ID1050A ENGINEERING DESIGN

HAND GESTURE - CONTROLLED ROBOT

PROTOTYPE : VIDEO LINK

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THE USER'S NEED

- To effortlessly move items with hand motions.
- For those with disabilities, especially those who have limited mobility, this project is tremendously helpful.
- With this, individuals are able to move objects with only their hands.

THE PROBLEM

What is the problem?

- Most of the physically challenged people find difficulty in operating devices and moving things .
- So there is a need to provide these people an accessible means of controlling devices through hand gestures .

EXISTING SOLUTIONS

PREVIOUS SOLUTIONS

- It can be challenging for people with disabilities to use remote control devices and control mechanisms like buttons and switches.

WHY THIS PROJECT ?

- ❖ This project provides an affordable option. Additionally, it is created for all user kinds.
- ❖ Children may play and learn about technology, and older persons and those with disabilities can benefit much from this as well.
- ❖ Additionally, it improves the independence and standard of living for those with disabilities.

MERITS AND DEMERITS

MERITS

- Natural way of controlling devices
- Interactive and interesting to learn
- Moves stuff for people by using simple movements
- Here, I performed something very easy and fundamental: we can build robots that can walk, pick up objects, and hand them to users simply by making hand gestures. But the price is higher .
- Helps disabled people

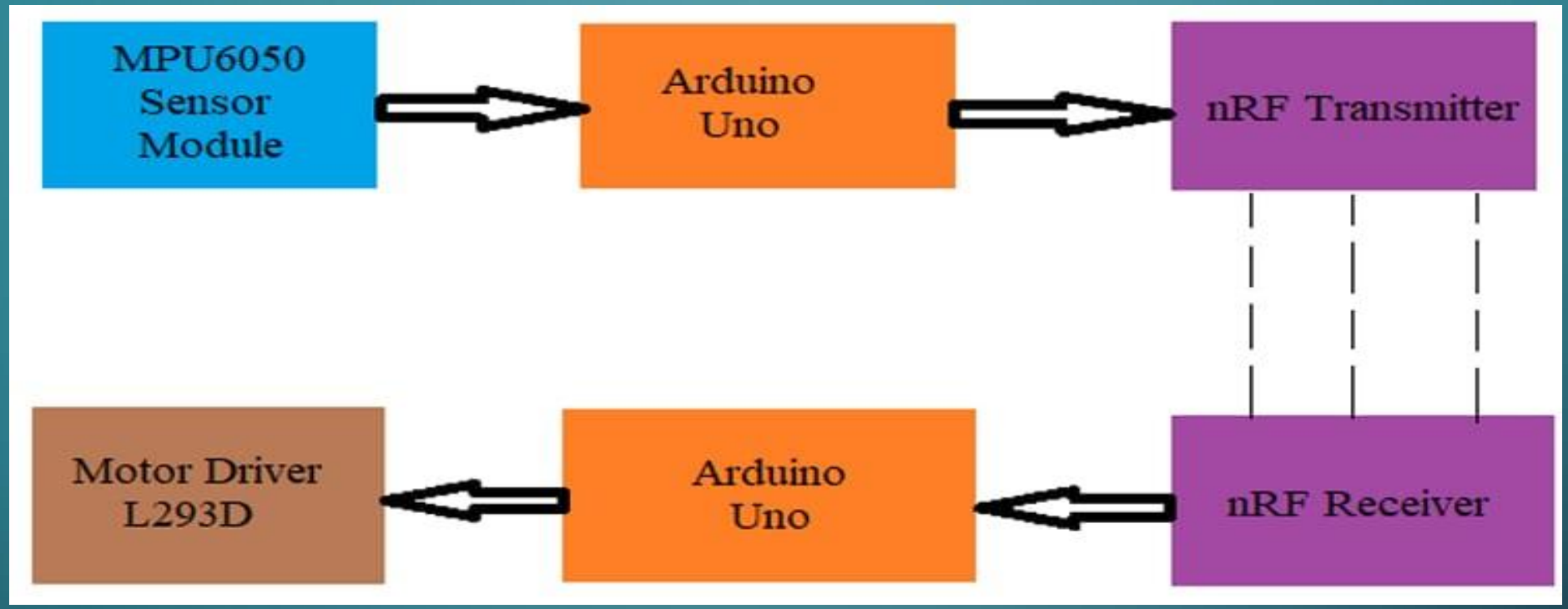
DEMERITS

- People will grow lazy because technology makes everything simple and allows them to move items without exerting any physical effort.
- I only have a few gesture controls here. This is a result of a tight budget..

