standards and Regulations to comply

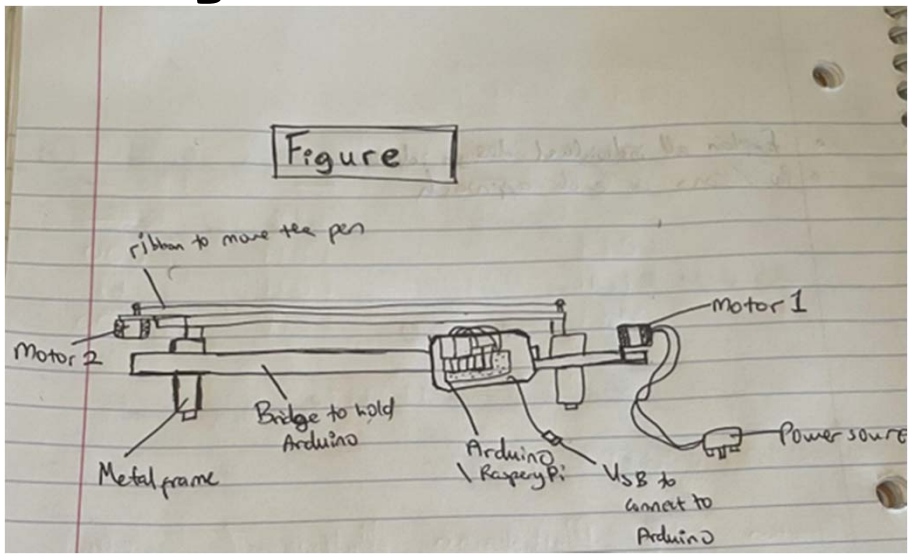
Compliance (Rules, Regulations, and Standards)	For python, we are in compliance with the IEEE python coding style. FDA will allow the range from 180 to 1 x 106 nanometers for it to be used.

Constraints of Society, Culture, and Environment

Environmental Constraints	Dimensions of the laserbot: Invisible Laser Radiation, the Max Power would be 1600 mW and the Wavelength will be 445nm.
Socio-Cultural Constraints	Replace the equipment producing the laser with a pencil to draw the tic-tac-toe board, which can be used to correct the mistakes.

Our Individual Designs

Design 1



COMPONENTS OF THE DEVICE IN THE FIGURE:

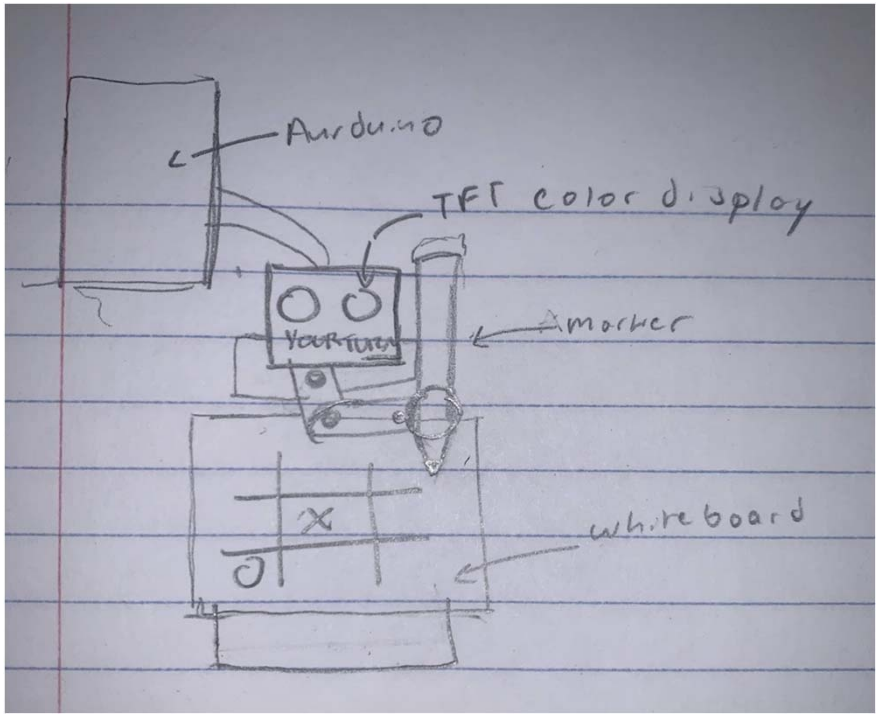
- Motors
- Mega Pi
- USB
- Power Source
- Metallic Bridges
- Ribbons
- Metal Frames, etc.

