

MIND CONTROLLED DRONE

Project Report submitted in partial fulfilment of the requirements for the degree of

BACHELOR OF TECHNOLOGY

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

By

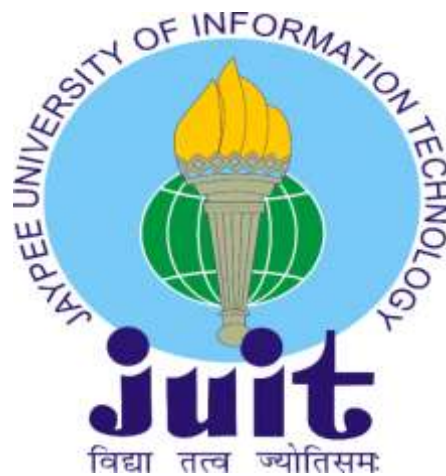
Prachi Bekta – 161679

Uday Sood – 161648

Surbhi Garg – 161073

UNDER THE GUIDANCE OF

Mr. Munish Sood



JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

May 2020

TABLE OF CONTENTS

CAPTION	PAGE NO.
DECLARATION	i
ACKNOWLEDGEMENT	ii
LIST OF ACRONYMS AND ABBREVIATIONS	iii
LIST OF FIGURES	v
ABSTRACT	vii
CHAPTER-1: INTRODUCTION	1
1.1 Background	1
1.2 Electroencephalogram	1
1.2.1 How does it work	1
1.2.2 Several ways to conduct an EEG	2
1.2.3 What does an EEG show?	2
1.3 MindWave Sensor and its working	2
1.4 Methods	4
1.4.1 Meditation Task	4
1.4.2 Attention Task	4
1.5 Results	4
1.6 Filtered Data	5
1.6.1 Attention Task	6
1.6.2 Meditation Task	6
1.7 Discussion	7
1.8 Future possibilities and reading brainwaves	7
1.9 Conclusions	9
CHAPTER-2: HARDWARE DESCRIPTION	10
2.1 Parts List	7
2.2 Description	11
2.2.1 Drone-PCB	11
2.2.2 Soldering Station	12
2.2.3 Neurosky MindWave Sensor	13
2.2.4 Multimeter	15
2.2.5 Breadboard, Jumper wires and Crocodile clip wires	16
2.2.6 Arduino MKR-1000	17
2.2.7 Resistors and Capacitors	22

CHAPTER-3: DESIGN AND IMPLEMENTATION	23
3.1 Drone PCB	23
3.2 Digital to analogue	26
3.3 The Arduino Circuit	30
3.3.1 Using Arduino on Desktop	31
3.3.2 Installing Drivers	32
3.3.3 Open first sketch	36
3.4 Mind Control	41
3.5 Conclusion	42
REFERENCES	43
APPENDIX A: CODE (PROCESSING MASTER)	44
APPENDIX B: CODE (DRONE CONTROL)	48
PLAGIARISM REPORT	50

DECLARATION

We hereby declare that our B.Tech Project Report entitled “**Mind Controlled Drone**” that has been submitted at **Jaypee University of Information Technology, Waknaghat, India** is an authentic record of our work done under the supervision and guidance of **Mr. Munish Sood**. We declare this work is not submitted elsewhere for the other degree or diploma.



Surbhi Garg
161073



Uday Sood
161648



Prachi Bekta
161679

I hereby certify that the above statement made by the students is true and they have performed this project under my supervision.



Mr. Munish Sood
Date:

ACKNOWLEDGEMENT

“IT ISN’T POSSIBLE TO ORGANIZE A PROJECT REPORT WITHOUT THE HELP AND ENCOURAGEMENT OF OTHER PEOPLE. THIS ONE IS CERTAINLY NO EXCEPTION.”

WE WOULD LIKE TO SINCERELY THANK AND APPRECIATE ALL THE PEOPLE WHO HAVE HELPED US DURING THIS ENDEAVOUR. WITHOUT THEIR ENCOURAGEMENT, HELP AND PROPER GUIDANCE WE WOULD NOT BE ABLE TO PERFORM WELL IN THIS PROJECT.

WE ARE INEFFABLY THANKFUL TO **MR. MUNISH SOOD** FOR HIS CONSTANT GUIDANCE AND HELP TO ACCOMPLISH THIS PROJECT.

WE ARE GRATEFUL TO DEPARTMENT OF ELECTRONICS AND COMMUNICATION FOR THEIR SUPPORT AND UTMOST GUIDANCE IN THIS PROJECT.

. WE ALSO ACKNOWLEDGE WITH A DEEP SENSE OF REVERENCE, OUR GRATITUDE TOWARDS OUR PARENTS AND OUR FRIENDS, WHO SUPPORTED US MENTALLY WITHOUT THEIR ENCOURAGEMENT AND TRUST, WE MAY NOT HAVE PUSHED OURSELVES TO DO BETTER IN THIS PROJECT.

THANKING YOU

LIST OF ACRONYMS AND ABBREVIATIONS

Sr. No	Acronym	Full Form
1.	ADC	Analog to Digital Converter
2.	ADHD	Attention Deficit Hyperactivity Disorder
3.	ARM	Advanced RISC Machines
4.	BCI	Brain-Computer Interface
5.	BT	Bluetooth
6.	CD	Compact Disk
7.	COM Port	Communication Port
8.	DAC	Digital to Analog Converter
9.	EEG	Electroencephalography/Electroencephalogram
10.	EEPROM	Electrically Erasable Programmable Read-Only Memory
11.	EMG	Electromyography
12.	fMRI	Functional Magnetic Resonance Imaging
13.	FTDI	Future Technology Devices International
14.	GND	Ground
15.	IDE	Integrated Development Environment
16.	IOT	Internet of Things
17.	IEEE	Institute of Electrical and Electronic Engineers
18.	KB	Kilo Byte
19.	kHz	Kilo Hertz
20.	LED	Light Emitting Diode
21.	LPT	Line Print Terminal
22.	MHz	Mega Hertz
23.	OEM	Original Equipment Manufacturer
24.	OS	Operating System
25.	PCB	Printed Circuit Board
26.	PET	Positron Emission Tomography
27.	PWM	Pulse Width Modulation

- | | | |
|-----|------|---|
| 28. | SoC | System on Chip |
| 29. | SPI | Serial Peripheral Interface |
| 30. | SRAM | Static Random-Access Memory |
| 31. | UART | Universal Asynchronous Receiver-Transmitter |
| 32. | USB | Universal Serial Bus |

LIST OF FIGURES

Figure	Caption	Page No.
1.1	Electroencephalogram (EEG)	1
1.2	MindWave Sensor	3
1.3	The brainwaves during specific tasks	5
1.4	Attention and Meditation scores For Attention Task	6
1.5	Attention and Meditation scores For Meditation task	6
1.6	Neurofeedback	7
1.7	An EEG headset with 256 electrodes	8
2.1	Drone and PCB	11
2.2	Soldering Station	12
2.3	Neurosky MindWave Sensor	13
2.4	Multimeter	15
2.5	Breadboard, Jumper Wires and Crocodile Clip Wires	16
2.6	Arduino MKR1000 Pin Description (Back)	17
2.7	Arduino MKR1000 (Front)	17
2.8	Capacitor 100uF, 100V	22
2.9	Resistors 220ohm	22
3.1	Case of Controller	23
3.2	De-Solder the joystick from the PCB	24
3.3	Single joystick component	25
3.4	PWM frequency on an oscilloscope	26
3.5	Low Pass Filter Sketch	27
3.6	Low Pass Filter	27
3.7	Low Pass Filters (four)	28
3.8	Output from Low Pass Filters through Jumper Wires	28
3.9	The output of the low pass filter on an oscilloscope	29
3.10	Complete Arduino Circuit Sketch	30
3.11	Complete Arduino Circuit	30
3.12	Arduino circuit attached to PCB	31
3.13	Boards Manager	32
3.14	Device Manager	33
3.15	Installing Arduino Drivers	34
3.16	Successful installation of drivers	35
3.17	Device Manager shows Arduino	36
3.18	Sketch Selection	36
3.19	Board Selection	37
3.20	Port Selection	37
3.21	Upload Button	38

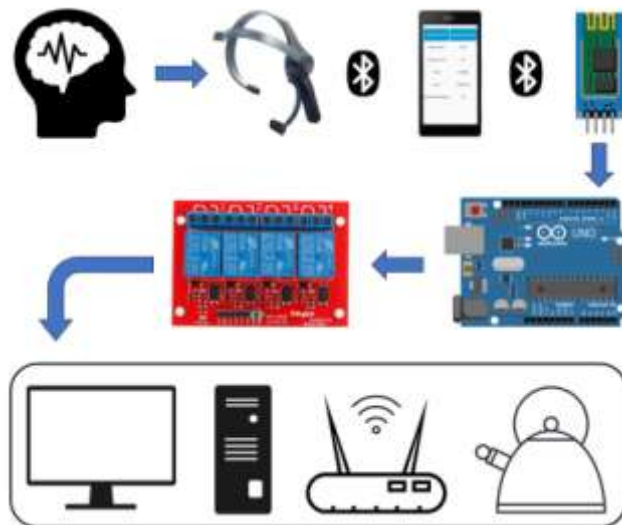
3.22	Arduino Circuit connected to Drone controller	39
3.23	Drone is now operational	40
3.24	Driver Disk	41
3.25	Holding the button for 3 seconds	41

ABSTRACT

Everybody has dreamt of controlling things through their mind at least once in their lifetime. We've seen the same, but just in movies and television. But today, in this era of high end technology, it's not too far when we'll be able to see devices and gadgets controlled through our minds. Such devices may even include cars, wheelchairs, home appliances, etc. It's just a matter of time.

Mind controlled devices may be extremely helpful for the aged or disabled people. Such devices may be life changing for the people suffering from paralysis or illnesses that bound them from physical movements. Even the able people would be able to use it for their convenience and luxury. It can be used for spiritual growth and meditation, it can sense attention levels, help us improve the way we think, it has a great scope in virtual gaming, and entertainment too. It's fascinating to even think about it, so why not work for it?

We'll basically be making a Mind Controlled Drone. To be honest, it won't work as a fully fledged drone, but even if it takes off via our brain signals, that would be an achievement for us. We'll be hacking a PCB to regulate it digitally via the signals of the Mind Wave Sensor.



Block Diagram

CHAPTER - 1

INTRODUCTION

1.1 Background:

Reading our mind seems fascinating. Brain scanning techniques like fMRI, or EEG are used to know our thinking process, mind status and our brain activity. All the experiments are done in research labs with high-tech devices. “The MindWave mobile”, is a transportable headset created to read our mind behaviour using EEG technology. We are able to experience it for fewer than 150 euros. How is it possible?

1.2 Electroencephalogram (EEG):

An electroencephalogram (EEG) is a non-invasive way to take a glance at the information electric signals in our brain. The check has been employed to assist conditions which include head accidents, headaches, brain tumours and dozing issues. Mind death can also be checked using EEG.

1.2.1 How does it work?

There are billions of nerve cells in our brain. These cells produce electric signals to our MindWave. During an EEG, small electrodes and wires are attached to our head. The EEG system increases the alerts and knowledge the output into wave pattern on laptop display.

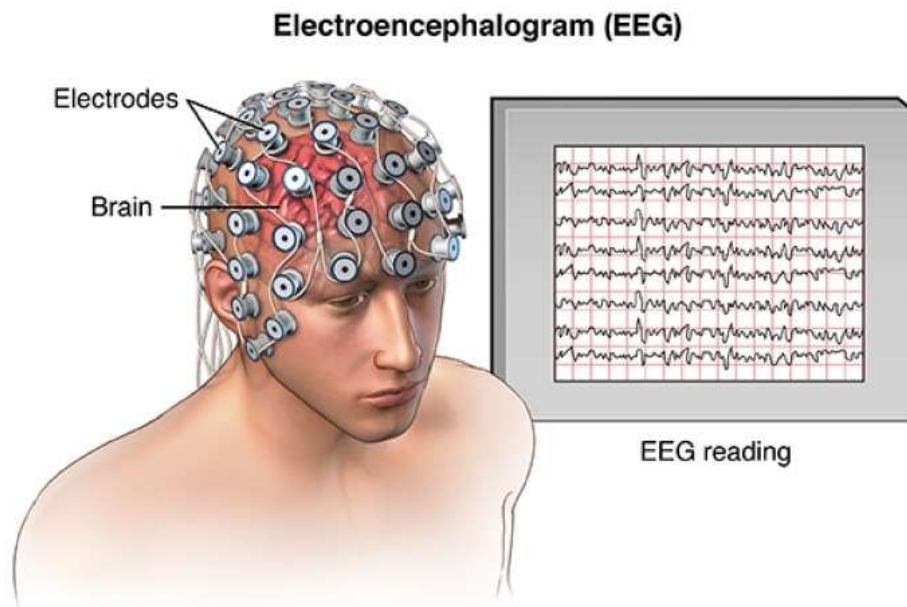


Figure 1.1: Electroencephalogram (EEG)

1.2.2 Several different ways to conduct an EEG:

- *Standard EEG* scanning is done in the office and typically takes more than 1 hour. It's better to take a snooze-deprived EEG, you need to possess only four hours of sleep. When our brain is burdened or fatigued abnormal brain patterns appear. This test may take two to three hours.
- *Ambulatory EEG* will require wearing a transportable EEG recorder around your waist to note the readings for certain days. The EEG recorder in conjunction with a diary you maintain of every day sports and drug dosages allows the medical doctor to understand the reason of unique EEG recordings.
- *Video EEG* monitoring is in specialized centres for patients suffering with frequent seizures or dozing issues. You are monitored both by way of EEG and a digital video camera. In this way your body behaviour is also monitored at the identical time as your EEG, to reason your condition.

