

# HIBA ASSAMAOUAT

## PROJECT PORTFOLIO

### ENGINEERING PROJECTS

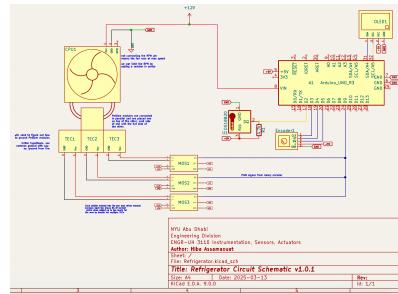
#### MULTI-STAGE PELTIER MODULE (TEC) BASED COMPRESSOR-LESS REFRIGERATOR

**Date:** Spring 2025

**Description:** This project focused on designing a refrigerator using Peltier modules instead of traditional compressors. Challenges tackled included managing thermal gradients and optimizing heat dissipation.

##### Specifications:

- Multi-stage Peltier cooling using TEC1-12706 modules
- Custom heat sink and fan system for efficient heat management
- Software/Hardware Used: Arduino (temperature control), PID Control, KiCad



#### END-TO-END WIRELESS COMMUNICATION SYSTEM (CAPSTONE PROJECT)

**Date:** Fall 2024 - Spring 2025

**Description:** This project focused on building a complete digital wireless communication system from transmitter to receiver. Challenges tackled included synchronization under noisy channels and minimizing bit error rate for different distances and obstacles.



##### Specifications:

- Schmidl & Cox synchronization and Hamming(7,4) channel coding
- Real-time BER analysis over varying distances and obstacles
- Software/Hardware Used: MATLAB, USRP (Software Defined Radio)

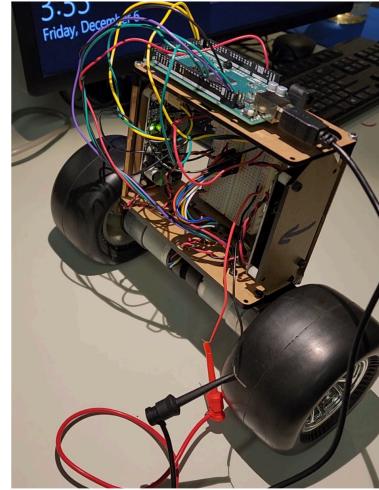
## SELF-BALANCING ROBOT CONTROL SYSTEM

**Date:** Fall 2024

**Description:** Designed and implemented a self-balancing robot that stabilizes itself on two wheels using PID control. Challenges tackled included minimizing oscillations and tuning the control parameters for different terrains.

### Specifications:

- Real-time tilt angle measurement using IMU sensors
- PID control for self-balancing
- Tools/Technologies Used: Arduino Mega, Simulink, MATLAB, MPU6050 Module, PID Tuning



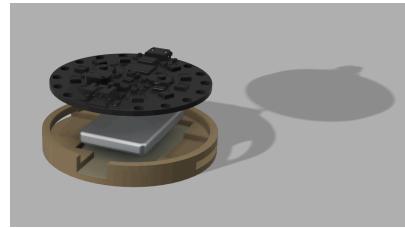
## PARKINSON'S DISEASE TREMOR DETECTION

**Date:** Spring 2024

**Description:** Built a wearable system to detect Parkinsonian tremors by analyzing accelerometer data. Challenges included designing effective bandpass filtering and calibrating sensitivity to different tremor frequencies.

### Specifications:

- Real-time tremor intensity detection
- Signal filtering and FFT-based analysis
- Tools/Technologies Used: Adafruit Circuit Playground, Arduino IDE



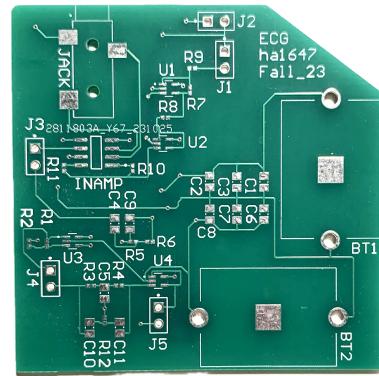
## ELECTROCARDIOGRAPHY (ECG) PRINTED CIRCUIT BOARD (PCB) DESIGN

**Date:** Fall 2023

**Description:** This project involved designing and fabricating a PCB capable of accurately capturing ECG signals. The focus was on minimizing signal noise using multiple physical filters including the notch filter.

### Specifications:

- Low-noise analog front-end for ECG signals
- Compact 2-layer PCB layout
- Tools/Technologies Used: Altium Designer, Breadboard



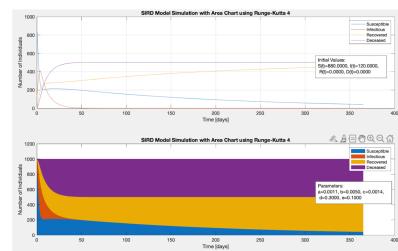
## SIRD Model using Runge-Kutta 4

**Date:** Fall 2023

**Description:** This project focused on modeling the spread of an infectious disease using a SIRD framework. Challenges tackled included ensuring numerical stability, accurately representing dynamic transmission rates, and verifying hypotheses on trends based on initial conditions.

### Specifications:

- Numerical simulation of infectious disease spread
- Fourth-order Runge-Kutta (RK4) method for solving ODEs
- Software/Hardware Used: MATLAB



## Recommendation System using the Lagrangian Method

**Date:** Fall 2023

**Description:** This project focused on developing a recommendation system that uses optimization principles to balance user preferences and system constraints. Challenges tackled included formulating the cost function and handling sparsity in user-item matrices.

### Specifications:

- Optimization-based recommendation formulation
- Lagrangian relaxation for constraints handling
- Software/Hardware Used: MATLAB

	1	2	3	4
A	Thumbs Up	?	?	Thumbs Down
B	?	?	Thumbs Up	?
C	Thumbs Down	?	Thumbs Up	?

## DESIGN PROJECTS

### SPECULATIVE DESIGN PROJECT

**Date:** Spring 2022

**Description:** This project focused on imagining speculative future technologies and their societal impacts. Challenges tackled included balancing realism and creativity in storytelling and visual design.

### Specifications:

- Critical design fiction exploring future scenarios
- Mixed-media visual storytelling
- Software/Hardware Used: Procreate, Adobe Dimension

