DAYANANDA SAGAR UNIVERSITY

Devarakaggalahalli, Harohalli Kanakapura Road, Dt, Ramanagara, Karnataka 562112

SCHOOL OF ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
(Artificial Intelligence and Machine Learning)

SPECIAL TOPIC REPORT ON

" PARTH - Paralysis therapy and monitoring device"

By

Akhila Rao D (ENG22AM0002)
Chandan V Reddy (ENG22AM0008)
Gaana Shree S (ENG22AM0014)

Under the supervision of

Prof. Pradeep Kumar K

Assistant Professor, Artificial Intelligence & Machine Learning, SOE

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CERTIFICATE

This is to certify that the Special topic-1 (22AM2406) titled “PARTH - Paralysis therapy and monitoring device” is carried out by **Akhila Rao D (ENG22AM0002), Chandan V Reddy (ENG22AM0008) and Gaana Shree S (ENG22AM0014),** bonafide students of Bachelor of Te)chnology in Computer Science and Engineering (Artificial Intelligence and Machine Learning) at the School of Engineering, Dayananda Sagar University,

Prof. Pradeep Kumar K
Assistant Professor.
Dept. of CSE(AI&ML),
School of Engineering
Dayananda Sagar University

Dr Jayavrinda Vrindavanam PHD. (NIT)
Head of Department
CSE (AI-ML)
School of Engineering
Dayananda Sagar University

DECLARATION

We, **Akhila Rao D** (**ENG22AM0002**), **Chandan V Reddy** (**ENG22AM0008**) and **Gaana Shree S** (**ENG22AM0014**) are students of the fourth semester B.Tech in Computer Science and Engineering(AI&ML), at School of Engineering, Dayananda Sagar University, hereby declare that the Special Topic-1 titled "**PARTH - Paralysis therapy and monitoring device**" has been carried out by us and submitted in partial fulfillment for the award of degree in Bachelor of Technology in Computer Science and Engineering(AI&ML) during the academic year 2023 2024.

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Abstract:-

The Internet of Things based robotic model proposed in this project addresses the healthcare needs of paralyzed patients by enabling them to perform vital tasks independently. Designed to operate without continuous supervision, the device assists patients in executing essential exercises such as limb movements, standing up, and sitting at regular intervals. Through a seamless integration of software and hardware components, the system receives instructions and orchestrates precise movements accordingly. By leveraging IoT technologies, the device ensures real-time monitoring and adjustment, catering to the unique requirements of each patient. This innovative approach not only enhances the efficiency of rehabilitation exercises but also fosters greater patient autonomy and self-reliance. Moreover, the device offers scalability and adaptability, accommodating diverse patient needs and evolving healthcare protocols. With its potential to alleviate the burden on caregivers and healthcare professionals, this IoT-enabled robotic assistance system represents a promising advancement in healthcare technology. By empowering paralyzed patients to engage in rehabilitative activities with greater independence, the device contributes to improving their overall well-being and quality of life.

1. INTRODUCTION:

This project is committed to enhancing the rehabilitation process for individuals with paralysis. Despite the availability of various manually operated devices intended for therapy and muscle movement stimulation, a notable deficiency exists in their inability to monitor voluntary movements initiated by patients. To bridge this gap, our device integrates motion sensors capable of detecting and relaying these movements to the attending medical assistant. This real-time recording of movements empowers healthcare providers to discern patterns, make informed decisions, and tailor therapy or medication adjustments to suit each patient's needs effectively. Furthermore, the device is equipped with a compact battery backup system, ensuring uninterrupted operation for a duration of up to six hours, thereby enhancing its reliability and utility in clinical settings.

2. PROBLEM STATEMENT:

Existing therapy devices for paralysis rehabilitation lack the ability to monitor voluntary patient movements. By integrating motion sensors that detect and relay these movements in real-time to medical staff, we aim to improve personalized care and ensure continuous operation with a six-hour battery backup.

3. OBJECTIVES:

- Personalized Rehabilitation Planning: By accurately tracking voluntary movements, healthcare providers can tailor rehabilitation plans to suit each patient's progress and needs. This personalized approach can optimize therapy effectiveness and accelerate recovery.

- Progress Monitoring: The device enables continuous monitoring of a patient's movement capabilities over time. This data can help healthcare providers assess progress, identify areas of improvement, and adjust treatment strategies accordingly.

