**Experiment No.09**

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| Program : BTech IT | Batch: A1 |
| Subject: Drone Technology | Date of Experiment: |
| Date of Submission: | Grade: |

A.1 Aim:

* To understand the process of calibrating Electronic Speed Controllers (ESCs) and the accelerometer sensor to ensure the proper functionality of a quadcopter.

A.2 Materials Required:

 Quadcopter frame with motors

 Electronic Speed Controllers (ESCs)

 Flight Controller (PX4)

 Transmitter and Receiver

 Battery

 USB Cable

 Ground Station Software (QGroundControl/Mission Planner)

 Propeller (should be removed during ESC calibration for safety)

A.4 Theory:

Part 1: ESC Calibration

Step 1: Remove Propellers

 For safety reasons, remove the propellers from all motors before proceeding with the ESC calibration.

Step 2: Connect the Flight Controller to Ground Station

 Power the flight controller by connecting it to the computer using a USB cable.

 Launch the ground station software (e.g., QGroundControl or Mission Planner).

Step 3: Enter ESC Calibration Mode

 Connect the battery to the quadcopter.

 Open the Power Setup menu in the ground station software.

 Choose the option to Calibrate ESCs. The system will guide you to enter calibration mode.

o In QGroundControl: Navigate to Vehicle Setup

> Power > ESC Calibration.

o In Mission Planner: Go to Initual Setup > Mandatory Hardware > ESC Calibration.

Step 4: Throttle Maximum Command

 Move the throttle stick of your transmitter to the maximum positoon.

 Plug in the battery. The ESCs will enter calibration mode, and you may hear beeps indicating readiness.

Step 5: Throttle Minimum Command

 After hearing the initial confirmation beeps, lower the throttle to the minimum position.

 The ESCs will then store the throttle range, and additional beeps will confirm successful calibration.

Step 6: Test the Calibration

 Disconnect the battery.

 Reconnect the battery and arm the quadcopter. Slowly increase the throttle to verify that all motors start spinning simultaneously.

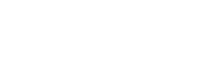
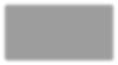
Observations and Learning:

 Attached the images as an outcome of this practical.



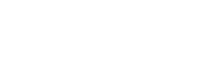
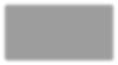
**Observations and Learning:**

Based on the steps and the experiment performed, here are our observations and details about the connections to the flight controller:



RadioLink

Transmitter



RadioLink

Receiver

# Basic Connections



Breadboard



ESC



Arduino

(

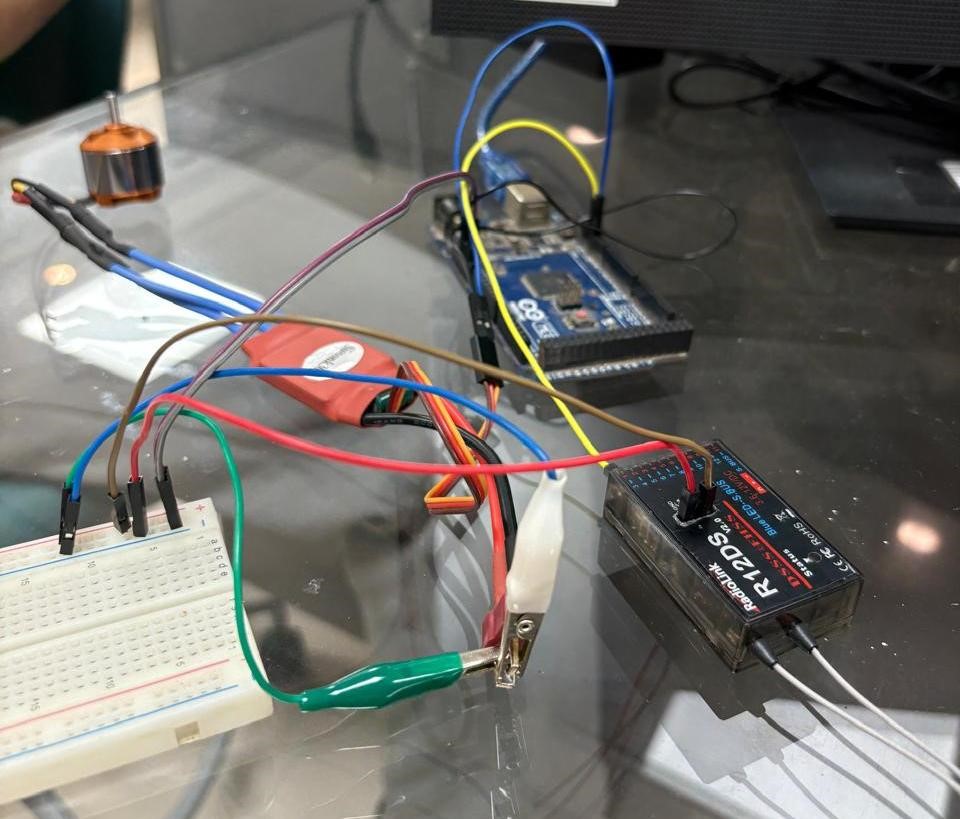
Flight Controller

)