DETAILS OF RESEARCH :

- People with disabilities often struggle to carry or move goods in daily life. Additionally, the necessity for mechanical arms in today's society is growing as a result of the difficulty or impossibility of human engagement in a variety of inhuman circumstances. Thus, this approach is quite helpful.
- Although remote control was a previous method, we need a more effective means to tell some robots to move. This is the first section. Then, we may tell robots to select items, hold them, and then hand them to a user. Additionally, this will be helpful in many areas, such as surveillance. This also applies to drones. Drones can only be operated by hand gestures. These robots can be utilized in wheelchairs and other conveyances.
- In the future, it might be possible to control objects with your thoughts thanks to a brain-computer interface.

THE PROTOTYPE



- Hand movements are utilized to control a robot in this project. The MPU6050 sensor first detects hand motions and sends raw data to the Arduino uno in the transmitter section.
- The Arduino Uno will examine it. Indicate how much the sensor is inclined in the x and y axes. The Arduino uno will encrypt it and send the data to the NRF24L01 transmitter

- Then, in the transmitter section, the NRF24L01 will receive it and send it back to the receiver part, the Arduino Uno. The tilt angles are then mapped to the motor speed of the robot chassis.
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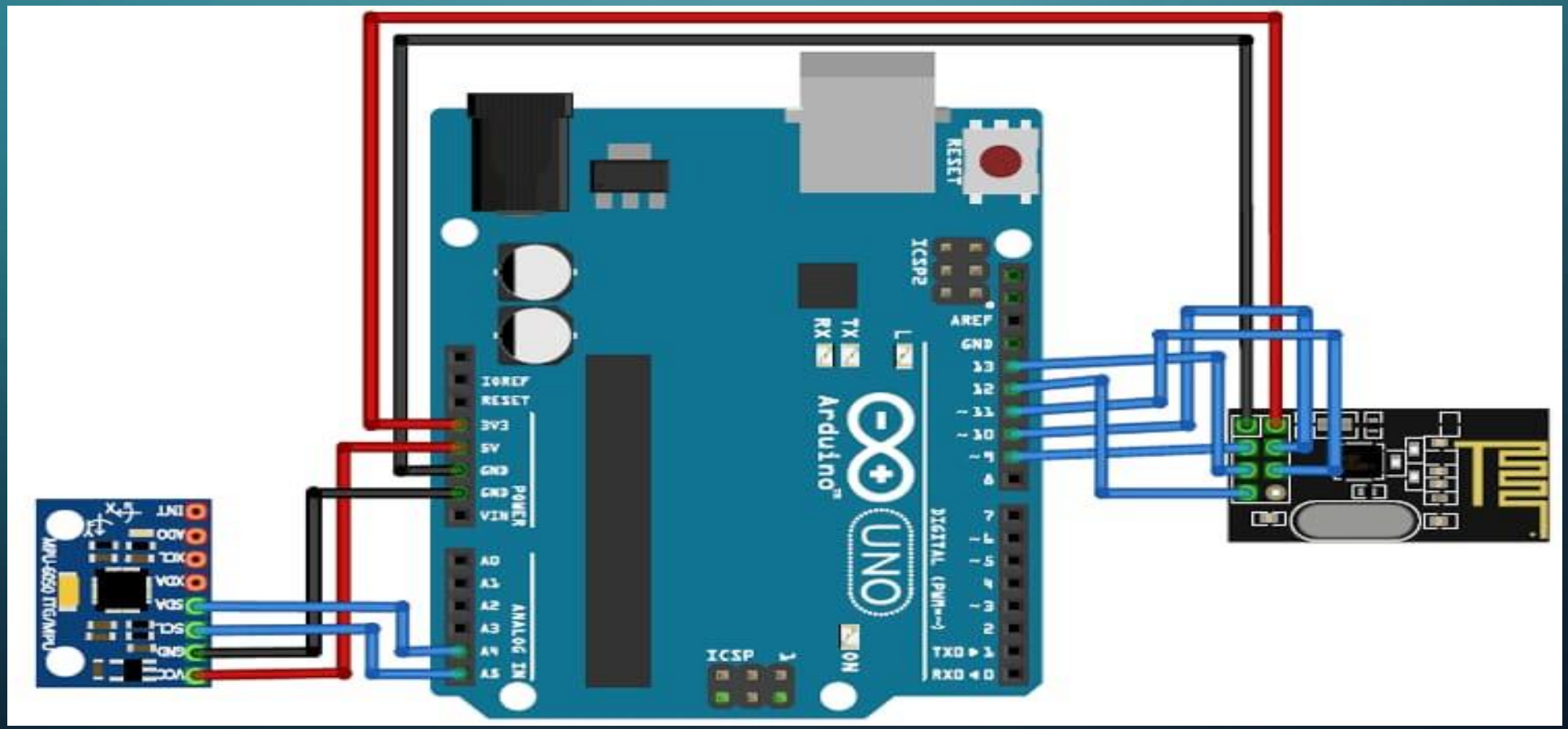
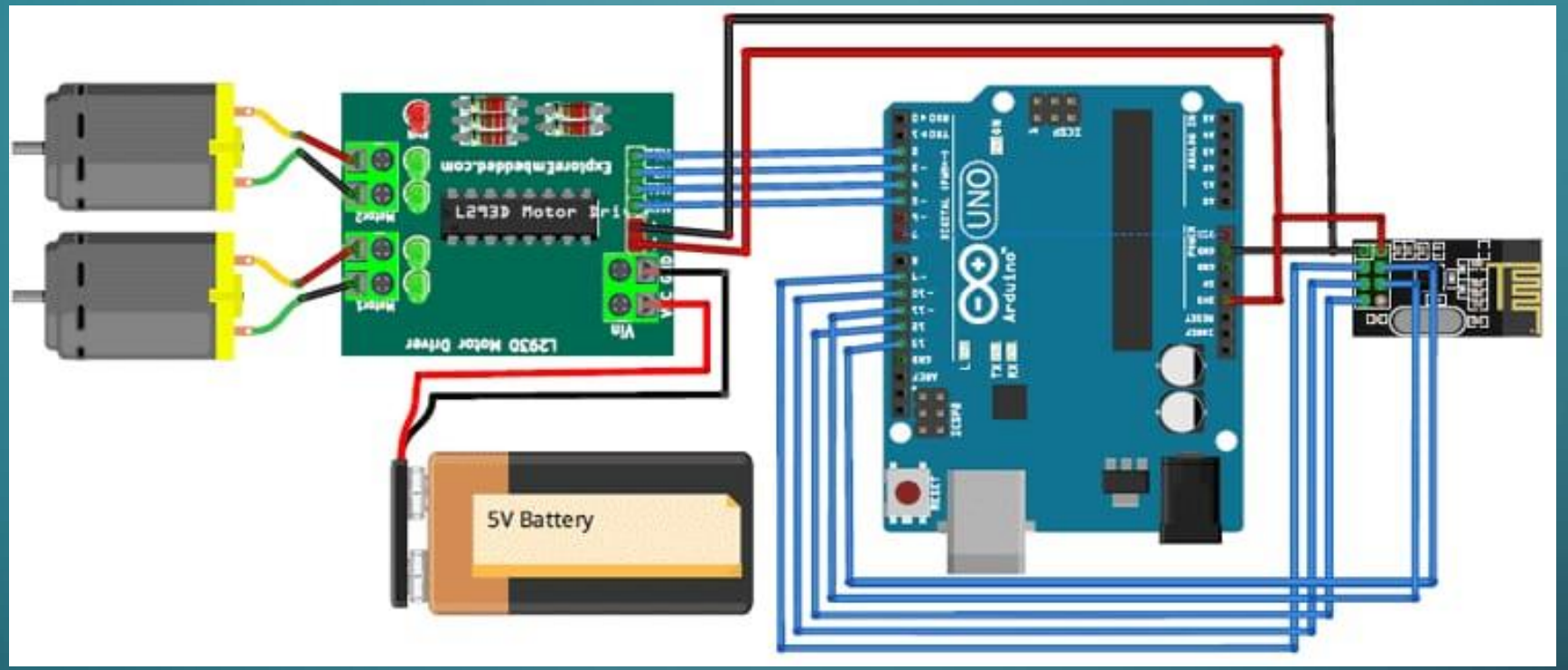
TRANSMITTER SECTION