1.2.3 What does an EEG show?

An EEG measures your mind energy waves. It's most commonly accustomed to know the kind and foundation of seizures.

An EEG is of price for diagnosing epilepsy best if it detects usual patterns of epilepsy. If it doesn't locate the proper styles, you will nevertheless have epilepsy and video EEG may be necessary to be sure about the condition.

EEG may also detect abnormal brain waves after a stroke, or neoplasm. Situations which include dizziness, headache, and snoozing issues can also show extraordinary mind patterns. It can also be accustomed verify mind loss of life.

1.3 MindWave Sensor and its working:

EEG stands for electroencephalography and it's relatively less-expensive mode of brain scanning. It reads our brain activity. We have billions of neurons in our brain which control our thoughts. The EEG headset reads the neuron frequencies via studying the electric powered interest of the neurons. Scientists have classified these frequencies in a sort of frequency bands. All the frequency bands are related to numerous states of mind:

- Delta waves (1-3 Hz): Deepest meditation and deep sleep
- Theta waves (4-7 Hz): Normal sleeping and normal meditation
- Alpha waves (8-12 Hz): Relaxation/reflection
- Beta waves (13-30 Hz): Active thinking, focus, anxiety

- Gamma waves (31-50 Hz): Conscious perception

Electrodes on scalp measure the EEG. These headsets may have the maximum amount as 256 electrodes to measure brain activity. They need such a big amount of electrodes to read mind interest in step with brain place. The Mind Wave cell has simplest 1 electrode that the Mind Wave mobile isn't successful to look at mind area particular but is pretty reasonably-priced.

We can join the Mind Wave cell through Bluetooth in order to play cognitive or video games. Games where you need "attention" or "meditate" to reach an aim, like switch on lights, or elevate a ball. Through above mentioned frequencies, we know that meditation and attention are the other brainwaves. Therefore, it must be enormously smooth for the device to decide among them.



Figure 1.2: Mind Wave Sensor

1.4 Methods:

For testing whether the Mind Wave cellular measures our awareness, it must provide returned distinctly centered scores when we're essentially focused. So, we would like to understand that we are focused, to get important result. The appliance (EEG ID) can give us the information. The appliance is capable to read brainsignals from the Mind Wave cellular. It additionally filters the knowledge & interprets into 2 rankings: "interest" and "meditation".

In order to test the working of device, we will assign certain tasks in "meditation mode" and "attention mode". These tasks can be done laying on bed to cut back the body motion to detect result. First, we will check the person's brainwaves activity with respect to the tasks, and then we are able to appearance how the filtered fact corresponds to the responsibilities.

1.4.1 Meditation-task

The best way to check the meditative-wave is meditation. We will try different postures for 15 minutes and target on our breathing. We expect to see lower frequencies during this meditation duty.

1.4.2 Attention-task

For this task we will play games to check us focus "Mind Games pro". These are Brain Games which need better attention to get correct rankings. We will play the sport "attention training" & "divided attention" to be positive that we have high attention.

1.5 Results:

Notice that when we wear our MindWave cell it might take us a minimum of quarter hour to connect. Consistent with some applications, we need to regulate it fairly on our head to induce a correct signal. Our smallest mistake may alter the EEG wave activity. Keep on checking whether the headset is placed properly on your head to catch better signals.

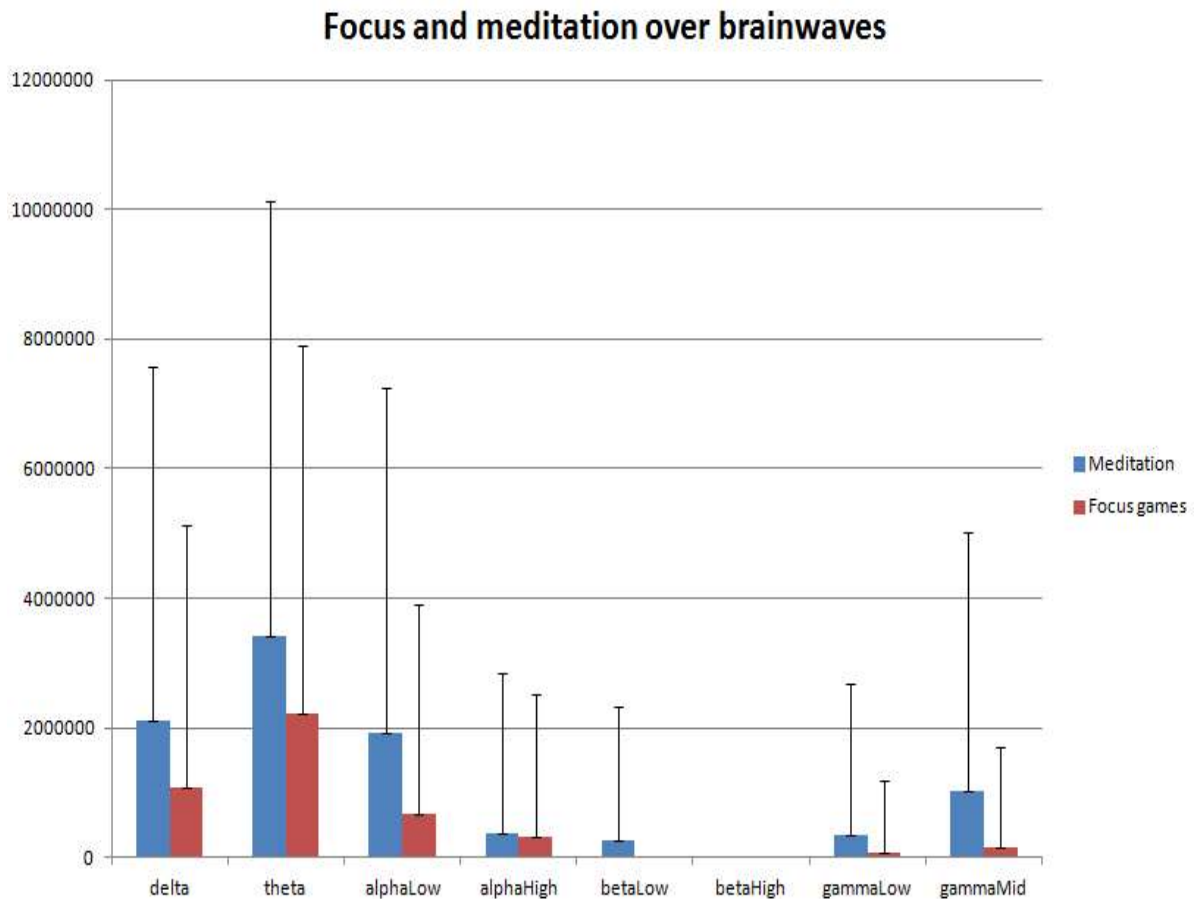


Figure 1.3: The brainwaves during specific tasks

Lower frequencies should be visible during meditative task, while the higher frequencies should be seen during Brain Games. In graph1, our brain is somewhere equally meditative and focussed in the focussed task.

In graph2, our brain is more meditative and somewhat less focussed in the meditation task.

1.6 Filtered data:

So once we are laying down, noises are still in the data. Thankfully, the EEG ID application uses filters to cut back the noise. The filtered records are modified in rankings; “meditation score” and “interest rating”, on a scale of zero-hundred.

1.6.1 Attention-task

While doing our “interest-venture” the actual fact offers again two ratings; meditation and attention score. There wasn’t much difference in both the mind states. The brainwaves were closer.

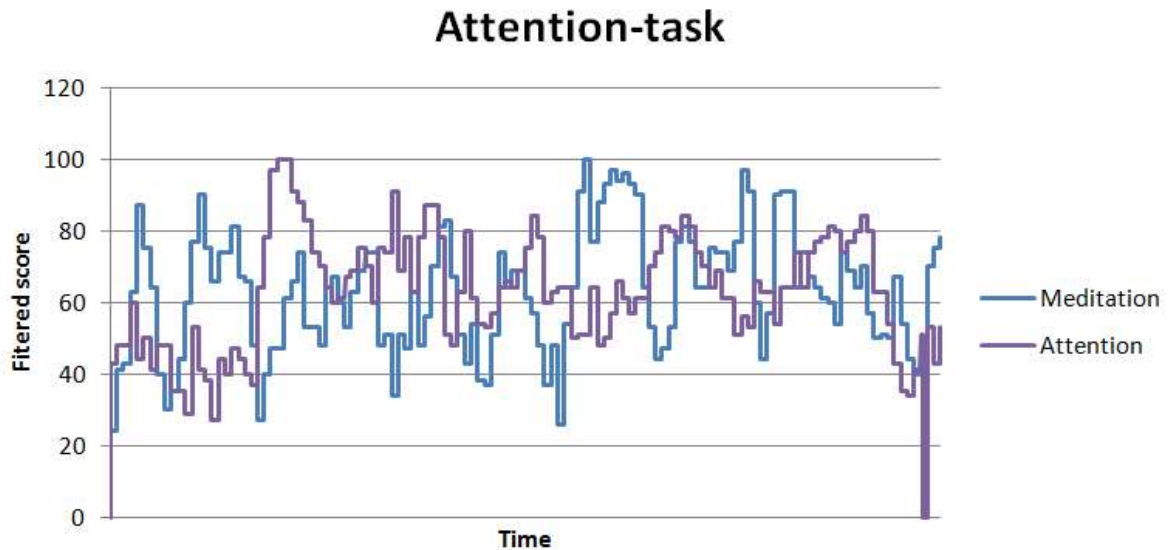


Figure 1.4: Attention and Meditation scores during Attention Task

1.6.2 Meditation-task

During the meditation task the brainwaves for both the mind states were more distinct, over the time meditative reading increased

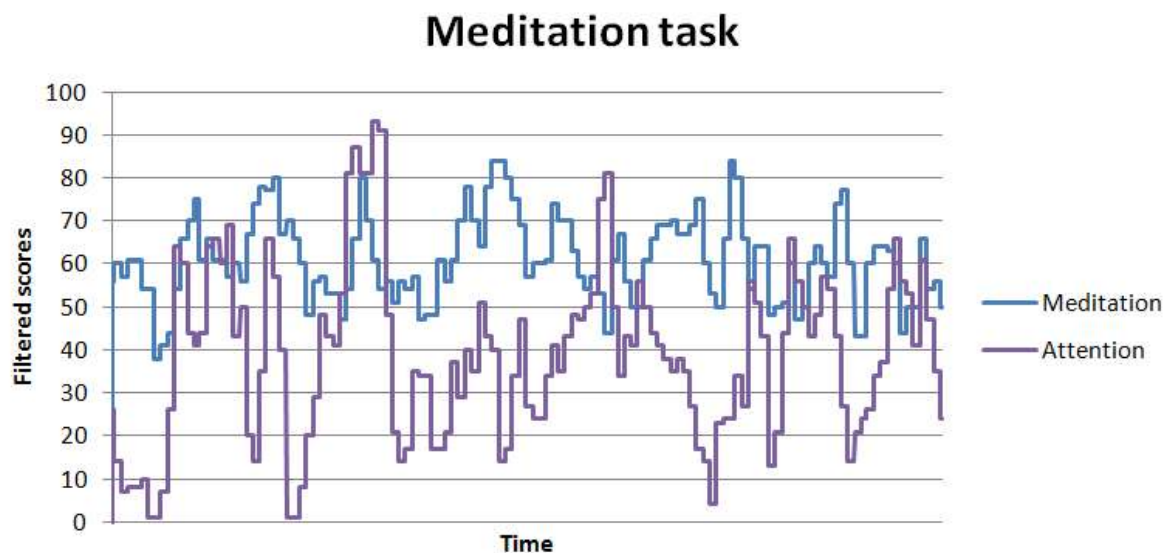


Figure 1.5: Attention and Meditation scores during Meditation task

1.7 Discussion:

The unfit records through the Mind Wave cell show large amount of noises in both the tasks. Even when we would not move any muscle and try to relax and lay down, we found excessive noise in the received records. Even the Mind Wave cell hesitates to avoid or get rid of these noises. So, we use the app in order to filter the rankings. The filtered “attention” and “meditation” rankings would help in working of tool to a great deal.

The brainwaves pattern showed different results during the meditation task from the pattern showed by brainwaves during the attention task. In the meditation task the variation was clearly visible; however during the focus (attention) task variations were not very clear. Maybe they were too focused on playing games that it overlapped.

1.8 Future possibilities of reading brainwaves:

Studying brain signals has many features and advantages. The first thing we may do is to have command on our thoughts with EEG headset. To achieve this think “I want to switch on the light”. The EEG headset is incapable to study our mind, it can understand the pattern of our brainwaves. This way, headset gathers knowledge about our brain pattern and making it easier to control things with our mind.

Secondly we need to learn our personal abilities through EEG headset. For instance; Theta-wave hobby is related to good reminiscence consolidation. Alpha-brainwaves of Musician’s are higher once they concentrate to trace as compared to common human beings.



Figure 1.6: Neurofeedback

There's something even more exciting stated as Neurofeedback. Neurofeedback flaunt our brainwaves to us directly and therefore we need to influence our brainwaves, with the idea to improve performance. Dozens of studies are finished on Neurofeedback. One have a glance at confirmed that with education individuals revealed to suppress Theta-wave activity are applied higher on attention-duties. Neurofeedback education is perhaps obliging to deficient cognitive problems and fatigue. Neurofeedback may be friendly for fibromyalgia-patients, although plenty of studies are not positive several studies showed that at the identical time as contributors had been capable of modulate their brainwave activities, their performance did not exchange.