Motor

# Connection to RadioLink



RadioLink



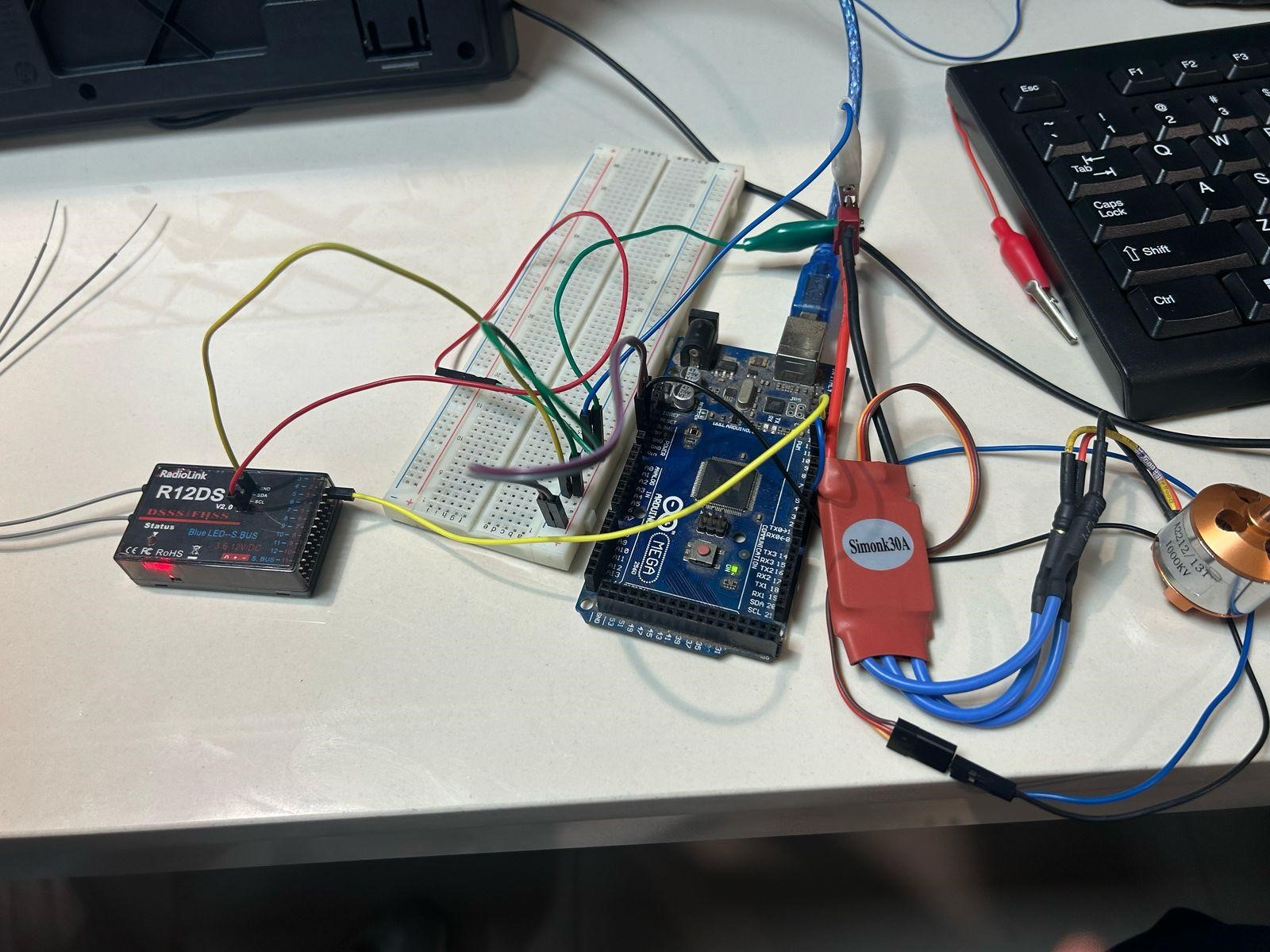
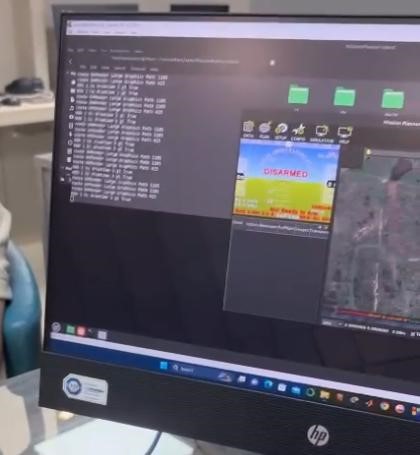
Crocodile Clip

We use a crocodile clip for more efficient power delivery.