- Research and Development: The aggregated data collected by the device can contribute to ongoing research efforts in paralysis rehabilitation.

- Patient Empowerment: By actively involving patients in their own rehabilitation process through real-time feedback on their movements, the device promotes a sense of empowerment and engagement in their recovery journey.

4. LITERATURE REVEIW:

1. **IoT- Based Solution for Paraplegic Sufferer to Send Signals to PhysiREcian via Internet** *Authors: L. Srinivasan , D. Selvaraj , D. Dhinakaran , T. P. Anish.*

This innovative IoT-based solution revolutionizes paraplegic therapy by employing a Microcontroller and GSM modem to facilitate seamless communication between the patient and their caregivers. Through this system, the device can send messages to the designated medical assistants or caregivers, providing updates on the patient's condition or requesting assistance as needed. Moreover, the system incorporates a responsive alarm mechanism triggered by messages received from medical assistants. In the event of an emergency, such as a sudden health crisis, the alarm will sound, alerting nearby individuals to the situation. This rapid response capability ensures that appropriate action can be taken swiftly, potentially saving valuable time and aiding in critical situations.While the primary focus of this system lies in enhancing communication and emergency response, it does not directly contribute to therapy or rehabilitation efforts. Nonetheless, by providing a reliable means of communication and emergency alerting, it complements existing therapy programs, fostering a safer and more supportive environment for patients undergoing paraplegic therapy.

2. **IOT Based Wireless Monitoring Stroke Patient with Partial Paralysis Assistance** *Authors:Pradeep Kumar S, Chandana Gireesh, Riti Dass, Sneha Sinha, Sumit Kumar, Subhra Chakraborty.*

This advanced device is designed to monitor the health parameters of patients with precision and efficiency. Equipped with a microcontroller, it possesses the capability to detect any deviations from normal health values, including temperature fluctuations and irregular heart rates. These crucial health metrics are promptly relayed to the designated medical assistant via a GSM module, ensuring immediate attention and appropriate action. In addition to transmitting alert messages, the device provides detailed information regarding the detected abnormalities, empowering medical assistants to make informed decisions swiftly. By offering real-time insights into the patient's health status, this device enhances the efficiency of healthcare monitoring and facilitates proactive interventions when necessary.

5.PROJECT DESCRIPTION:

This project aims to enhance the rehabilitation process for individuals with paralysis by addressing the limitations of current therapy devices, which fail to monitor voluntary movements initiated by patients. Our solution integrates advanced motion sensors capable of detecting and relaying these movements in real-time to healthcare providers. This feature allows medical assistants to observe movement patterns, make informed decisions, and tailor therapy or medication adjustments to each patient's specific needs. Additionally, the device is designed with a compact battery backup system, ensuring reliable and uninterrupted operation for up to six hours. This innovation promises to significantly improve the efficacy and personalization of paralysis rehabilitation in clinical settings.

5.1 REQUIREMENTS:

Node MCU - NodeMCU is a low-cost open source IoT platform. It initially included firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which was based on the ESP-12 module. for controlling the device's operations and transfering data.

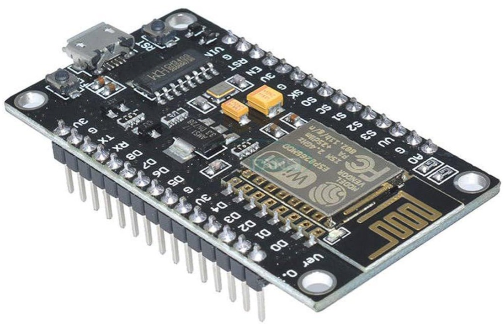

Figure 1: Node MCU

Sensors- Triaxial accelerometers provide simultaneous measurements in three orthogonal directions, for analysis of all of the vibrations being experienced by a structure. Each unit incorporates three separate sensing elements that are oriented at right angles with respect to each other. ADXL345 triaxial accelerometer sensor is used.

