

PROTOTYPE OF VIBROTACTILE HEADBAND

I. CIRCUIT

I.A Components

- Arduino MEGA ADK microcontroller board
<https://www.arduino.cc/en/Main/ArduinoBoardMegaADK>
- Adafruit DRV2605L Haptic Motor Controller
<https://www.adafruit.com/products/2305>
- 10mm Linear Resonant Actuators 4mm type (C10-100 Precision Microdrives)
<https://www.precisionmicrodrives.com/sites/default/files/products/datasheet/c10-100-10mm-linear-resonant-actuator-4mm-type-datasheet.pdf>
- Adafruit Perma-Proto Half-sized Breadboard PCB
<https://www.adafruit.com/products/571>

I.B Assembly

The circuit was built on a breadboard to receive the Haptic Driver component which has the inputs VIN, GND, SCL, SDA, and IN. VIN and GND appear in red and black, while SCL and SDA are blue and orange.

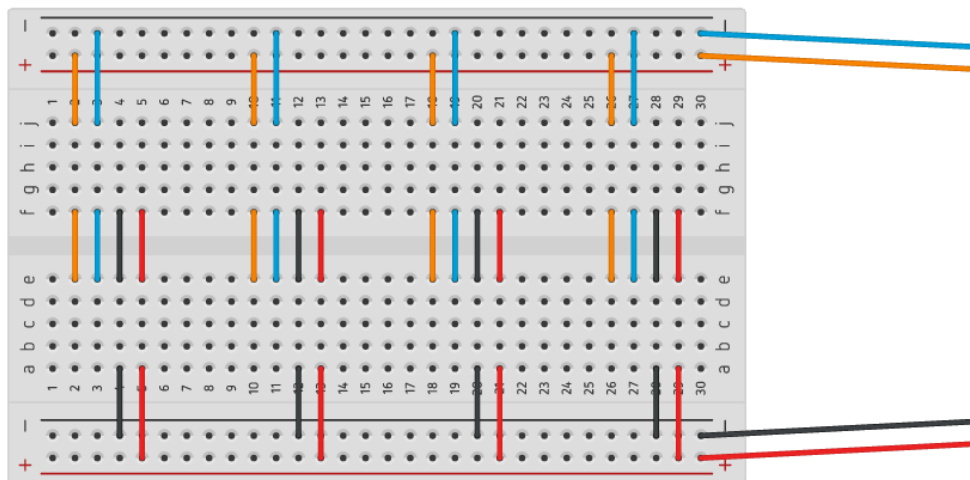


Fig. 1 - Preparing the breadboard

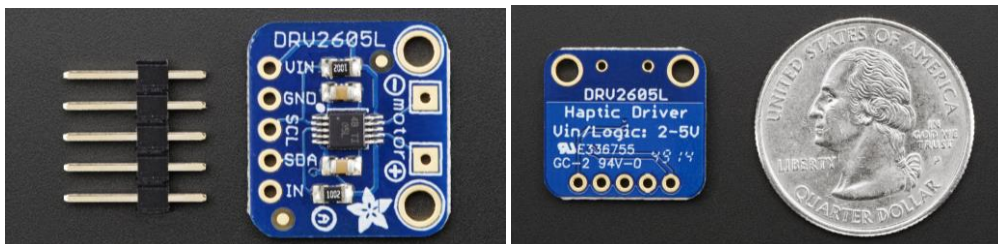


Fig. 2 – Haptic Driver

Then, eight Haptic Drivers must be added to the board to control eight vibrating motors.

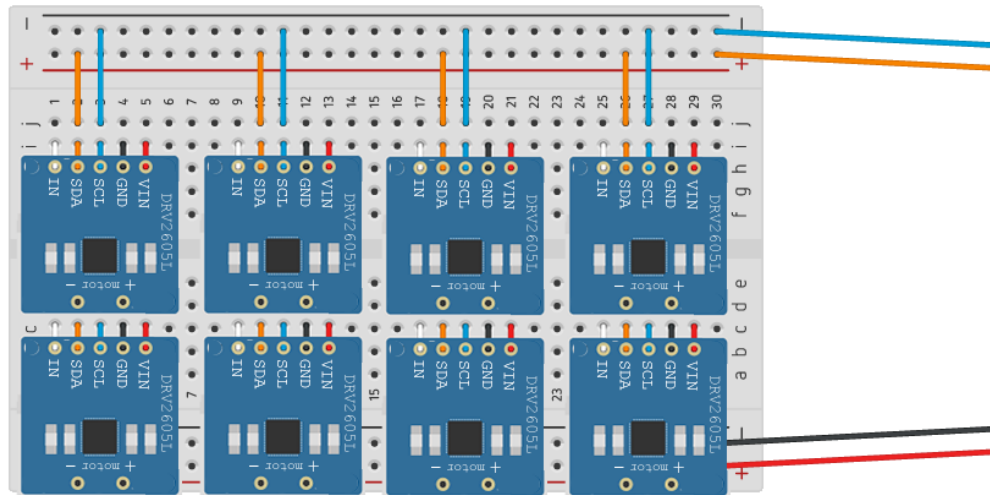


Fig. 3 – Adding the haptic drivers

The VIN inputs on the haptic drivers are used to control the motor by PWM signal. They were connected to the Arduino board from the pins 2 to 9. Then, the SDA was connected to the pin 20 and the SCL to the pin 21 (those pins work for the Arduino Mega SDK, but differs for other boards). The GND was connected to the ground pin and the VIN pin was connected to the 3V pin.