Studies show some thrilling possibilities with business use, in spite of our technology growth; we still need to get there. Mindwave activity detects brain signals for specific region and our headset being a single-electrode device, and makes it impossible to study any particular region. EEG-headsets that are employed in studies have up to 256 electrodes and measure particular brain regions. Wet electrodes work better to dry electrodes.



Figure 1.7: An EEG headset with 256 Electrodes

1.9 Conclusions:

Everyone is ready to find the MindWave Mobile measure between attention and meditation up to a point. Noises within the measurements and unattached-electrode have been an issue to measure exclusive brainwaves precisely. But we cannot blame anyone as Neurosky never claimed that the Mind Wave mobile is capable of measure unique brainwaves.

For now, the Mind Wave mobile is simply a fun test to check where we can we use our attention and meditation. Neurosky was brave enough to start fresh, very exciting idea in the growth of economic EEG headsets. Hopefully, future headsets will have better electrodes & therefore will give higher results.

CHAPTER - 2

HARDWARE DESCRIPTION

2.1 Parts list:

- Drone and controller
- Soldering Station & accessories (copper wire, de-solder pump, tin, solid wires)
- Multimeter
- MindWave sensor
- Arduino MKR1000
- Breadboard
- 4* 100uF capacitors
- 4*220Ω Resistors
- 12* Jumper wires
- 6 Crocodile clip wires
- We require 4 resistors (unknown value)

2.2 Description:

2.2.1 Drone-PCB:

- We may drone of our choice. The comptrollers work with two-axis joysticks. We'll bypass these joysticks.
- We can get any kind of drone from Amazon or Flipkart.
- This controller requites 4* 1.5V batteries which makes it totally 6.0v.
- This voltage isn't equal to the output of the Arduino MKR1000.
- So, we'll only use two batteries.
- It is feasible to opt any Arduino, but we've to remember that we may damage the board if we exceed the voltage our PCB can hold.
- The PCB should be opened carefully or it can break.



Figure 2.1: Drone and PCB

2.2.2 Soldering Station:

- A soldering station is required for de-soldering PCB's joystick components.
- We also need to solder resistors and solid core wires into the PCB.
- A solder with sharp tip is preferred.
- Solder must be used carefully as it gets very hot and can cause harm to us.
- Wearing some kind of gloves may reduce the risk of getting burns.
- Perform the soldering operations with someone's guidance.



Figure 2.2: Soldering Station

2.2.3 Neurosky MindWave Sensor:

NeuroSky, Inc. is a manufacturer of Brain-Computer Interface (BCI) technology for consumer product applications, which became geographically located in California. The company modify electroencephalography (EEG) and electromyography (EMG) in order to form customer retail for enjoyment (video games), training, and vehicle.

NeuroSky tech permits low-price EEG-employed in studies & merchandise less expensive dry sensors; past versions of EEGs require application of a conductive gel on the sensors and the head. The system encompass integral electric-powered “noise” software program. Neurosky extensively is a gadget manufacturer taking element builders, and research to install into their products and structures.

The Mind Wave Mobile 2 headset converts our laptop into a brain hobby screen. The headset effectively measures brainwave patterns and video display the attention levels of humans as they interact with numerous apps. This headset is beneficial for building apps for fitness, training and enjoyment.

The Mind Wave family consists of Mind Wave and Mind Wave Mobile 2 headsets. The Mind Wave is designed for PCs and Mac, while the Mind Wave Mobile 2 is well suited with PCs, Mac and mobile gadgets much like the iPhone, iPad, and Android.



Figure 2.3: Neurosky MindWave Sensor

For trying out whether the MindWave mobile measures our brainwaves accurately, it must

provide great level of concentration to the specific target. So, we need to understand that with proper mind control and concentration, we will get required data. The software used for EEG can deliver us the results. The software examines the brain signals from the MindWave cell and sends information. It also clean the records and represent it into two terms: “interest” and “meditation”.

In order to check the accuracy and working of this device we need to assign ourselves with certain tasks/duties to show our brainwave communication in “meditation mode” & “attention mode”. The above tests can be performed by laying down to lessen the movement and notice the facts recorded by the MindWave mobile. Firstly, we are able to see how the MindWaves communicate to the given task, and then we can see how the filtered statistics depict our brain actions.

2.2.4 Multimeter:

- A multimeter is required to check voltages of the joystick.
- The voltage of PCB must match with the voltage of Arduino.
- It is also used to find the value of resistances which are used in the project.



Figure 2.4: Multimeter

2.2.5 Breadboard, Jumper Wires and Crocodile Clip Wires:

- The circuit is to be made on the breadboard.
- The Arduino MKR1000 is mounted on the breadboard.
- Jumper wires (Male to Male) are used to connect the Arduino Pins to their respective Low Pass Filters.
- Low Pass filters are further connected to respective pins of the PCB of the Drone through Crocodile clip wires.



Figure 2.5: Breadboard, Jumper Wires and Crocodile clip wires.

2.2.6 Arduino MKR1000:

The Arduino MKR1000 stands for “Maker 1000”. Arduino is used in IOT tasks since it has a feature of on-board Wi-Fi function. It additionally runs on 32-bit structure making it fast and more dependable with encryption. Arduino is designed for beginners as it simpler to induce for those who are starting with IOT initiatives and have less idea on networking.



Figure 2.6: Arduino MKR1000 Pin Description (Back)



Figure 2.7: Arduino MKR1000 (Front)

Arduino MKR1000 supplies a practical and value-effective solution with additional Wireless Fidelity affinity feature to the projects with sightest knowledge in networking. This may be specifically designed for IoT and gadgets.

It is totally based at the Atmel ATSAMW25 SoC.

The Arduino circuit includes batteries connected to the Arduino/Genuino MKR1000 circuit to run on battery power or we may also use the exterior 5V (working on outside strength). Supply switching is performed spontaneously.

It is a proper 32bit structure, the standard wealthy, small energy Wi-Fi. We can use the Arduino Software (IDE) for programming. It is the desired board for the rising IoT element form tasks.

The board is supplied with 5V through USB slot.

Different from other Arduino & Genuino forums, the MKR1000 works at 3.3V. Thus, 3.3V is the maximum tolerate able voltage for I/O pins. If any I/O pin is supplied with voltages higher than 3.3V, it will harm the board. Therefore, we use two batteries of 1.5V each making total of 3V.

Technical Specifications:	
Board Power Supply (USB/VIN)	5V
Supported Battery (*)	Li-Po single cell, 3.7V, 700mAh minimum
Circuit Operating Voltage	3.3V
Digital I/O Pins	8
PWM Pins	12 (0, 1, 2, 3, 4, 5, 6, 7, 8, 10, A3 - or 18 -, A4 -or 19)
UART	1
SPI	1
I2C	1
Analog Input Pins	7 (ADC 8/10/12 bit)
Analog Output Pins	1 (DAC 10 bit)
External Interrupts	8 (0, 1, 4, 5, 6, 7, 8, A1 -or 16-, A2 - or 17)
DC Current per I/O Pin	7 mA
Flash Memory	256 KB
SRAM	32 KB
EEPROM	No
Clock Speed	32.768 kHz (RTC), 48 MHz
LED_BUILTIN	6
Full-Speed USB Device and embedded Host	
LED_BUILTIN	6
Length	61.5 mm
Width	25 mm
Weight	32 gr.

2.2.7 Resistors and Capacitors:

- We will make Low Pass Filters using resistors and capacitors.
- Resistors are soldered within the PCB of the Drone.
- Low Pass Filter is used to transform Digital signal to Analog signal (DAC).

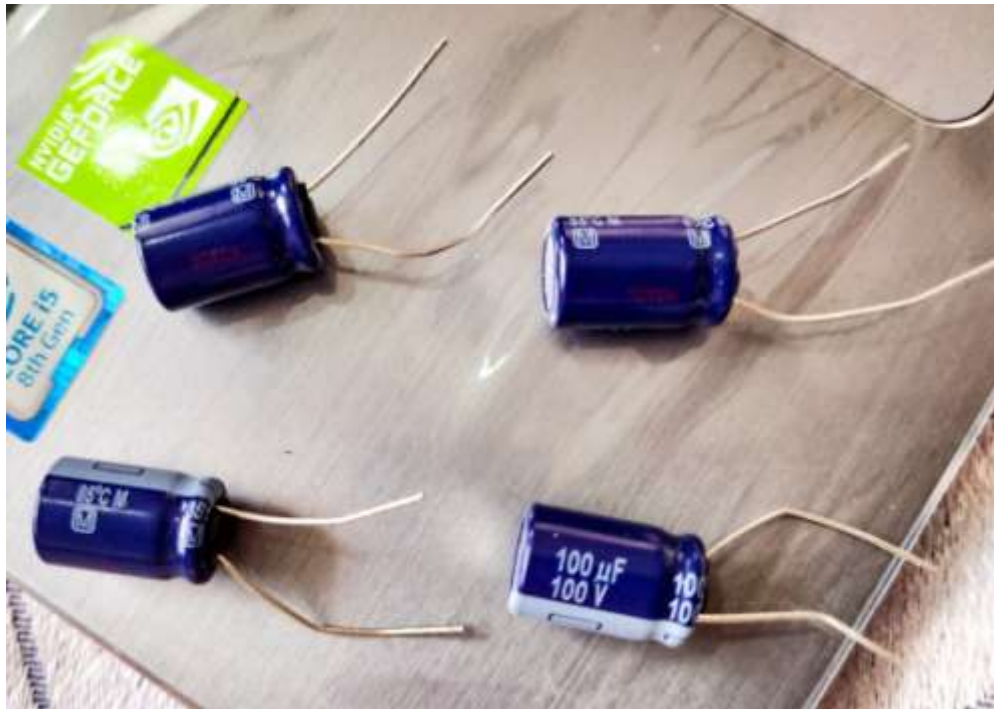


Figure 2.8: Capacitor 100uF, 100V



Figure 2.9: Resistors 221 ohm

CHAPTER-3

DESIGN AND IMPLEMENTATION

3.1 Drone PCB:

Any drone can be used. The comptrollers work with joysticks. We will bypass the joysticks.

- This comptroller makes use of 1.5V batteries, using two batteries will be approximate 3.3v. This voltage is similar to the output of the Arduino MKR1000.

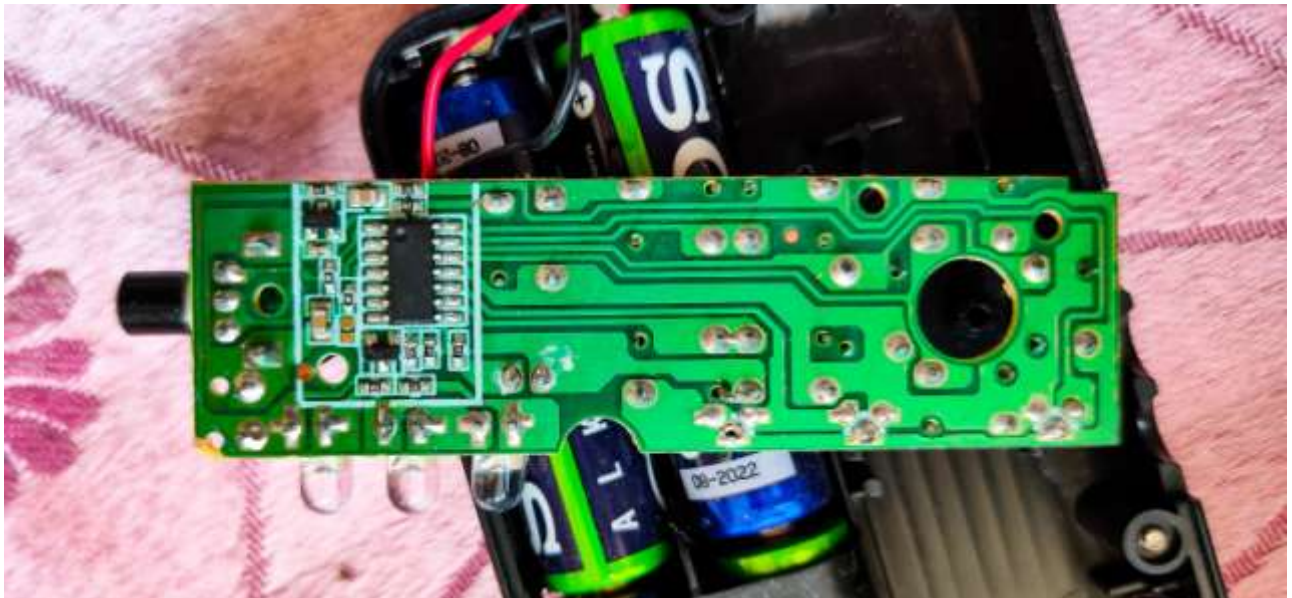


Figure 3.1: Case of Controller

- We may use any Arduino, however we should be conscious not to exceed voltage that PCB may hold or we will harm the breadboard.
- Measure the voltages of the joysticks.

