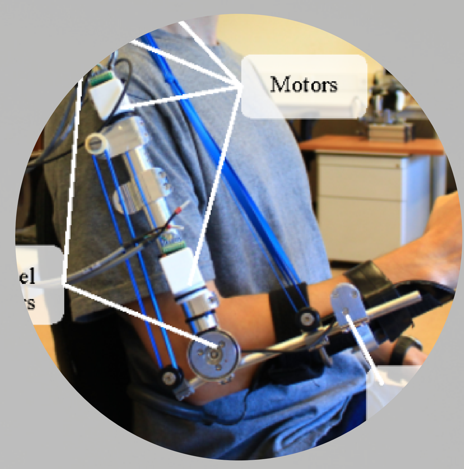
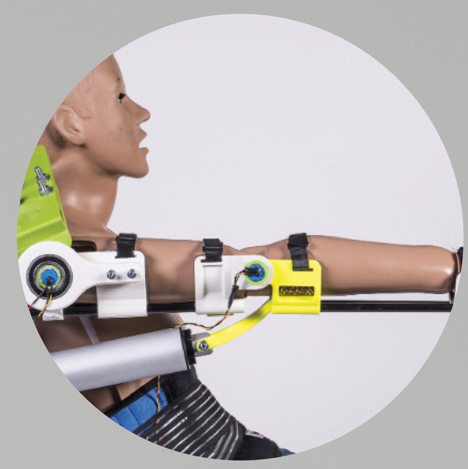
Development of Dynamic Arm Supportfor Children with Duchenne Muscular Dystrophy

BUĞRA SARIGÖZ
Supervisor
Atila YILMAZ
Hacettepe University Electrical and Electronics Engineering

Introduction

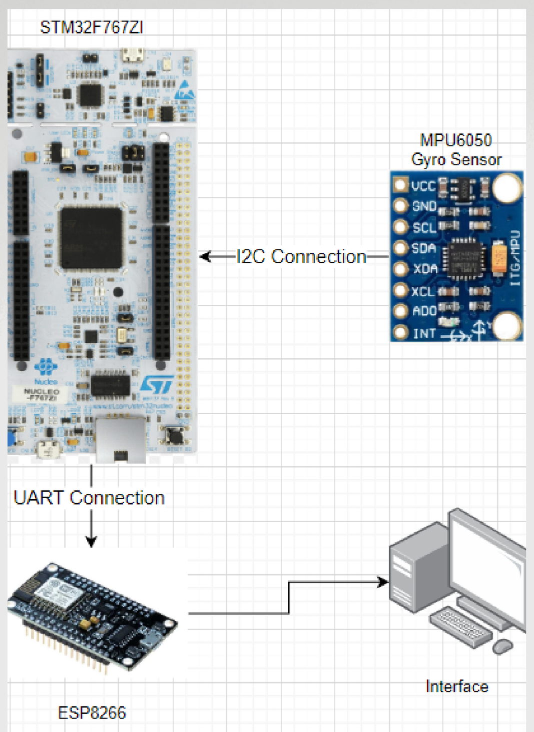
This project consists of an external support system for children with DMD to support their arms. There are many parts of this project. I mainly worked on the part of the project where we classify arm movements. There will be 3 different arm movements. First of them is that in a seated position, place one hand on the thigh and then bring it to the mouth. Second is while seated, place one hand on the thigh and then bring it over the head. Third is while seated, with hands resting by the sides, raise one arm to the side.

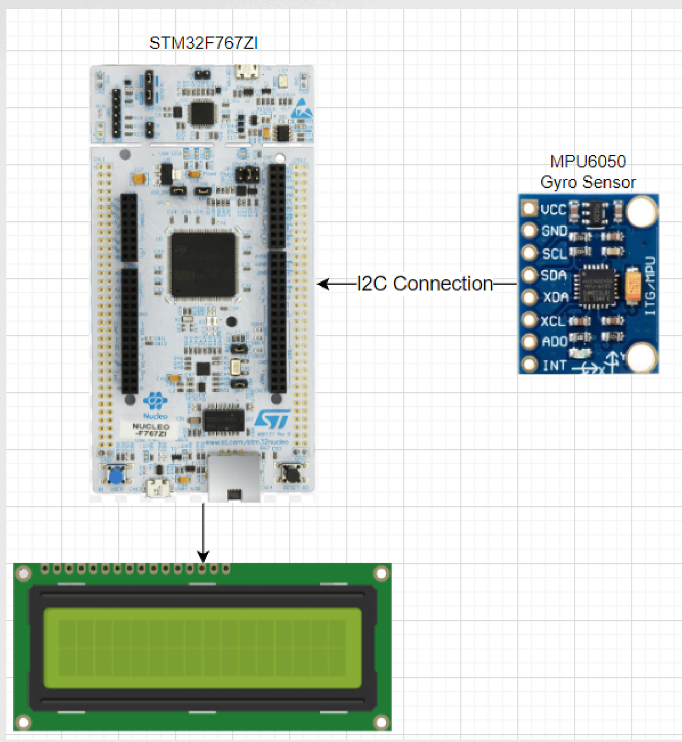




EMBEDDED SOFTWARE

In this phase of the project, I have successfully obtained pitch and roll values from the MPU6050 gyro sensor using STMF767ZI. I intend to utilize these data in subsequent stages of the project.
After getting the pitch and roll values from the MPU6050 gyro sensor using STMF767ZI, I send these numbers to the ESP WiFi sensor using a UART connection. The ESP helps to make communication work on the interface side too. This setup allows me to smoothly share information and interact through the interface, making the project more user-friendly and functional.