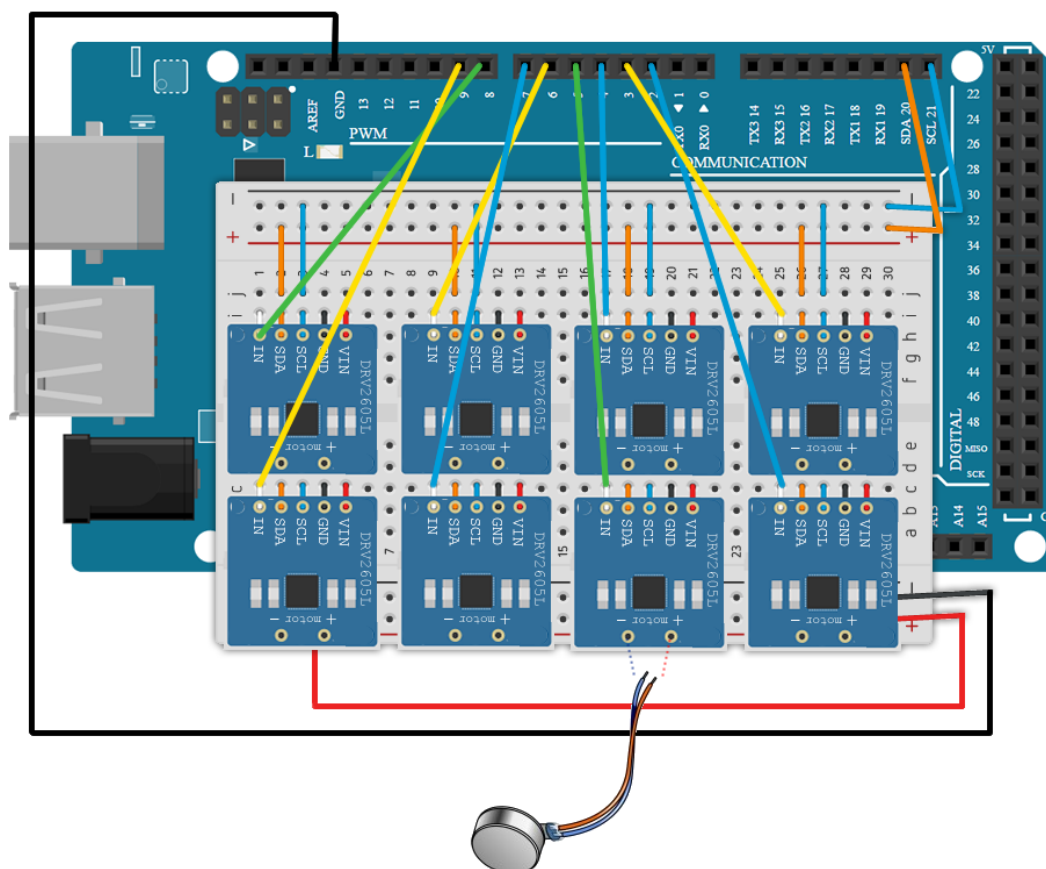
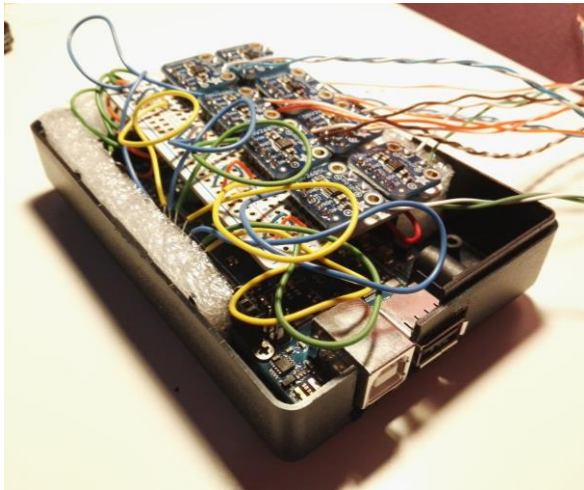
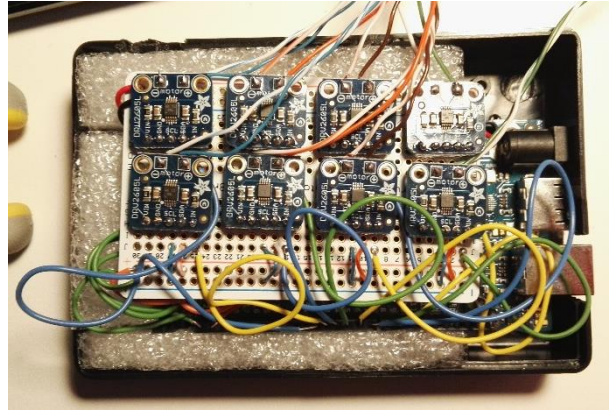
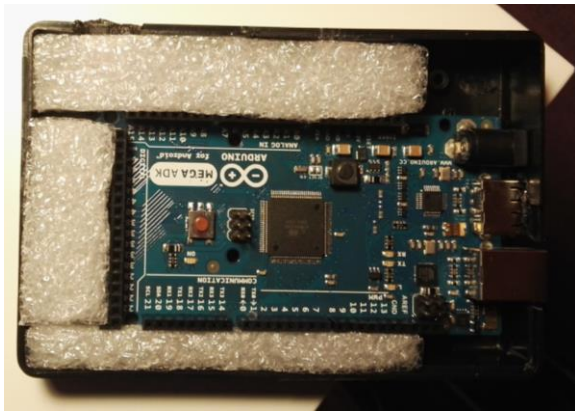