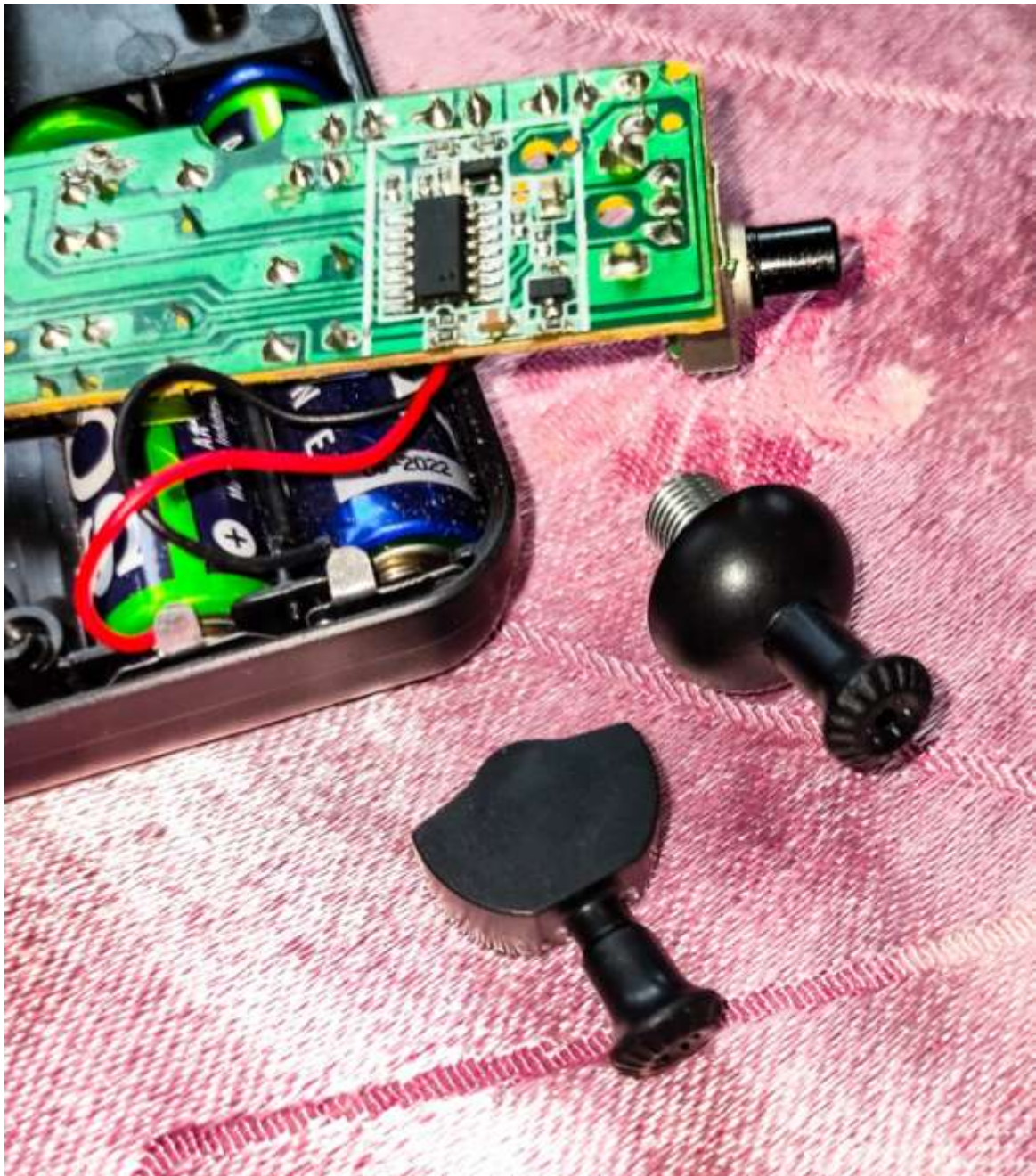


Figure 3.2: De-solder the joystick additives from the PCB.

- In fact these joystick acts unit of measurement simply potentiometers.
- A potentiometer is associate analogue rheostat.
- Attach the multimeter to the + (Plus sign) & – (Minus sign) .
- Fix four resistors to the + (Plus) and – (Minus) of the controller.

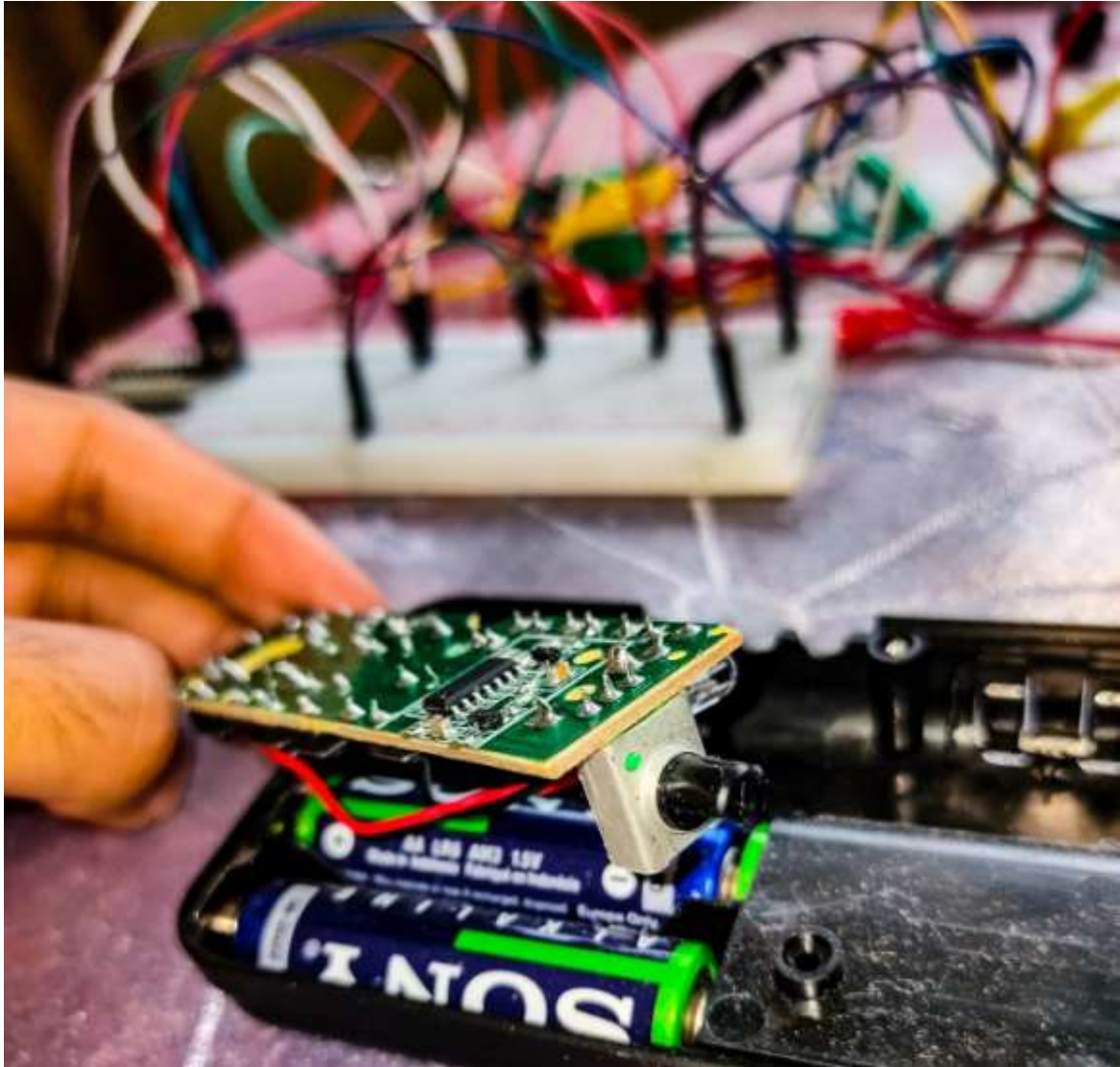


Figure 3.3: Single joystick component

- Also, solder middle wires to the + (B+) and - (B-) ports at the PCB.
- And solder middle wires to the sign ports of the joysticks.
- Our controller is ready for the succeeding step.

3.2 Digital to analogue:

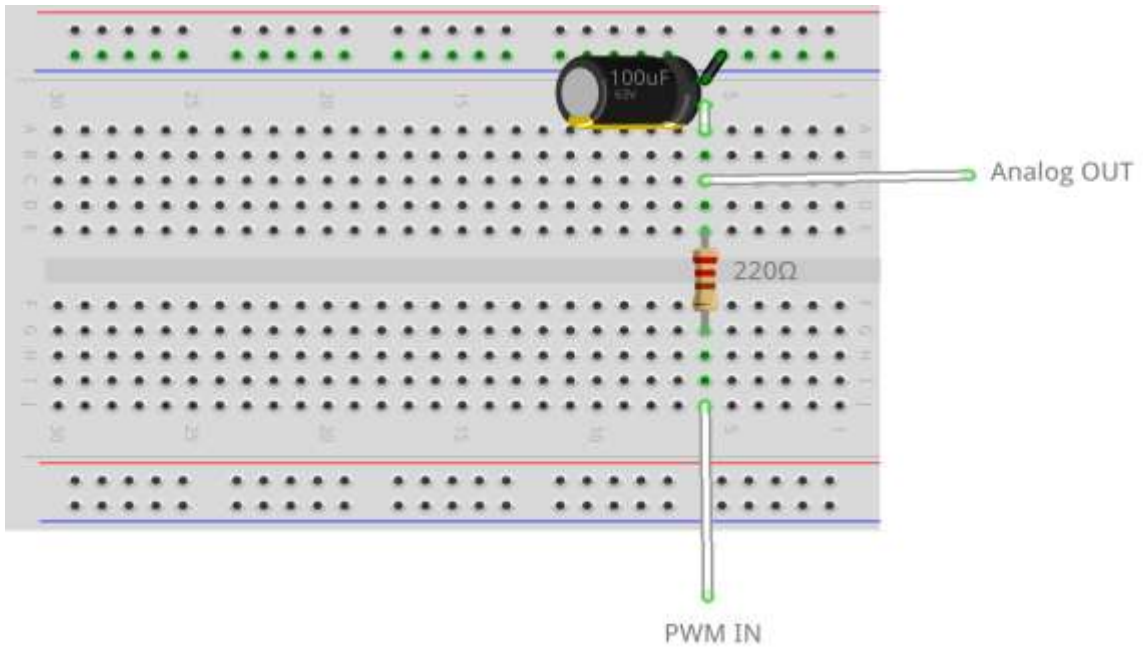
The product may be a PWM signal

The PCB is now expecting a consistent voltage.



Figure 3.4 PWM output on an oscilloscope

- We may use a diversity of DAC converters such as a DAC chip to generate an analog value.
- Using any other option will make the process longer, we want to make a simple circuit so we use a Low Pass Filter, to deliver the specified product.
- We will use a capacitor and a resistor, to create a Low bypass filter,