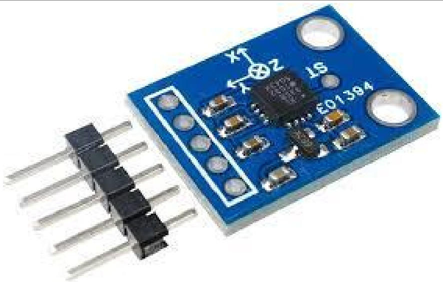

Figure 2: Triaxial accelerometer sensor

Actuators - A micro-servo motor is a rotary actuator that allows for precise control of angular position. It consists of a motor coupled to a sensor for position feedback. It also requires a servo drive to complete the system. The drive uses the feedback sensor to precisely control the rotary position of the motor. SG90 micro servo motor is used

Figure 3: Micro-servo motor

Power Supply - Rechargeable batteries

User Interface: Buttons, switches for input controls.

<u>Software components:</u>

An **mobile application** to receive information about movement.

5.2 CIRCUIT DIAGRAM:

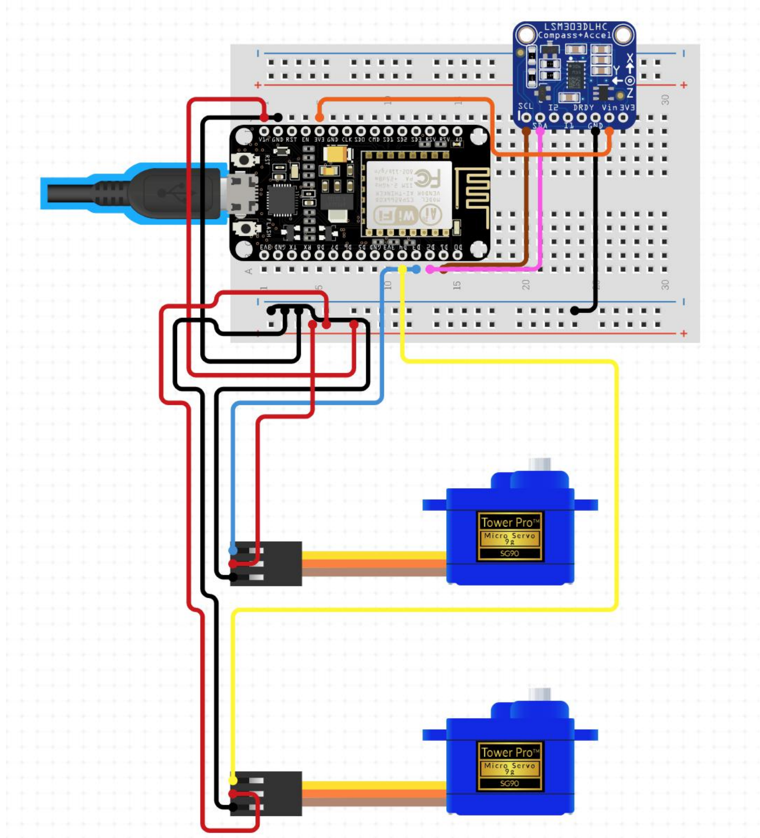

Figure 4: Circuit diagram for one finger.

6. METHODOLOGY:

When an individual receives a diagnosis of paralysis, consistent exercise becomes imperative to facilitate the recovery of the affected body parts. These exercises need to be performed daily to encourage the restoration of functionality. In cases where a caretaker is not financially feasible, our wearable device steps in to aid in the therapy process. Utilizing a Node MCU brain, the device is programmed with specific exercise regimens tailored to the patient's needs, which can be adjusted as required. Through stimulation based on the programmed regimen, the device assists in guiding and facilitating the prescribed exercises. This innovative approach not only empowers patients to engage in their own therapy but also offers a cost-effective solution for those without access to constant care. In the context of paralysis rehabilitation, our innovative solution employs motion sensors to detect any voluntary movements initiated by the patient. These sensors seamlessly integrate with the Node MCU device, equipped with Wi-Fi capabilities, enabling real-time transmission of movement data to the patient's medical assistant.

The device securely stores records of these movements in its memory, ensuring comprehensive documentation for future reference during regular check-ups.This wealth of data serves as a valuable resource for healthcare providers, allowing them to monitor the patient's progress, identify trends, and make informed decisions regarding the necessity for any adjustments to the therapy regimen. Should the patient require a different type of therapy, a customized program can be swiftly designed and implemented based on the recorded movements. This dynamic approach ensures that the patient receives tailored and evolving treatment, maximizing the likelihood of a successful recovery from paralysis. With each therapy session, the device continues to monitor and adapt, persisting until the patient achieves complete restoration of function. By leveraging technology to optimize rehabilitation efforts, we aim to enhance patient outcomes and foster a pathway towards full recovery and restored independence.