RECEIVER SECTION



- The Arduino then sends these commands to the robot driver, who controls the motors by altering the potential difference between them.
- We can do this by uploading flawless programs to both Arduino boards.
- As a result, we can control robot movement via hand gestures.

COMPONENTS AND BILL OF MATERIALS

- Robot chassis : ₹464
- Microcontroller – Arduino uno(with cable) : 700*2 = ₹1400
- L298N Motor driver : ₹200
- MPU6050 : ₹200
- NRF24L01 : 2*256.34=₹512.68
- Battery (HW+AA+ADAPTER) : ₹360
- Wires : ₹190
- Total cost = ₹4500
- I'VE INCLUDED THE LINK TO THE BILL FILE HERE- BILLS

DETAILS OF TEST PLANNED

Overview :

- Component testing
- Sensor calibration
- Software testing
- Functional testing
- Range testing
- User testing
- Hardware testing

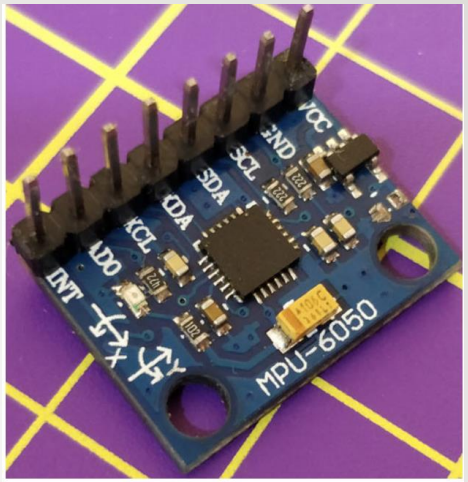
COMPONENTS TESTING

- We first tested each and every component. To test them, we used basic test routines. Following that, we attempt to submit our desired codes.Following that, we created a report for all testing. We also documented all of the these.

- I've given a link to the files containing all of the test programs.