Design 2

COMPONENTS OF THE DEVICE IN THE FIGURE ABOVE:

- servo motors (for the robotic arm, basically 6)
- reed sensors (64)
- Propeller microcontroller
- chess board
- 5-10k ohm resistors
- 6-100 ohm resistors
- 7-1k ohm resistors
- 8-2.2k ohm resistors
- 9-0.1uf capacitors
- 10-3.3v voltage regulator

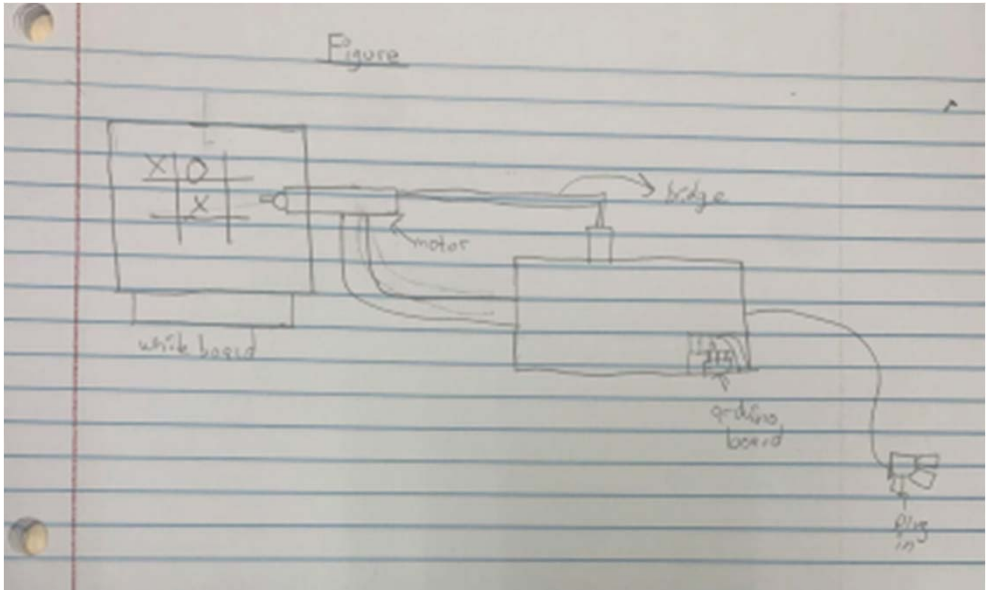
Design 3



COMPONENTS OF THE DEVICE

- Arduino Uno microcontroller
- Three cheap 9 grams servo motors
- 1.8 inch TFT color display
- Infrared receiver
- Button
- Buzzer
- Screws
- Whiteboard
- External power source