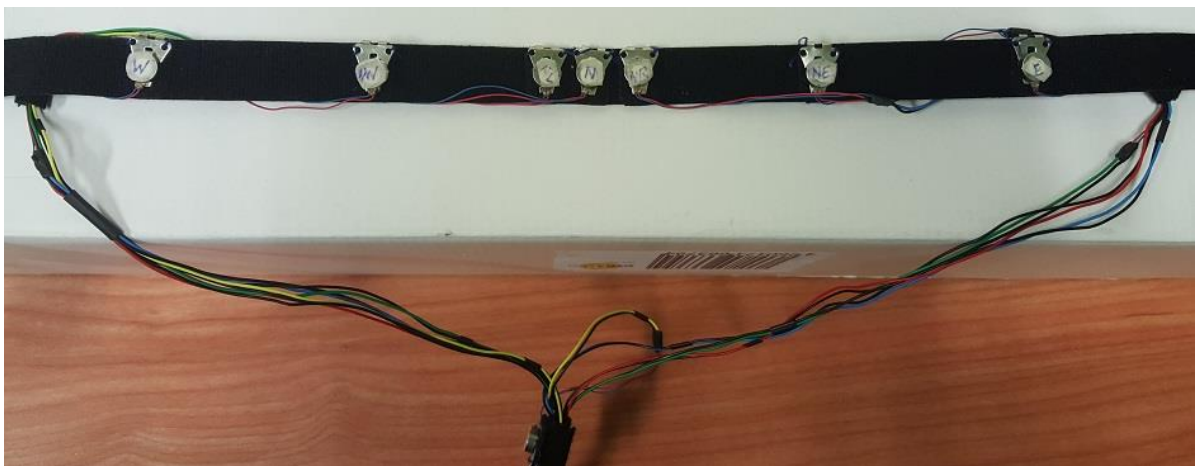
Fig.4 – Connecting the breadboard to the Arduino

Then, the eight motors were connected to the drivers with cables of 1 meter each. The final board was placed on a container with the space for the Arduino and open spaces for the cables.



II. HEADBAND

The eight motors were simply attached to pieces of Velcro to be easily repositioned on a larger strap of Velcro. Motors in cardinal and collateral positions are placed 7.5 centimeters apart. Two other motors were placed 0.5 centimeters apart from the central one.



III. SOFTWARE

To set the headband it is necessary to load an Arduino piece of software.

- First, install the Arduino IDE
<https://www.arduino.cc/en/Main/Software>
- Then, download the Adafruit_DRV2605 Library and follow the instructions in the page
<https://learn.adafruit.com/adafruit-drv2605-haptic-controller-breakout/wiring-and-test>

Finally, create a new project in Arduino with the following code:

```
#include <Wire.h>
#include "Adafruit_DRV2605.h"
Adafruit_DRV2605 drv;

int digOut = 8;    // Number of digital outputs
int PWM = 255;    // 100% duty cycle
int PIN = 0;

void setup() {
  Serial.begin(57600);

  // DRIVER
  drv.begin();
  drv.useLRA();
  drv.setMode(DRV2605_MODE_PWMANALOG);
  drv.selectLibrary(6);
  drv.writeRegister8(0x01, 3);
  drv.writeRegister8(0x03, 6);
  drv.writeRegister8(0x20, 0);
  drv.writeRegister8(0x1D, 0);

  // OUTPUT: Motors
  for (int i = 0; i < digOut; i++) {
    pinMode(i+2, OUTPUT);
    analogWrite(i+2, 0);
  }
}

void activateMotor(){
  analogWrite(PIN, PWM);
  delay(500);
  analogWrite(PIN, 0);
}

void loop () {
  // Activate each motor on the order it was in the previous array
  PIN = 2; activateMotor();
  PIN = 7; activateMotor();
  PIN = 8; activateMotor();
  PIN = 5; activateMotor();
  PIN = 3; activateMotor();
  PIN = 6; activateMotor();
  PIN = 9; activateMotor();
  PIN = 4; activateMotor();

  // Waits 5 sec before repeating the vibrations
  delay(5000);
}
```