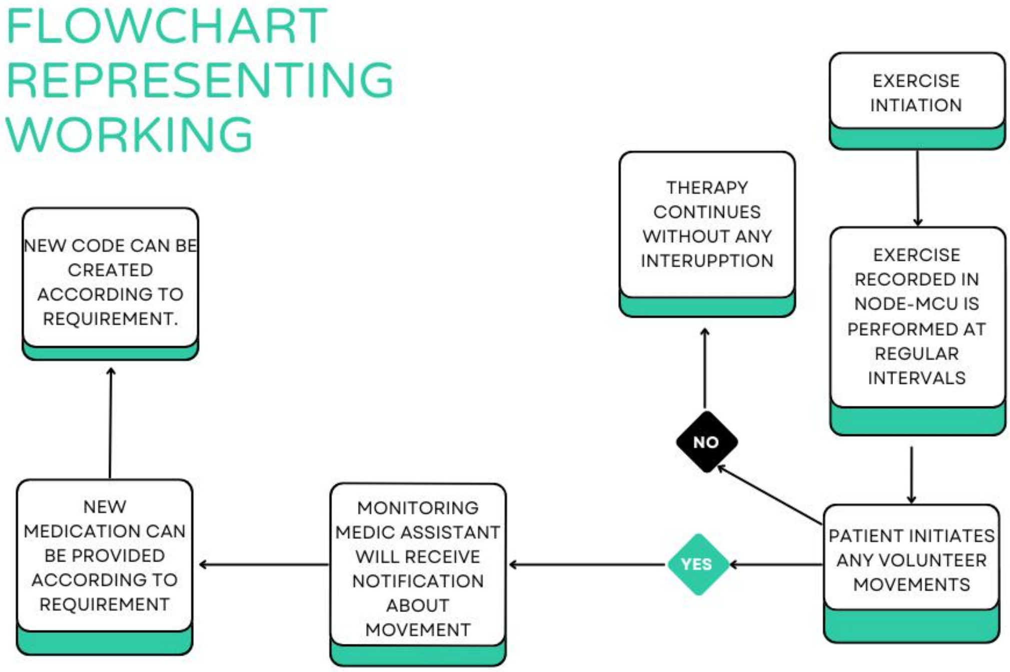

Figure 5: Block diagram explaining working of PARTH.

7. RESULT AND ANALYSIS:

The implementation of the IoT-based solution for paraplegic therapy has yielded significant outcomes in enhancing patient care and safety:

1. **Improved Communication**: The integration of the Microcontroller and GSM modem has facilitated seamless communication between patients and their medical assistants or caregivers. Messages regarding the patient's condition and requests for assistance are transmitted efficiently, leading to quicker response times and improved coordination in care delivery.

2. **Enhanced Emergency Response**:The responsive alarm mechanism triggered by messages from medical assistants has proven effective in alerting nearby individuals to emergency situations. This feature has enabled swift action in critical scenarios, potentially mitigating adverse outcomes and ensuring the safety of the patient.

3. **Monitoring Health Parameters**: The device's ability to monitor health parameters such as temperature and heart rate has provided valuable insights into the patient's physiological status. Abnormalities detected by the microcontroller are promptly communicated to medical assistants, enabling timely interventions and proactive management of health issues.

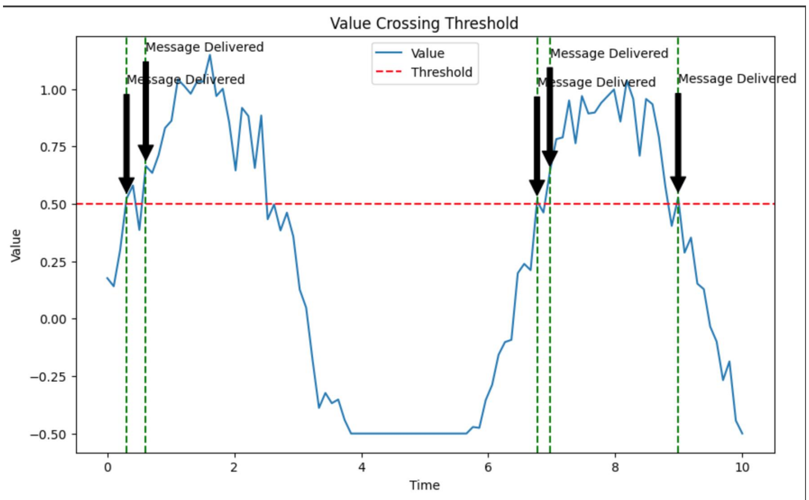

Figure 6: Graph illustrating process of delivering message to caretaker.