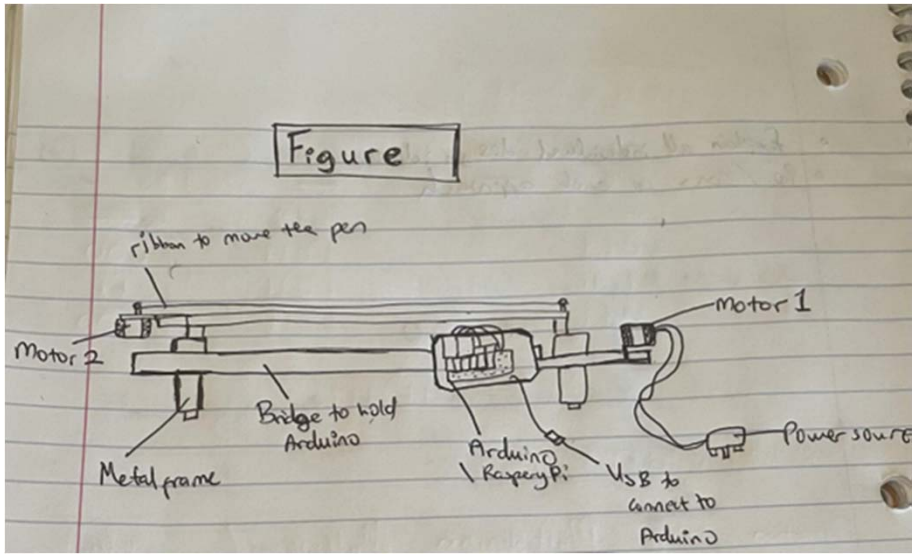
Design 4

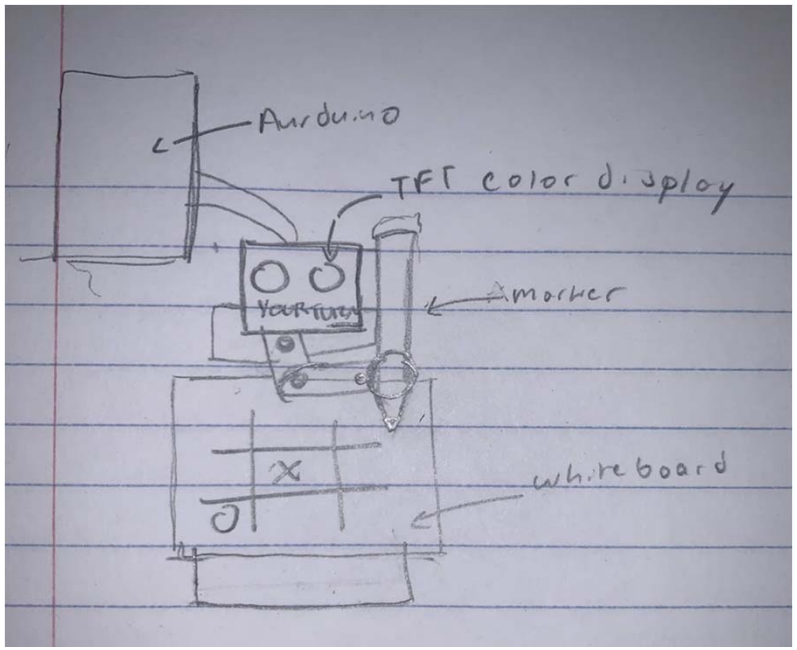


Components that are used:

- Whiteboard w/ tic-tac-toe game
- Motors
- Bridge
- Arduino Board
- Plug-in/Power Source
- Pen

2 solution designs selected





Pros & Cons of the 2 designs

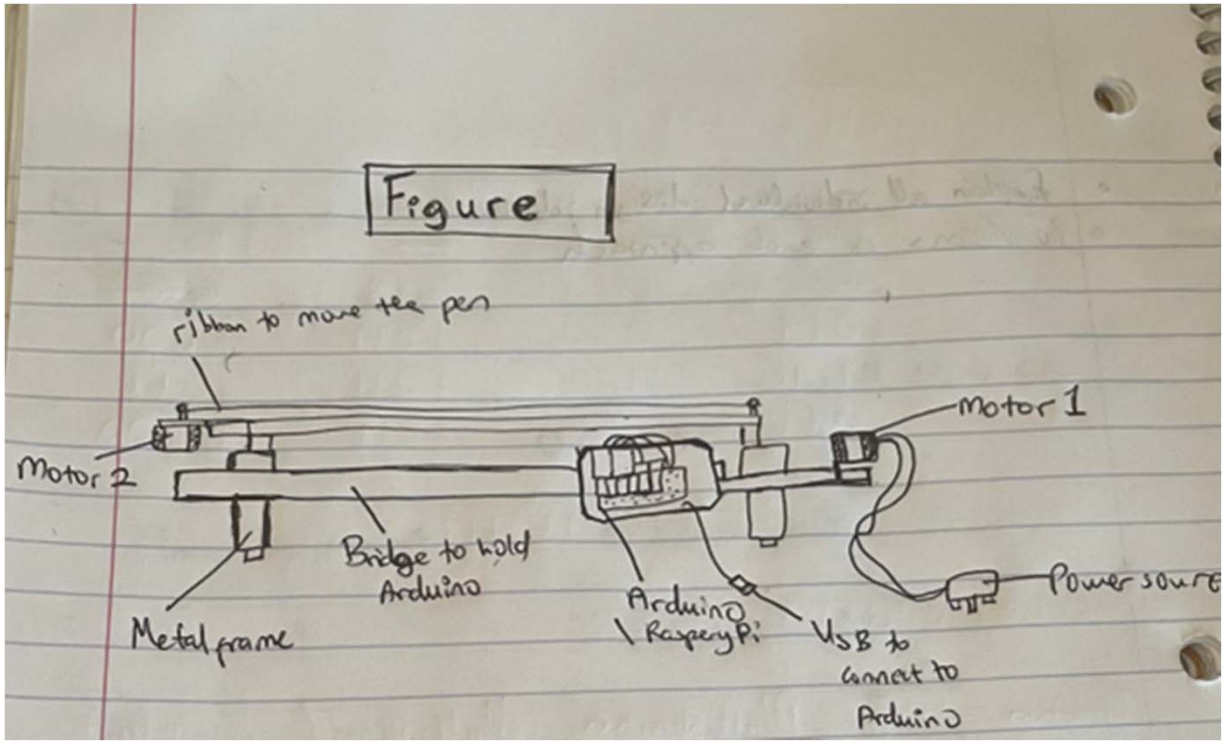
Design 1

Uses a pen instead of a laser	Only moves the motors on the x and y planes and not the z plane
Easy to integrate since we are using Mega pi which runs both Raspberry Pi and Arduino	Not the most portable device as it weighs 3.87kg
Uses the required AC input voltage which is between 100 - 240 V	
The voltage being used to operate the device makes it environmentally friendly	