fritzing

Figure 3.5: Low Pass Filter Sketch

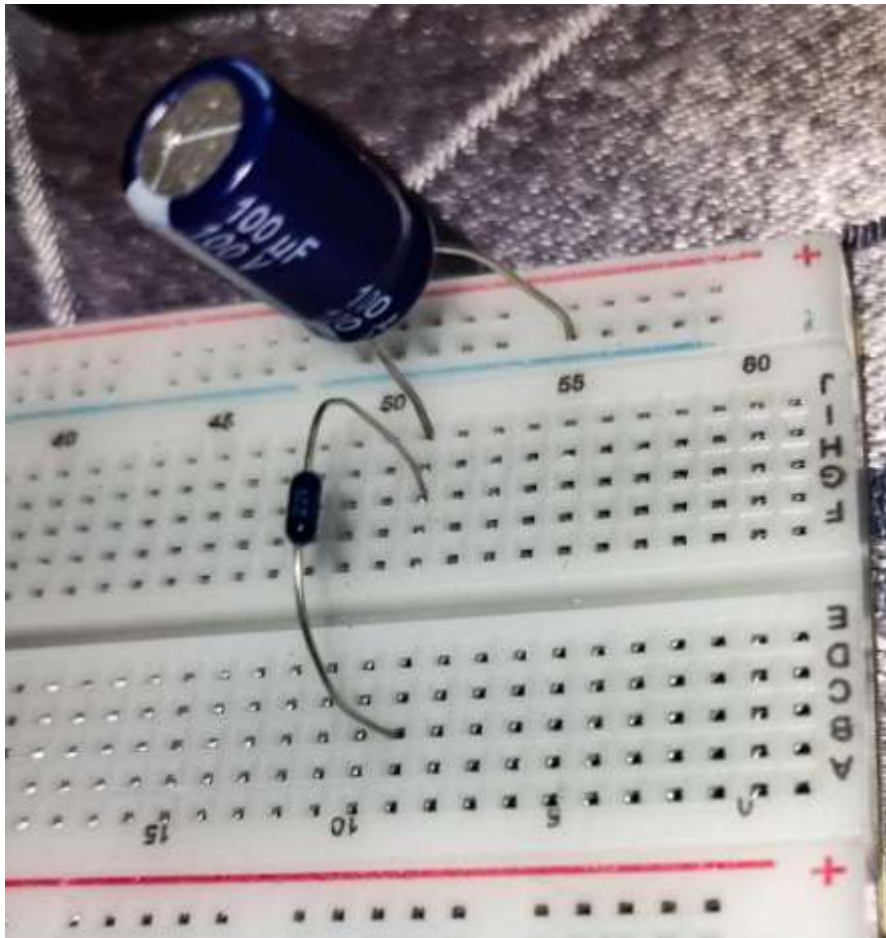


Figure 3.6: Low Pass Filter

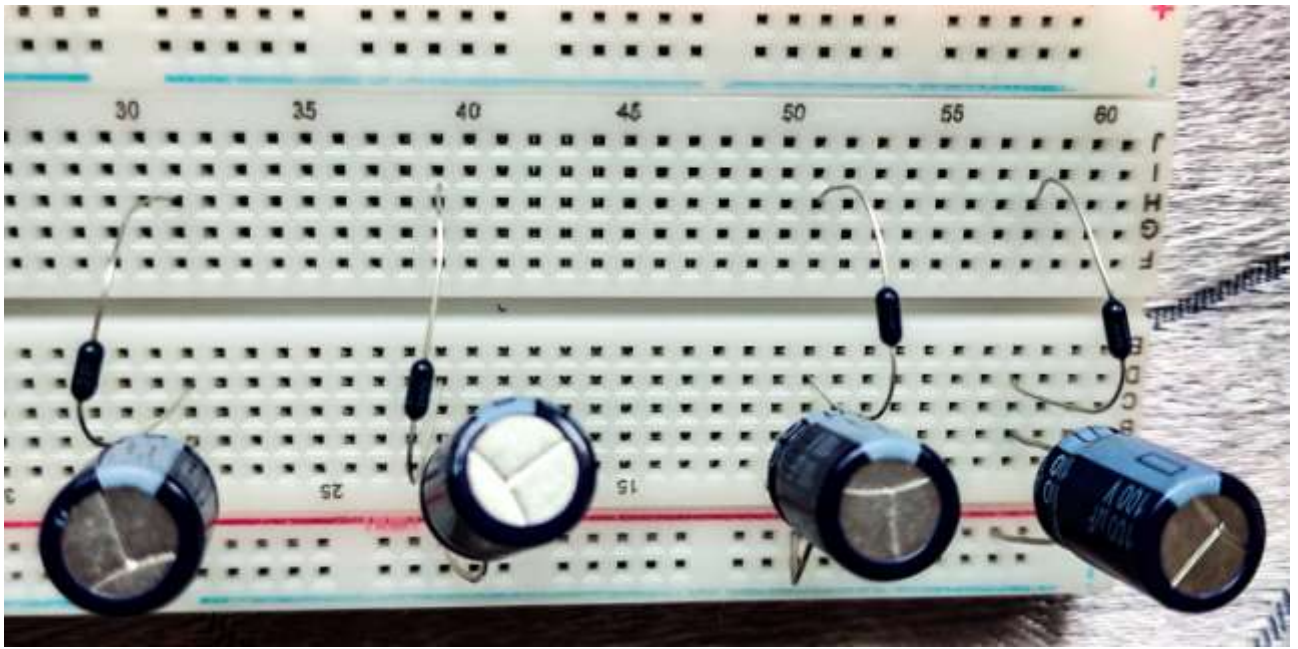


Figure 3.7: Low Pass Filters (four)

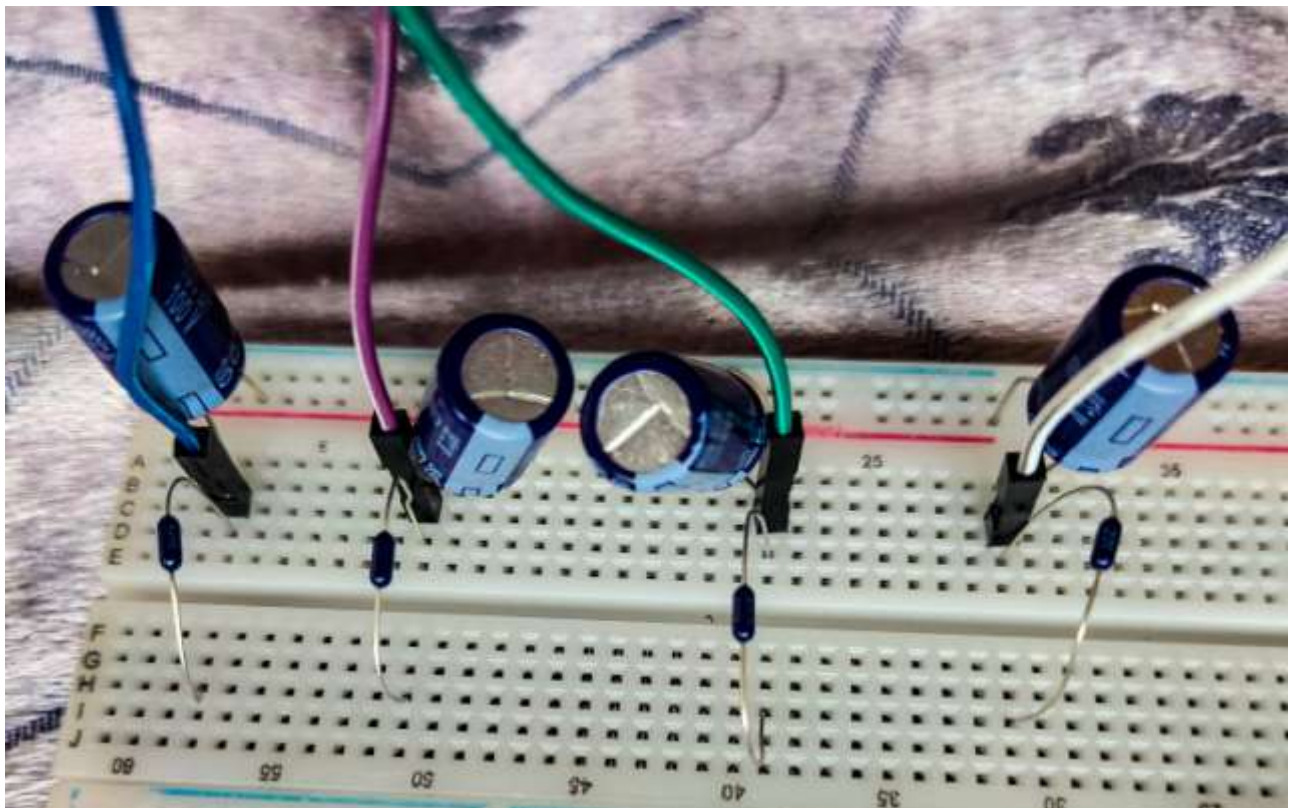


Figure 3.8: Output from Low Pass Filters through Jumper Wires

The attribute of a low bypass filter out is that the analog voltage will progressively alternate.

This ckt gives us the preferred final results and uses a low amount of components.

We use Low pass filter as it is easy and fast, thus gives us consistent voltage.

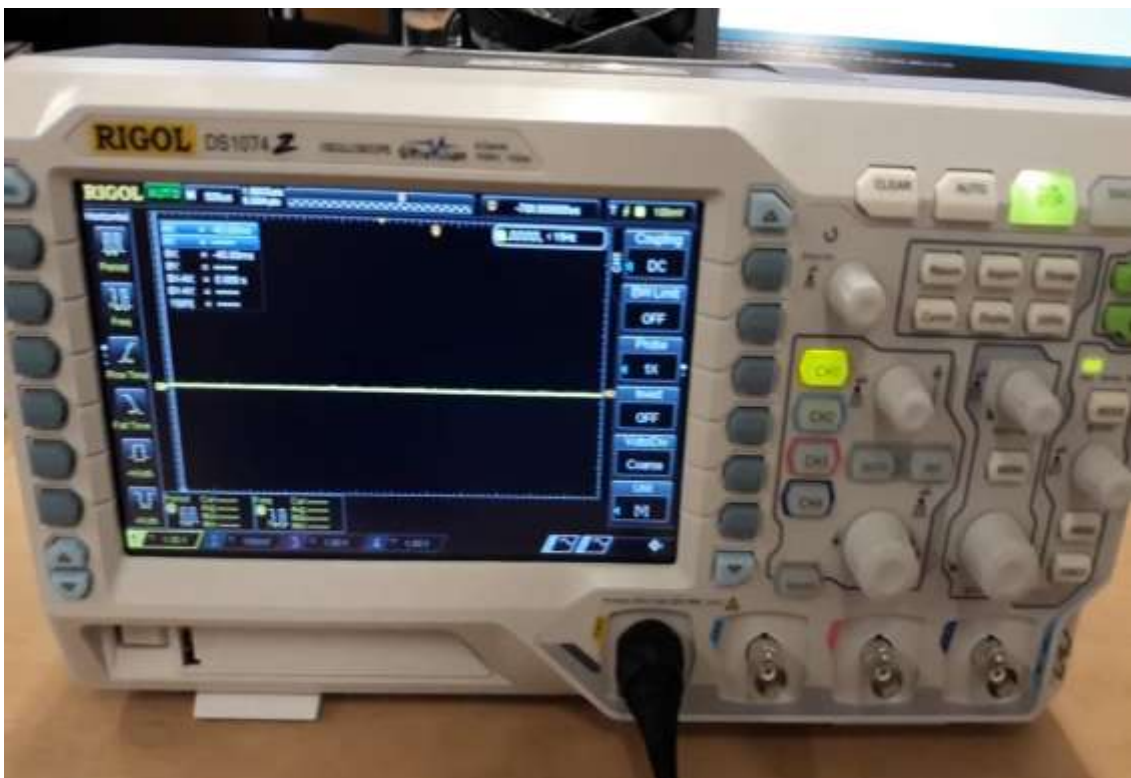


Figure 3.9 The output of the low pas filter on an oscilloscope

3.3 The Arduino Circuit:

The low bypass filter is primary and important in the below figure. Make 4 low pass filters in a row and we've got an analog voltage for all 4 inputs.