8 . CONCLUSION:

In conclusion, the implementation of the IoT-based solution for paraplegic therapy has demonstrated significant advancements in patient care and safety. Through improved communication, enhanced emergency response capabilities, and real-time monitoring of health parameters, the technology has positively impacted patient outcomes by facilitating faster response times, proactive management of health issues, and overall better coordination of care.

The success of the project can be attributed to its seamless technological integration, user-centric design, and tangible impact on patient well-being. Moving forward, continued refinement and enhancement of the device's functionality, coupled with ongoing evaluation and feedback from users, will be crucial for maximizing its effectiveness in paraplegic therapy and addressing the evolving needs of both patients and healthcare providers. This innovative solution represents a promising step towards advancing the quality of care and improving the lives of individuals with paraplegia.

9 . REFERENCES:

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[2] . IoT- Based Solution for Paraplegic Sufferer to Send Signals to PhysiREcian via Internet Authors: L. Srinivasan , D. Selvaraj , D. Dhinakaran , T. P. Anish.

[3] IOT **Based Wireless Monitoring Stroke Patient with Partial Paralysis Assistance** Authors:Pradeep Kumar S, Chandana Gireesh, Riti Dass, Sneha Sinha, Sumit Kumar, Subhra Chakraborty.

[4] Hira Beenish, Ahsan Sheikh, Fakeha Nasir **-Design and Implementation of a Monitoring System for Paralysis patient using IoT-KIET Journal of Computing & Information Sciences** [KJCIS]-2021| Volume 4 | Issue 2| Page.no:49 to 58.

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10 . CODE:

THE BELOW CODE IS FOR THERAPY AND MONITORING USING AURDINO BOARD.

```
#include <Servo.h>

int pos = 0;

const int xPin = A1;
const int yPin = A2;
const int zPin = A0;
int minVal = 511;
int maxVal = 575;
int x;
int y;
int z;
Servo servo_5;
Servo servo_6;
Servo servo_7;
Servo servo_8;
Servo servo_9;

void setup()
{
  Serial.begin(9600);
  pinMode(2, OUTPUT);
  servo_5.attach(5, 500, 2500);
  servo_6.attach(6, 500, 2500);
  servo_7.attach(7, 500, 2500);
  servo_8.attach(8, 500, 2500);
  servo_9.attach(9, 500, 2500);
  analogReference(EXTERNAL);

}

void loop()
{
  /*//Therapy
  for(int i=0;i<100000;i++)
   {
  for (pos = 0; pos <= 90; pos += 1)
 {
    servo_5.write(pos);
    servo_6.write(pos);
    servo_7.write(pos);
    servo_8.write(pos);
```

```
    servo_9.write(pos);
    delay(50);
  }
  for (pos = 90; pos >= 0; pos -= 1)
{
   servo_5.write(pos);
    servo_6.write(pos);
    servo_7.write(pos);
    servo_8.write(pos);
    servo_9.write(pos);
    delay(50);
  }
  }*/
  //Monitoring
  int xRead = analogRead(xPin);
  int yRead = analogRead(yPin);
  int zRead = analogRead(zPin);
  int xAng = map(xRead, minVal, maxVal, -90, 90);
  int yAng = map(yRead, minVal, maxVal, -90, 90);
  int zAng = map(zRead, minVal, maxVal, -90, 90);
  x = (int)RAD_TO_DEG * (atan2(-yAng, -zAng) + PI);
  y = (int)RAD_TO_DEG * (atan2(-xAng, -zAng) + PI);
  z =(int) RAD_TO_DEG * (atan2(-yAng, -xAng) + PI);
  Serial.print("x: ");
  Serial.print(x);
  Serial.print(" | y: ");
  Serial.print(y);
  Serial.print(" | z: ");
  Serial.println(z);
  if ((x!=225) || (y!=225)|| (z!=225))  // maximum safe deceleration.
  {
       Serial.print(" MOVEMENT DETECTED ");
       digitalWrite(2, HIGH);
       delay(1000);
  }
         digitalWrite(2, LOW);
}
```