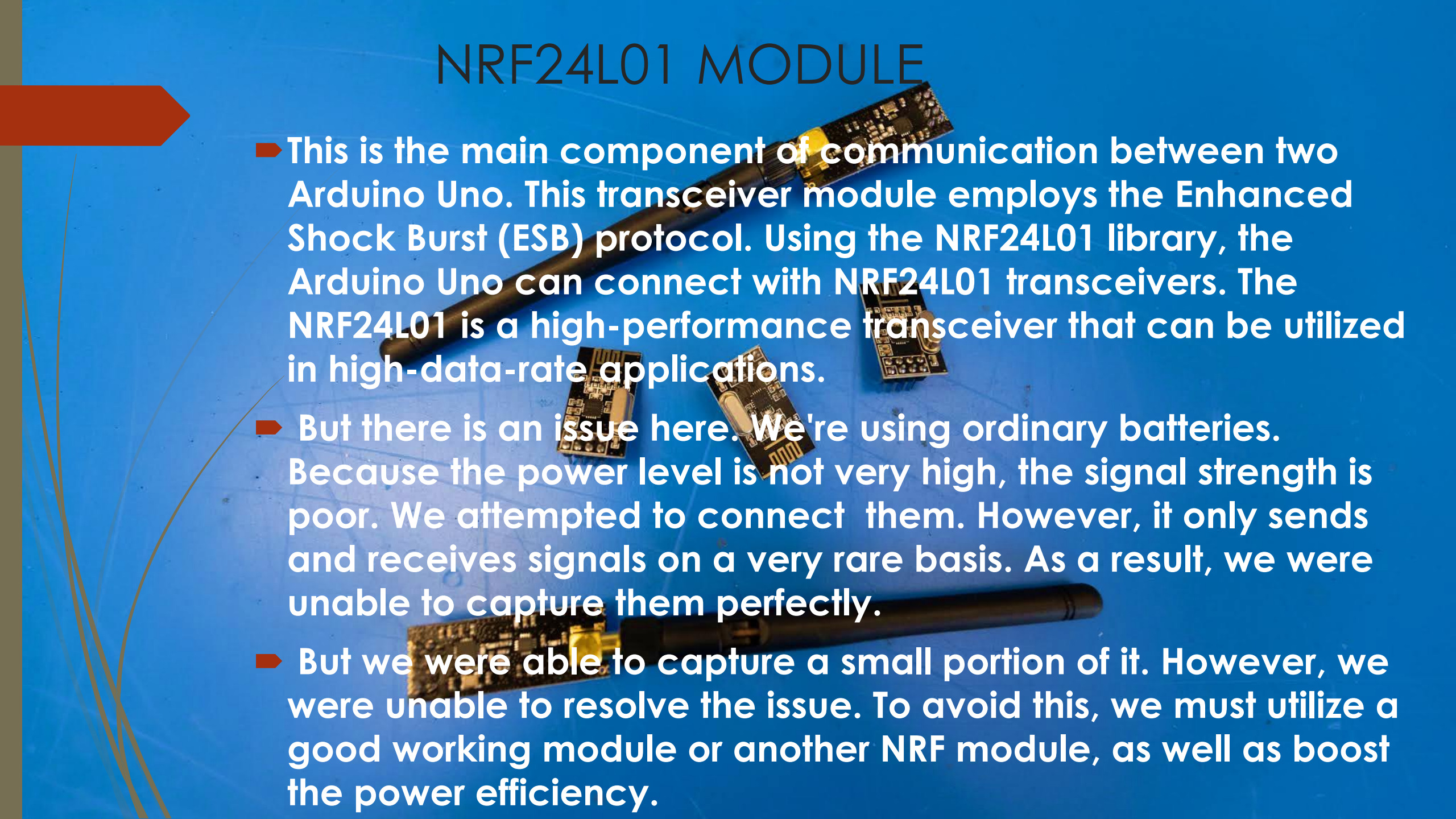
  - NRF24L01 TRANSCEIVER : NRF24L01 TRANSMITTER AND RECEIVER
  - MPU 6050 : **MPU 6050**

SENSOR CALIBRATION



- The **MPU6050** is a accelerometer gyroscope chip. With that we can tell how much the sensor is titled . With the help of this sensor we can detect how much our hand is titled. So that we can send signals to the receiver part. So it is important to calibrate it .
- Mpu6050 gives raw data . We have to convert them into our desired value. So we have to map these values to our desired physical quantity.
- After this we did other testing such as software testing, user testing, etc

NRF24L01 MODULE



- This is the main component of communication between two Arduino Uno. This transceiver module employs the Enhanced Shock Burst (ESB) protocol. Using the NRF24L01 library, the Arduino Uno can connect with NRF24L01 transceivers. The NRF24L01 is a high-performance transceiver that can be utilized in high-data-rate applications.
- But there is an issue here. We're using ordinary batteries. Because the power level is not very high, the signal strength is poor. We attempted to connect them. However, it only sends and receives signals on a very rare basis. As a result, we were unable to capture them perfectly.
- But we were able to capture a small portion of it. However, we were unable to resolve the issue. To avoid this, we must utilize a good working module or another NRF module, as well as boost the power efficiency.

SOFTWARE TESTING

I have shared the link to our final code and **PROTOTYPE VIDEO** here:

TRANSMITTER CODE : Transmitter code

RECEIVER CODE : Receiver code

VIDEO :

https://drive.google.com/file/d/1dQSv3X5BS09ebSSsMRasrg3LY33LWesT/view?usp=drive_link