Design 3

Because of the size it's mobile	The robot marks the move first
	Not very challenging

Schematics of the Top Solution Design



Top Solution Design

Schematics of the Top Solution Design:

- The device consists of two motors to move the pen on the x plane and the y plane.
- It has a ribbon on which the pen holder moves on.
- It has a power source to ensure the device moves.
- It consists of a Mega Pi board which is compatible with both Arduino and Raspberry Pi making it easier for people to operate it.
- It has four bridges made out of steel which hold the movable components and Mega Pi board. It has 4 metallic frames which keeps the device standing
- It also contains a usb port to connect the Mega Pi board to a pc to run the adequate code for the device

Detailed Description of the Design

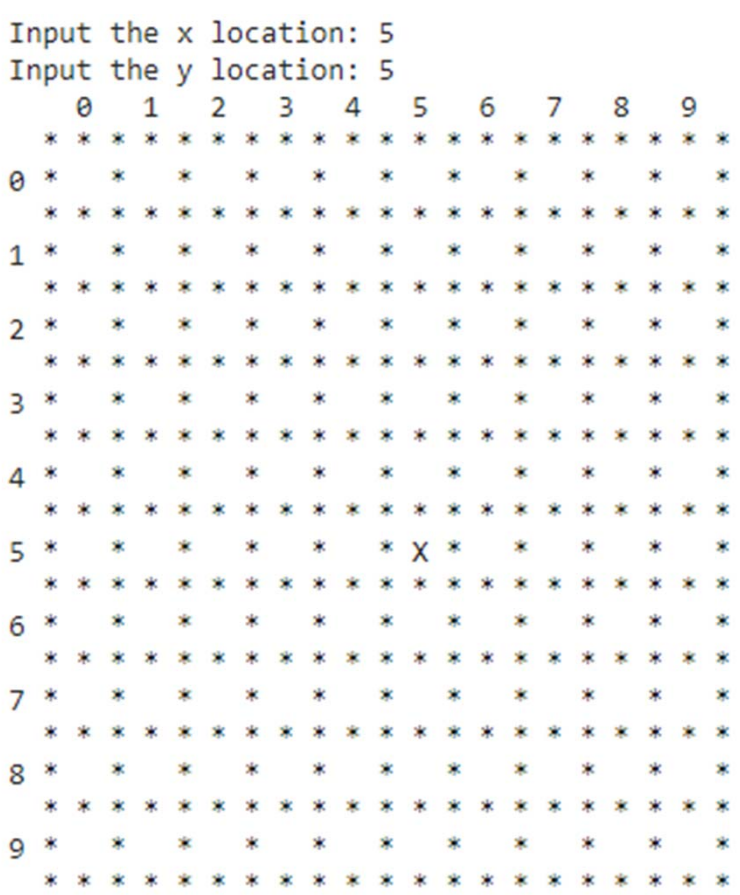
- Hardware and Software block diagram:
- The software is written in python using brute force
- The hardware is a laserbot structure which has the laser replaced by a hand-held device to hold a pencil to draw the data from software
- The hardware and software are connected using MegaPi

Operation of the solution

How the final product would work:

- The player makes a move stating the exact position they wish to play on the 10X10 tic-tac-toe board.
- The CPU then plays a countering move
- This operation repeats itself and the board is constantly updated
- All the moves and the board are then copied using the hardware onto the paper/whiteboard
- Once the winning condition is met the game is over and it declares if player 1 wins, loses or ties.

Software:



Future Works

Through the end of this semester:

- We intend to implement this design and create a device that can play tic tac toe with other people.
- We intend to make a version which plays against CPU in case the user has no one to play with.
- Ensure that all the win conditions, losing conditions and draw conditions work to full accuracy.
- Ensure that the MegaPi takes the input of the software precisely.

Future Works

Next semester:

- Ensure that both motors run correctly
- Ensure that the diagonal z axis is drawn properly using the pen/pencil handler.
- Ensure that the hardware draws precisely what is shown from the software

Conclusions

In conclusion, considering the pros and cons and the decision matrix of our designs, we were able to pick the best design to go with as well as which components from other designs we wanted to integrate into our solution design. We discovered that Omar's Design best addressed the issue of kids not having anybody to play with, and considering that technology is one of our primary concerns these days, Design 1 would best enhance kids productivity. Design 1 has components that are most compatible with the software we intend to use and has excellent functionality. We intend to implement this design and create a device that can play tic tac toe with other people.