(This setup can either be connected to the battery, or it can take power from the flight controller when connected to the PC: testing purposes only.)

# Connection to the PC

When we connect this setup to the PC, due to some hardware troubles we couldn’t connect to the MissionPlanner. Although, the RadioLink did light up & the Radio Transmitter had it’s initial beeps, and this was observed in MissionPlanner:



Connection to the PC



RadioLink



Flight Controller



ESC



Motor



Breadboard

Since the battery we had was LiPo and we did not want to risk tampering it, we connected the components to a Variable PSU, which is our main power source:

Power Source is providing 11.9 V (suitable according to our motor’s KV rating and ESC)

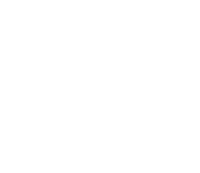
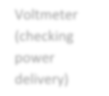
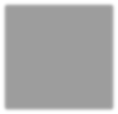
A close-up of a power supply

AI-generated content may be incorrect.

# Switching to the Variable PSU



Variable PSU



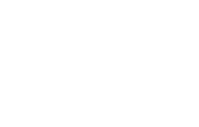
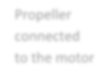
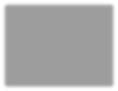
Voltmeter

(

checking

power

delivery)



Propeller

connected

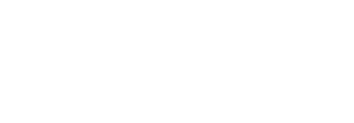
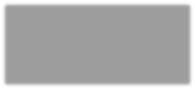
to the motor



Transmitter

Close Up of the Transmitter

# Connection to the Transmitter (Remote Control)



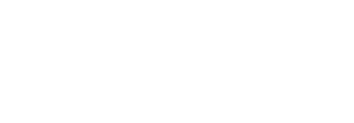
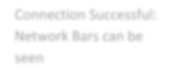
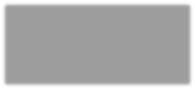
Not Connected yet:

N

etwork bars are not

visible

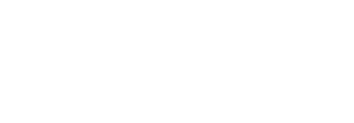
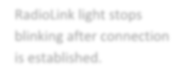
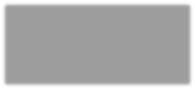
After establishing connection with the RadioLink (receiver), the screen looks something like this:



Connection Successful:

Network Bars can be

seen

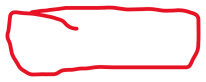


RadioLink

light stops

blinking after connection

is established.

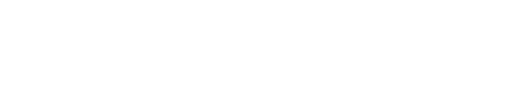
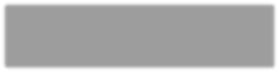


# Using the Transmitter to Control Motor Rotation

Rotation of the Motor: (The propeller has been disconnected to avoid injuries.)



The motor can be seen rotating here.



Toggling Controls on the Transmitter:

MAX THROTTLE

The transmitter is sending a signal via RadioLink to perform the rotation based on the inputs, which goes further to the ESC that is connected to the motor; and the motor rotates according to the direction specified by the transmitter.

# Reading of the Oscilloscope

The connections to the oscilloscope were done as follows:

A computer monitor and keyboard with wires

AI-generated content may be incorrect.

Readings Observed:

A person holding a remote control

AI-generated content may be incorrect. A person holding a remote control

AI-generated content may be incorrect.

A person's hands on a remote control

AI-generated content may be incorrect. A person holding a remote control

AI-generated content may be incorrect.

A close up of a device

AI-generated content may be incorrect.

Stable Reading when no Input is pressed

A person holding a remote control

AI-generated content may be incorrect. No Inputs Pressed

A slight disturbance in the wave is seen on the oscilloscope. Only Channel 3 and 4 were recorded

**Conclusion:**

*We were able to establish connection between various components in a drone. Due to limitations in hardware and other software difficulties, the drone flight could not happen; but we managed to understand the mechanism behind the communication between the transmitter and the receiver and how the controls make the motors move via the ESC, and how the signals show up on the oscilloscope as readings.*