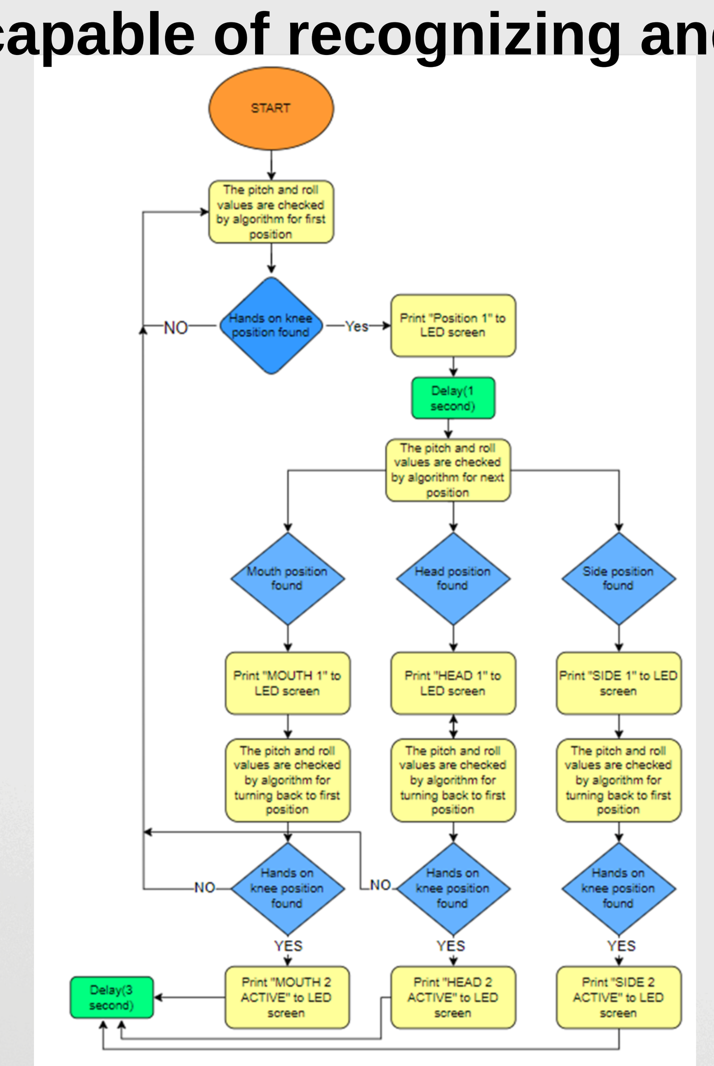


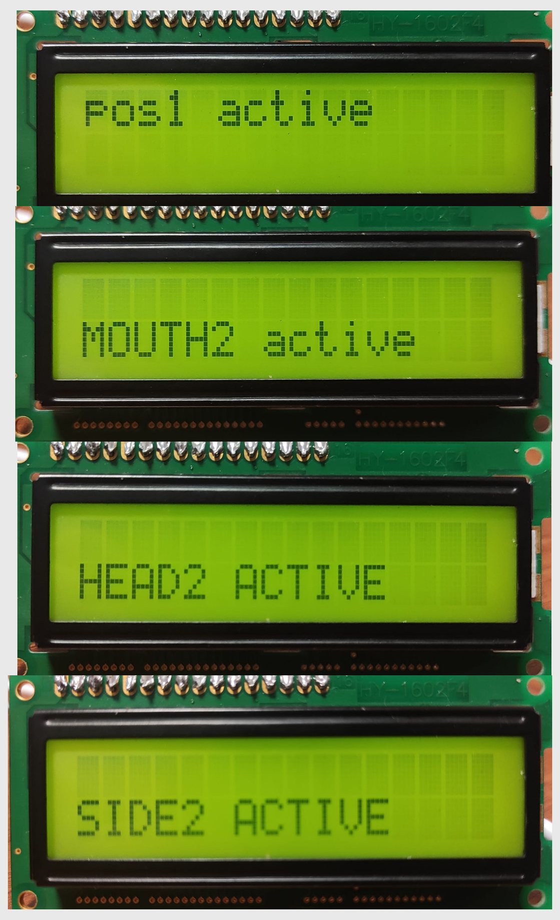
KNN ALGORITHM

KNN (K-Nearest Neighbors) is a machine learning tool for classification. It assigns categories to objects based on their similarity to nearby objects in a feature space. In our project, we use KNN to categorize arm movements like eating, hand-to-head, and arm extension. By comparing new movements to known ones, the algorithm accurately detects these actions.
Although the K-Nearest Neighbors (KNN) algorithm could be better in some ways than my own algorithm, we faced a problem during the training part of KNN. Our data collection speed wasn't fast enough, so the KNN training didn't work as well as we needed it to. This made KNN not as useful for our project. In future of project this duty can be improved with KNN algorithm

MY ALGORITHM

In my algorithm, I directly interfaced the result with an STM32 device, eliminating the need for high-speed data transmission over Wi-Fi. I connected a gyro sensor to my arm, allowing me to monitor changes in pitch and roll angles while performing specific movements. By tracking these angle variations and devising an algorithm to interpret them, I was able to determine the path I had followed and identify the completed movements. This innovative approach enabled me to create an algorithm capable of recognizing and categorizing my physical movements accurately.





Acknowledgements

- **This project was completed within the context of ELE401-402 Graduation Project courses in Hacettepe University, Faculty of Engineering, Department of Electrical and Electronics Engineering.**
- **I thank to Dr. Atila YILMAZ as supervisor for invaluable contributions to my project.**