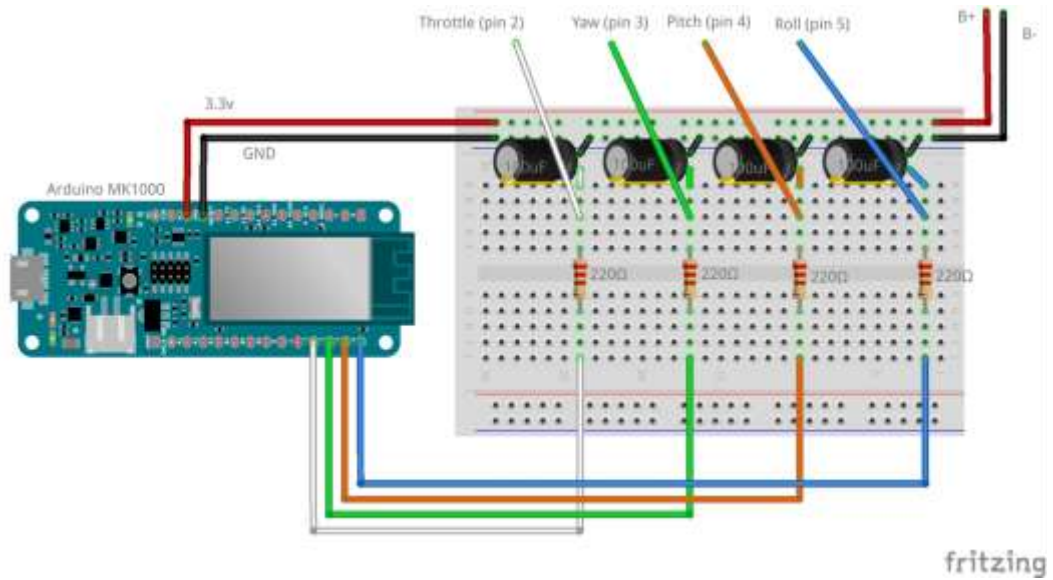


Figure 3.10: Complete Arduino circuit sketch

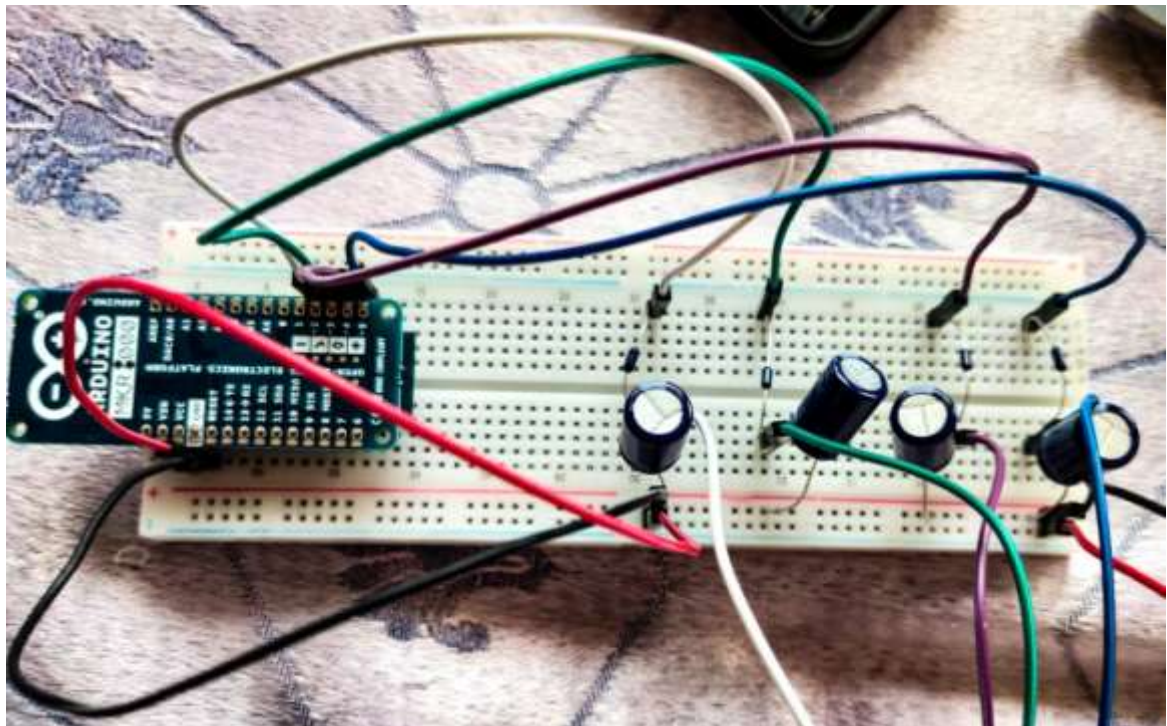


Figure 3.11: Complete Arduino Circuit

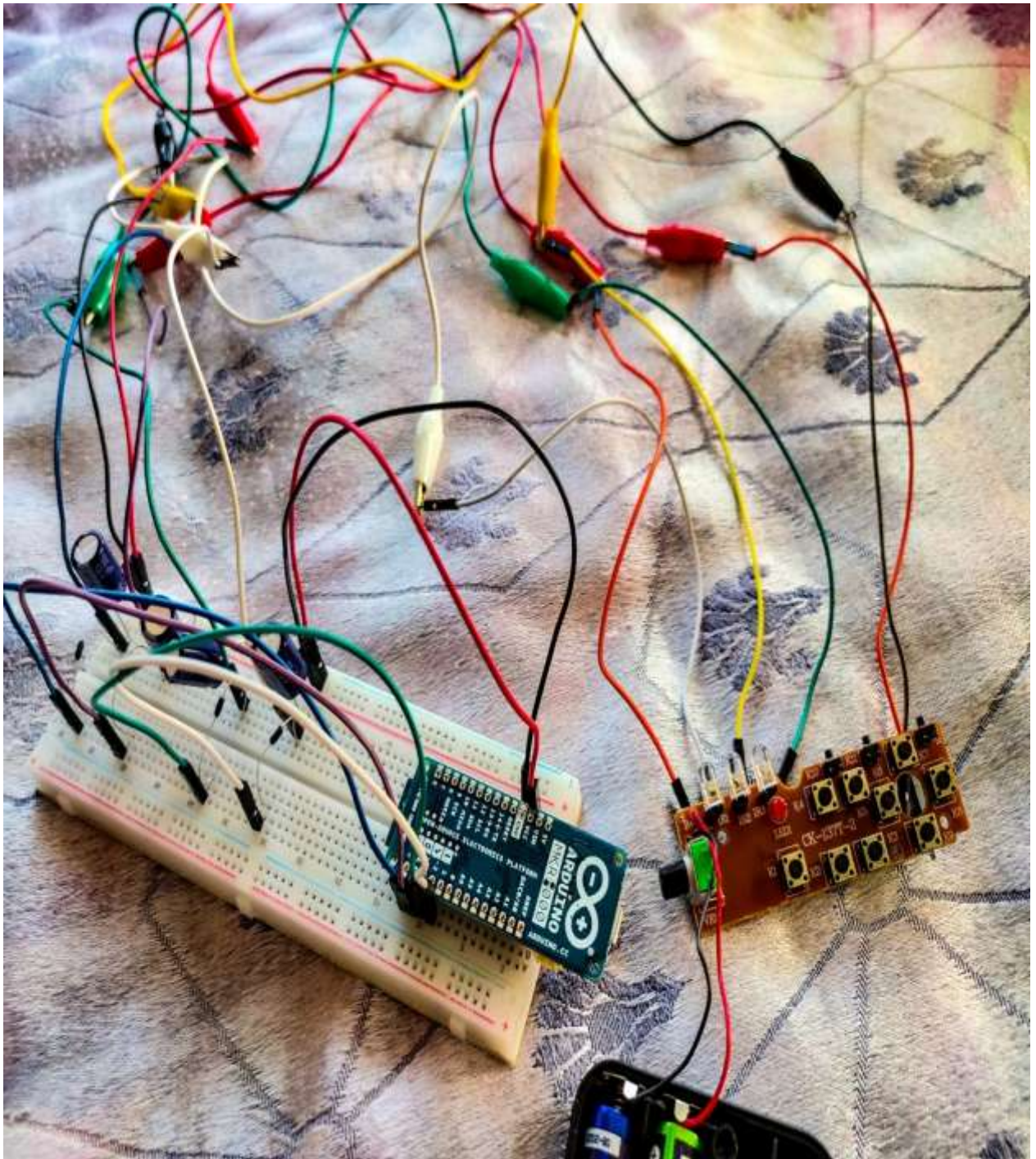


Figure three.12: Complete Arduino Circuit connected to PCB

3.3.1 Use your Arduino MKR1000 at the Arduino Desktop IDE

In order to make your MKR1000 work while offline, use Arduino Desktop IDE and upload the Atmel SAMD Core.

Choose Tools menu > Boards > Boards Manager.

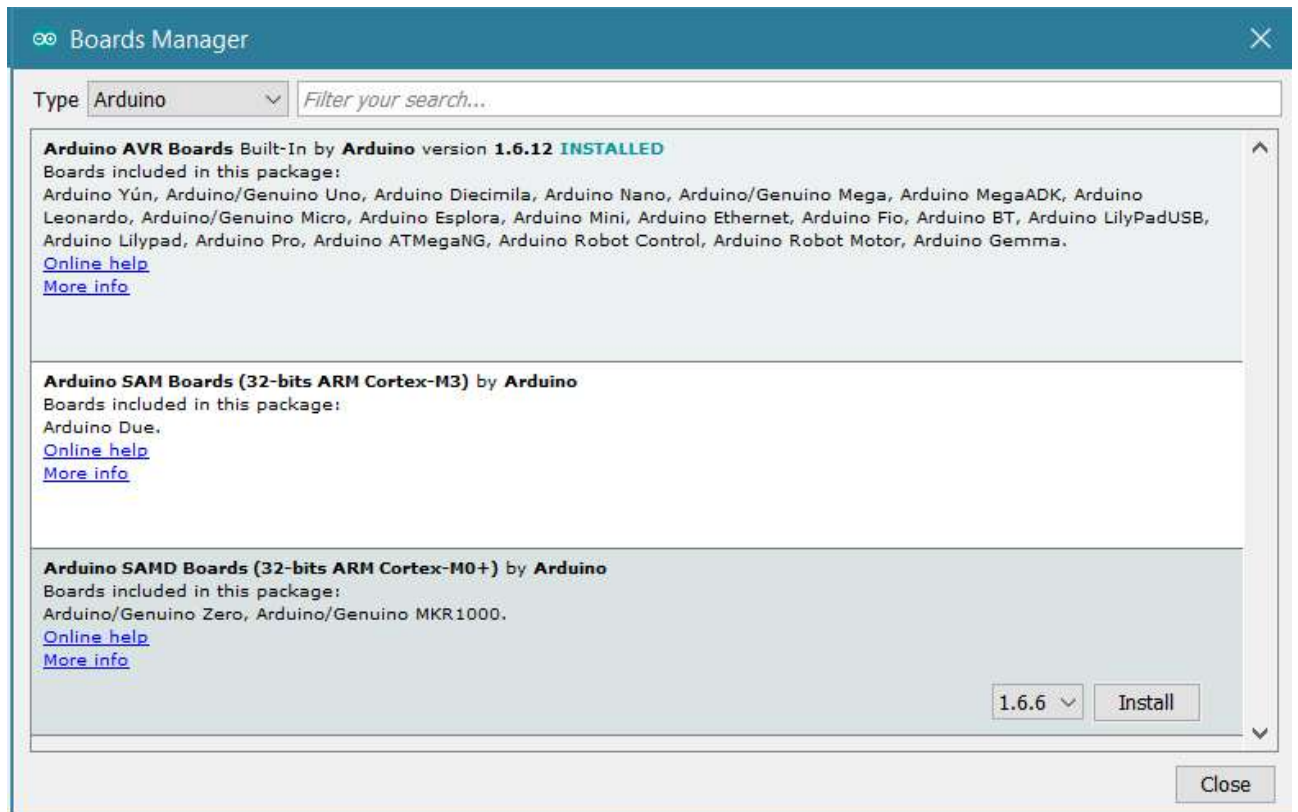


Figure three.13: Boards Manager

3.3.2 Installing Drivers for the MKR1000

With the SAMD center established, proceed with the thrust founded.

OSX

- No thrust installation is crucial on OSX. Hoping on OS, you will get a conversation field asking you to open the “Network Preferences”.
- Click on "Apply".
- The MKR1000 will show up “Not Configured”, while it’s running. You can end the System Preferences.

Windows (examined on 7, 8 and 10)

- Connect the MKR1000 with a USB cable (on PC). Windows will display that the board is connected. Inform the windows wherein the thrust is.
- Click on Menu > “System and Security”(in board navigate).
- Click on System, open the Device Manager. Find among listing “Ports (COM & LPT)”. Figure out an open port named “MKR1000”.

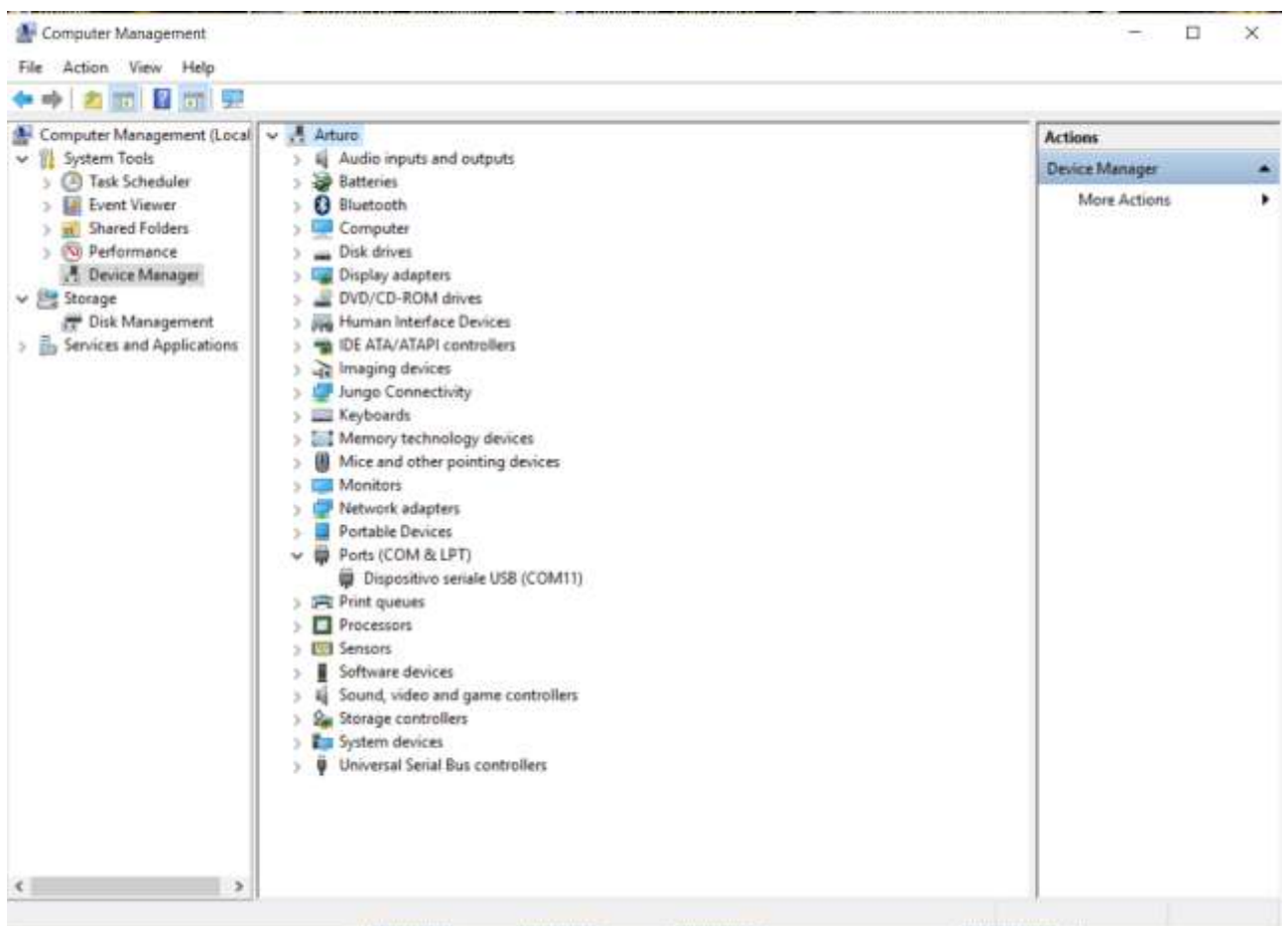


Figure 3.14: Device Manager

- Right click on the “MKR1000” and “Update Driver Software”.
- Select the “Browse my PC for Driver software” option.