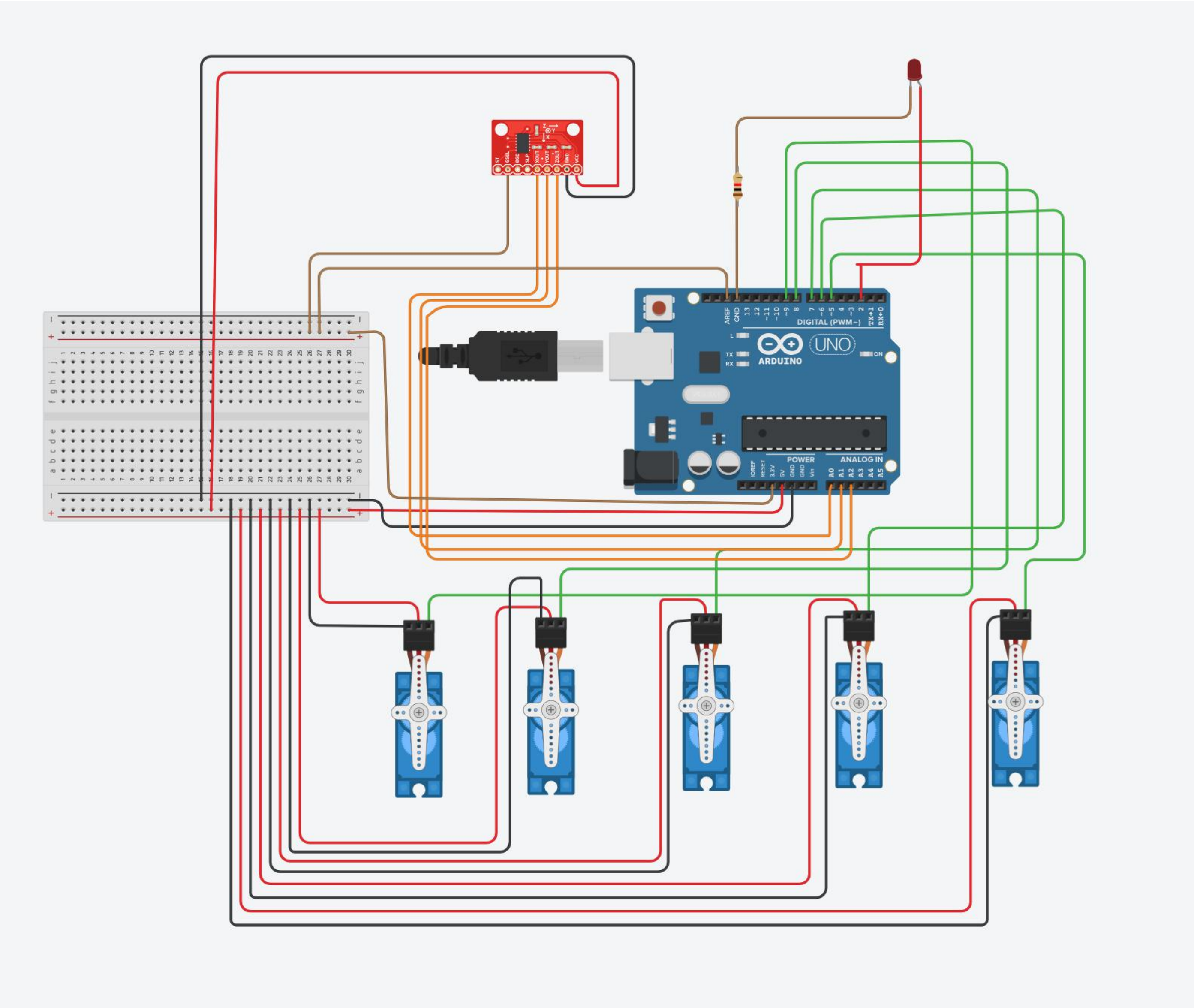

Figure 7: Circuit diagram for PARTH