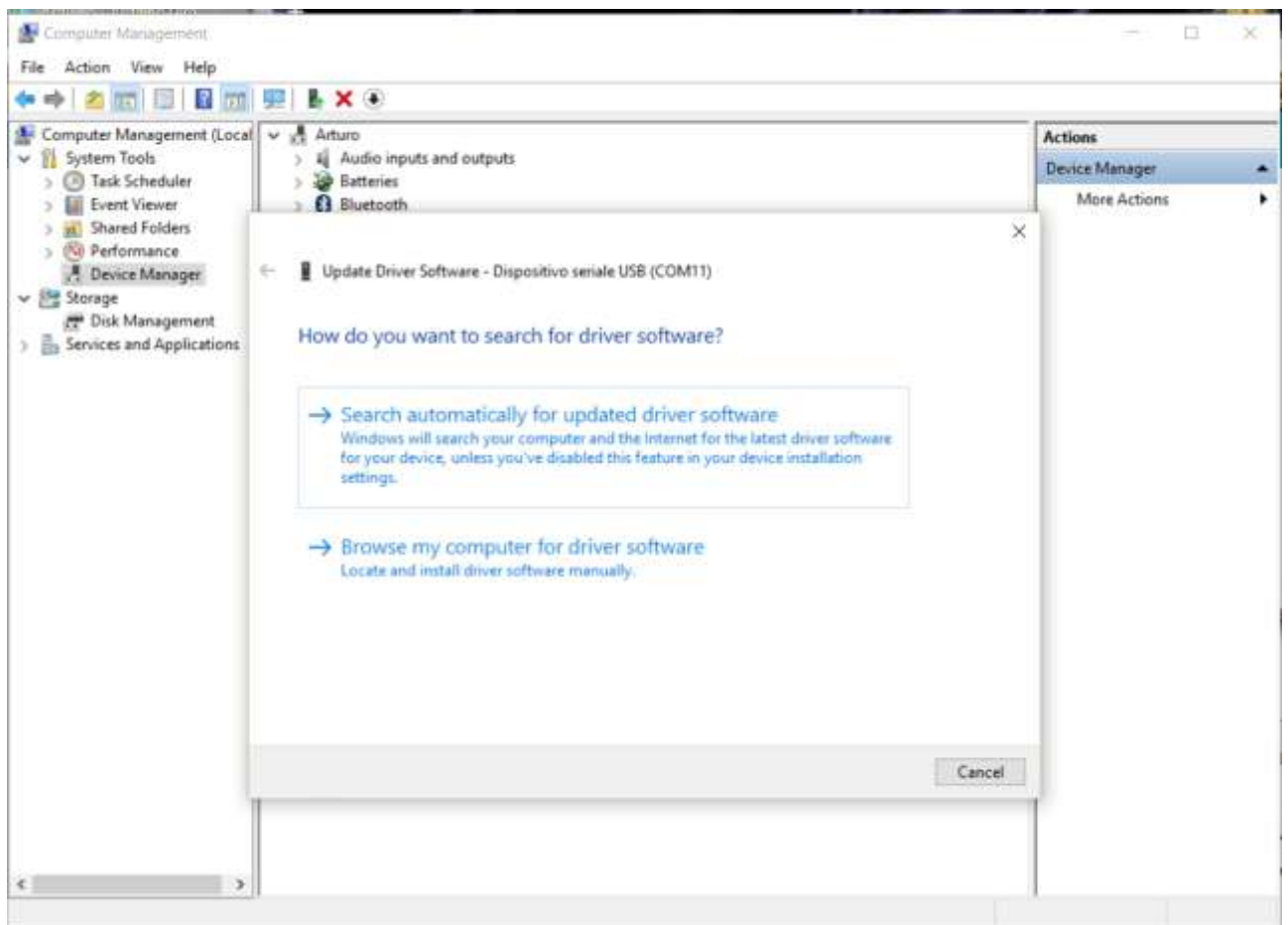


Figure 3.15: Installing Arduino Drivers

- Unzipped the Arduino Software you downloaded earlier. Find and choose the “Drivers” folder inside the foremost important Arduino folder (no longer the “FTDI USB Drivers”). Press “OK” then “Next”.
- If any warning is displayed approximately not passing Windows Logo trying out, click “Continue Anyway”.
- Driving force installation will be proceeded.

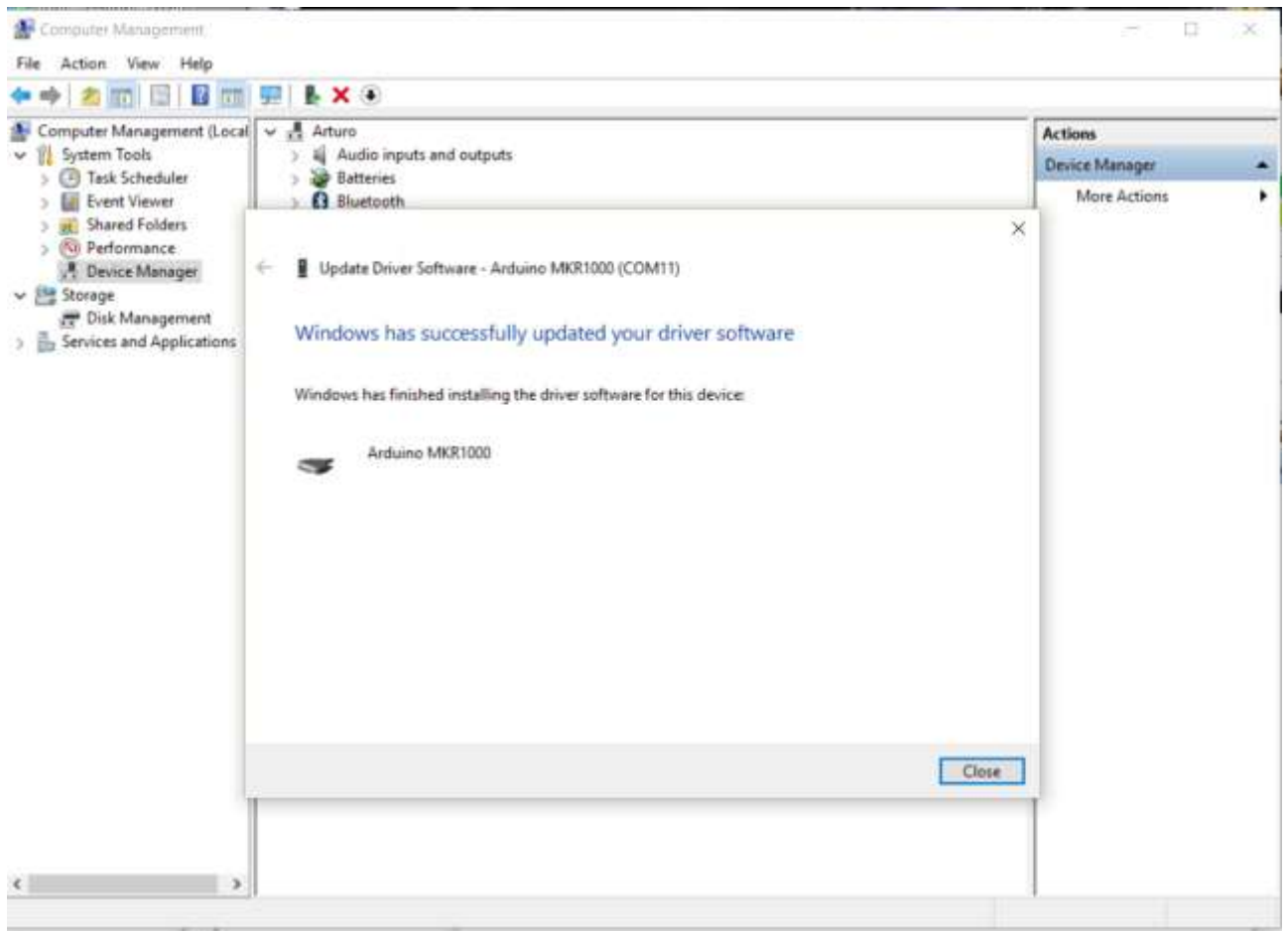


Figure 3.16: Successful installation of Drivers

- You have mounted the motive force on your PC.
- In the Device Manager, you'll see a port listed as "MKR1000 (COM24)".
- If you've multiple COM gadgets, COM port with the best number will probably be MKR1000.

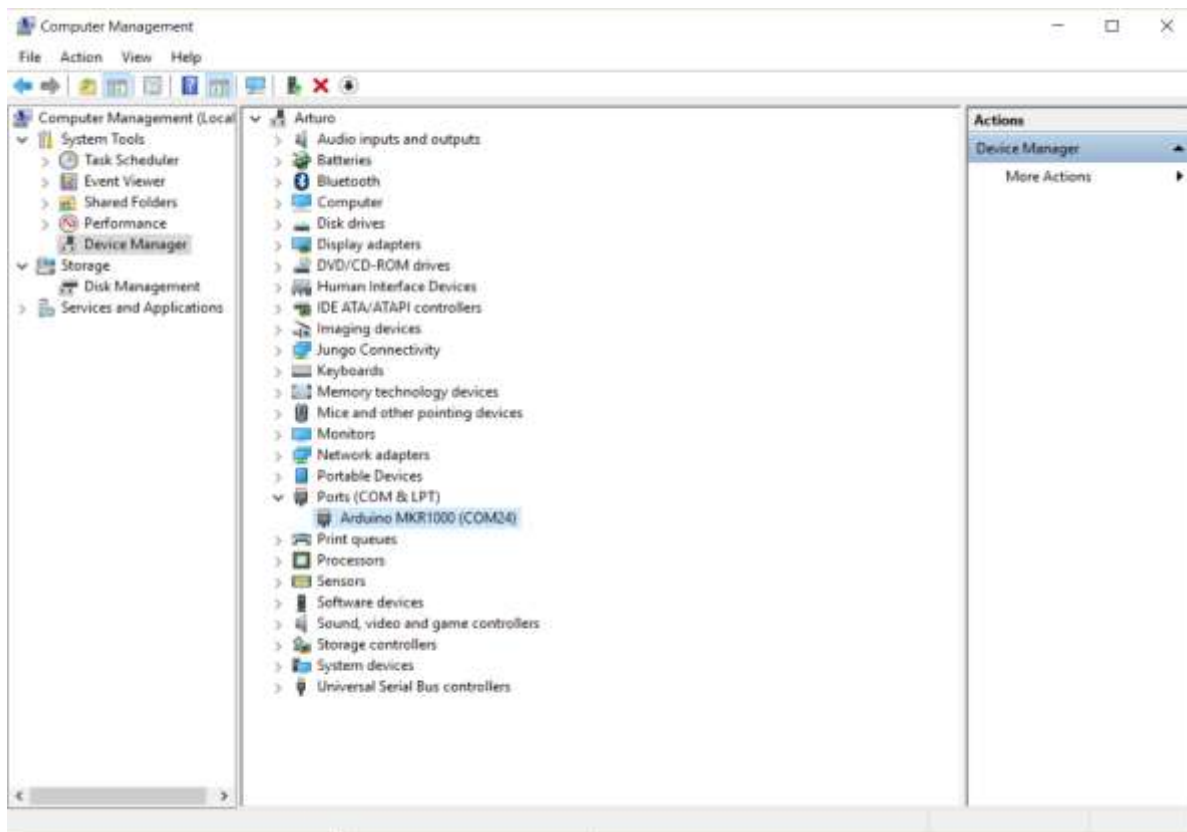


Figure 3.17: Device Manager indicates Arduino

3.3.3 Open your first comic strip

Open the Blink in Arduino 1.8.0 and follow the steps show in below picture.

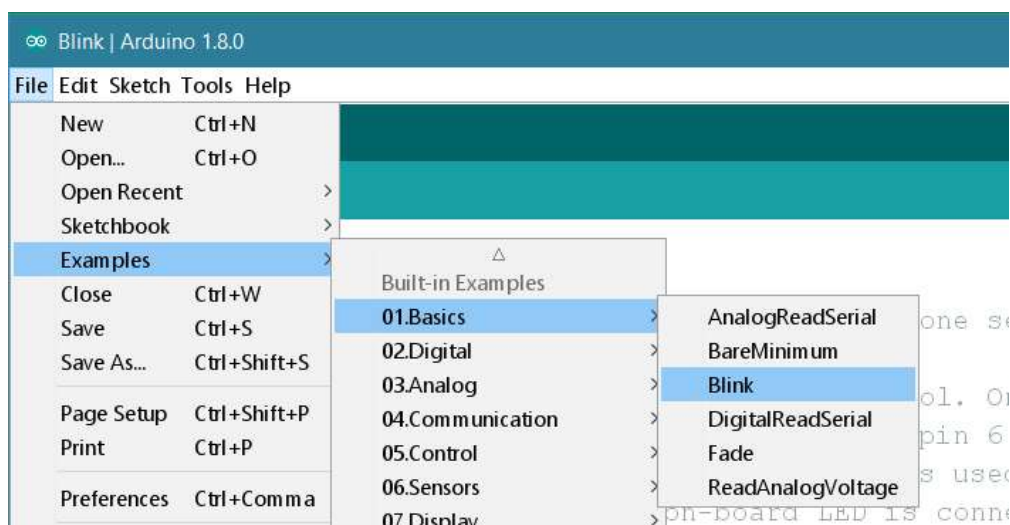


Figure 3.18: Sketch Selection

Select your board and port

Choose the access inside the Tools -> Board menu (your Arduino or Genuino board).

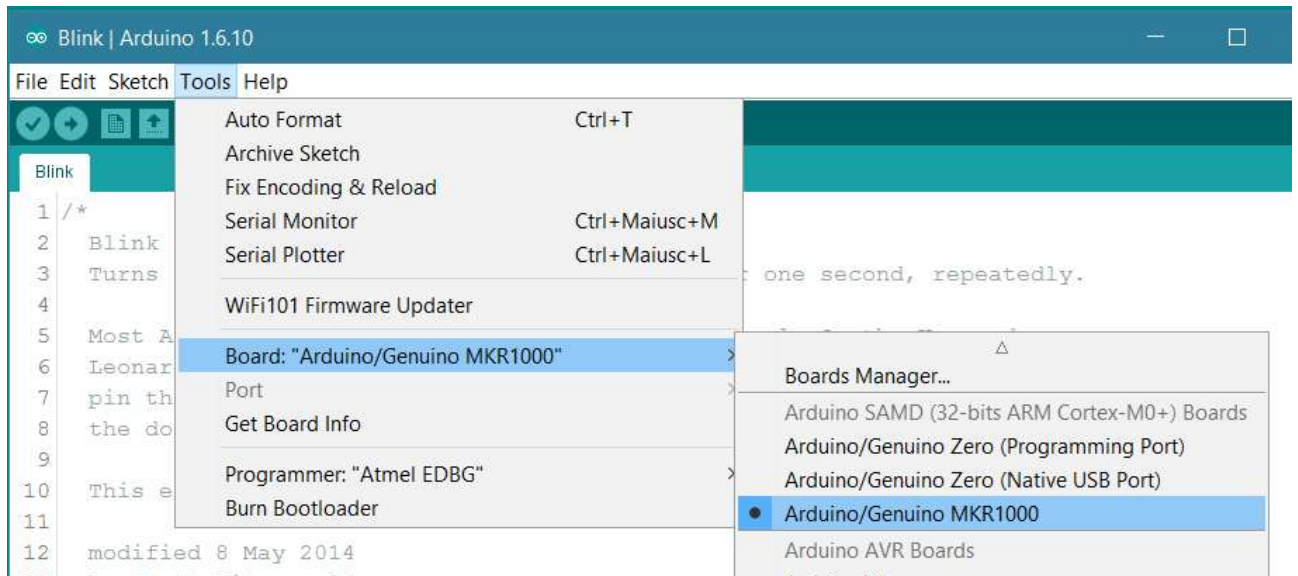


Figure 3.19: Board Selection

Select the serial tool interface menu. This may be often probably be COM3 travel searching, disconnect everything; now the access that is not visible will be Arduino board. Reconnect and choose the interface.

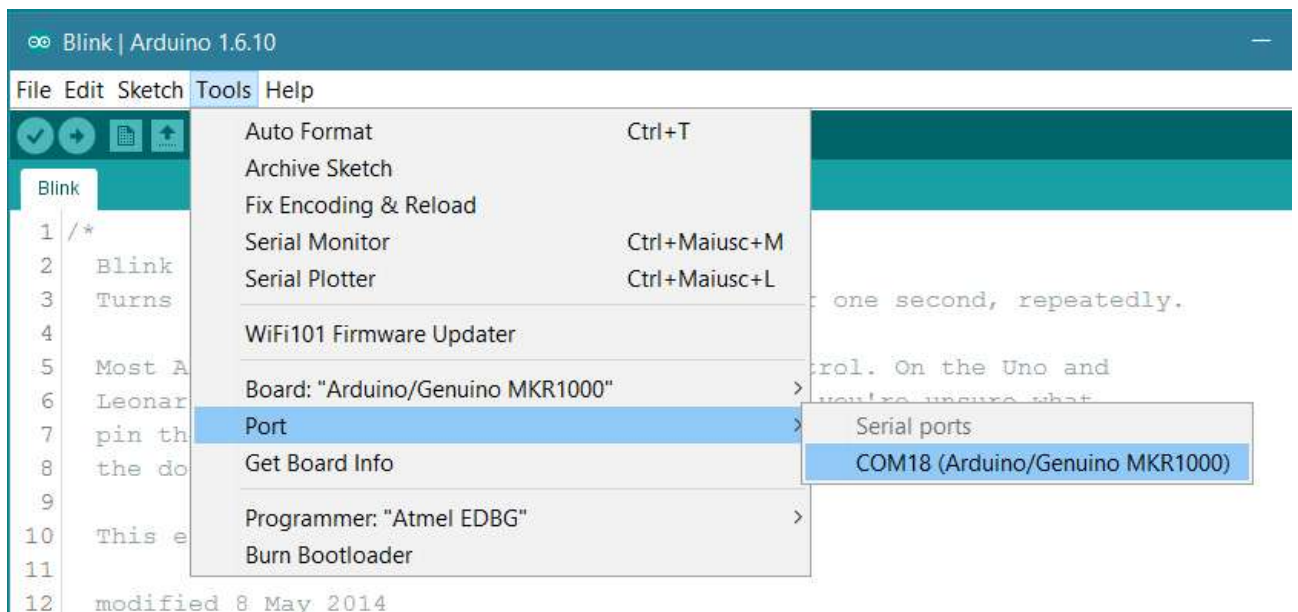


Figure 3.20: Port Selection

Upload this system

Now, clearly click on the "Upload" button. Wait, then you'll see the green development bar the popularity bar. If the upload is a hit, the message "Done importing" is displayed at the left corner of the IDE.



Figure 3.21: Upload Button

After some time the upload finishes, notice the on-board LED blinking (in orange). Congratulations! Your MKR1000 is up-and-strolling. In case any issues, please check the troubleshooting guidelines.

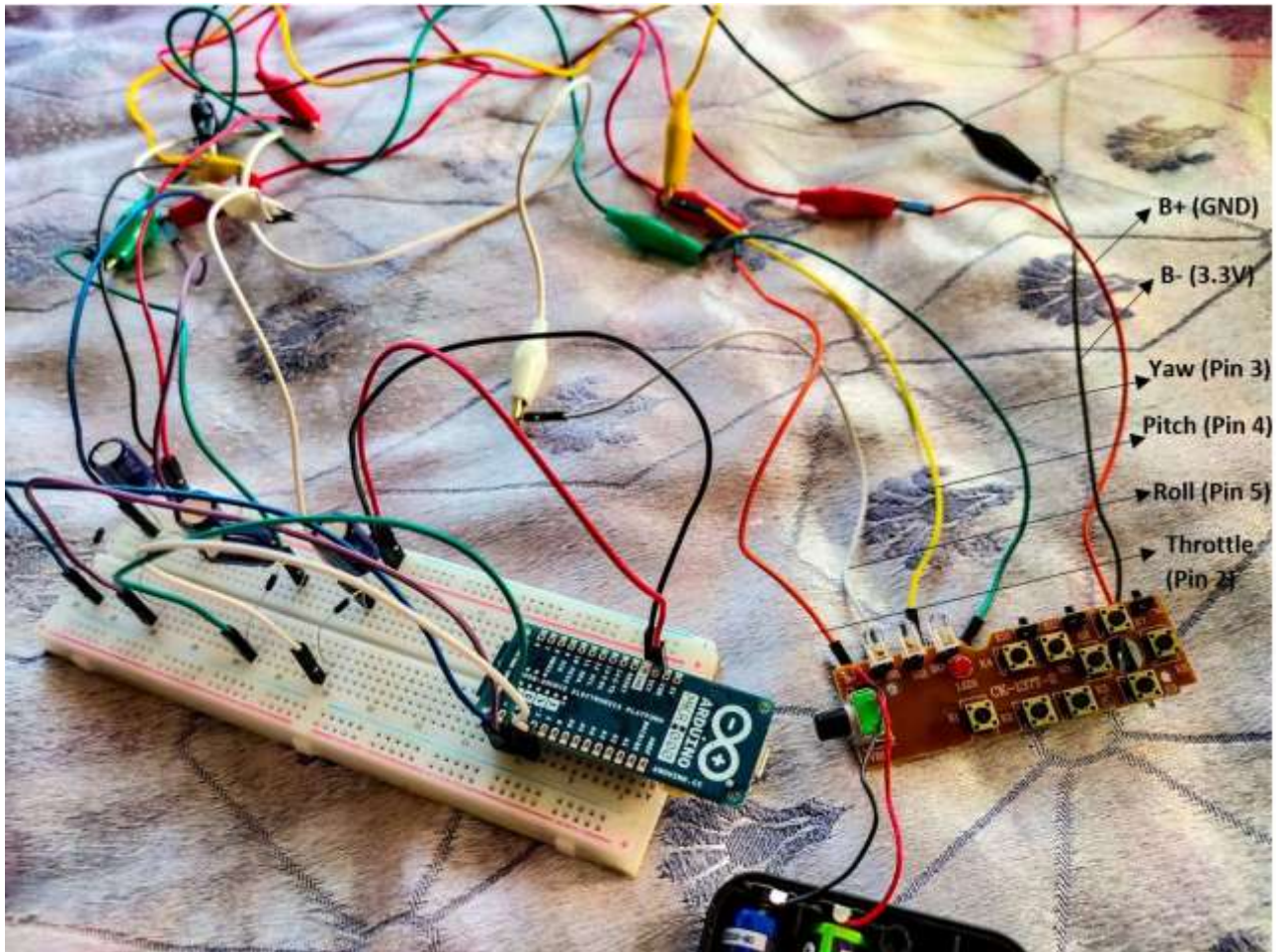


Figure 3.22: Arduino circuit connected to Drone Controller

The drone overview:

- Pin 2 => UP / DOWN at the LEFT facet of the PCB
- Pin 3 => LEFT / proper at the LEFT corner of the PCB
- Pin 4 => UP / DOWN at the RIGHT aspect of the PCB
- Pin 5 => LEFT / proper at the RIGHT facet of the PCB

Now add your caricature to Arduino MKR1000.

The Arduino will exchange the batteries and the bypassed joysticks will get alerts. You'll be able to build your personal applications.

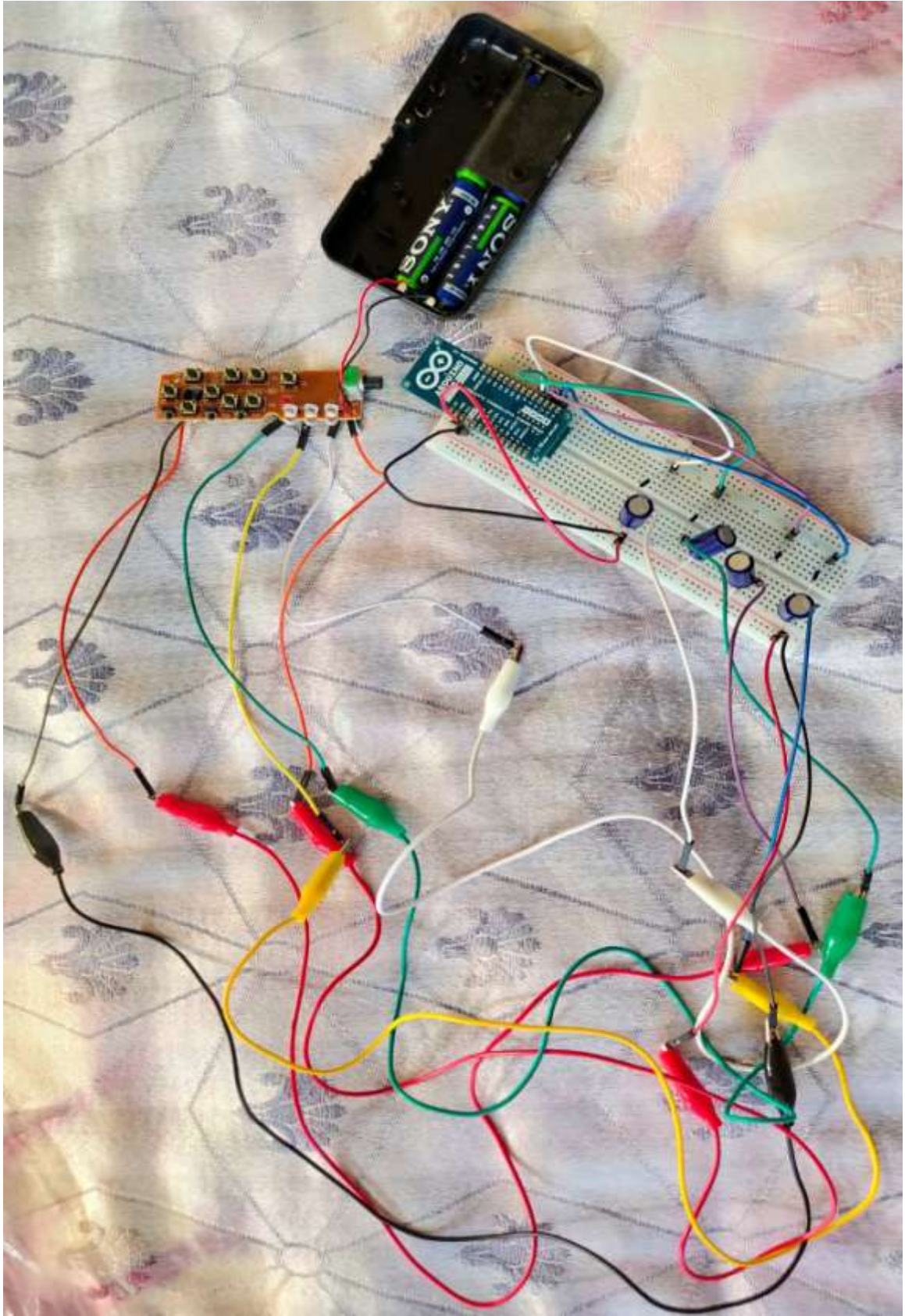


Figure 3.23: Drone is now operational

3.4 Mind control:

Install all of the drivers to the PC.

CD is provided with your MindWave Sensor.



Figure 3.24: Driver Disk

Connect the Mind sensor via Bluetooth to PC. Press the button for few seconds, if blue LED is blinking, then sensor is discoverable.



Figure 3.25: Holding the button for 3 seconds

Once connected,

- Install the library from the given link
<http://jorgecardoso.Eu/processing/MindSetProcessing/#download>
- Unzip the library.
- Make positive the com-ports are accurate, or we'll grow with the errors. We can discover the com-ports in the device supervisor.
- Click on ThinkGear Connector, now locate the com-port of the MindWave sensor. Underneath "Options".

```
receiver = new Serial (this, "COM10", 115200);
```

```
mindSet = new MindSet (this, "COM5");
```

We can regulate the Processing code to our choice.

Run the Processing caricature and give attention to the drone. When our awareness goes above 40% our drone will take off. In order to land the drone, avoid concentrating by letting your mind distracted.

3.5 Conclusion:

Most of us are fascinated to try things that hold the power to work with our brain signals and our concentration. The idea itself is so interesting and unique. Imagine our future, where everything is controlled through our brain, cars, devices, gadgets, etc. It will be a big turning point in the evolution of technology. Many studies are being done on this topic, as how can we implement it in near future. If we can fly a drone (any kind of drone), using a brain wave sensor then, it is a new theory in technology world. If it is possible, then other things working with our brain wave are possible too. It will take some time to reach that future, but possibilities may things work.

We hope our project gave some knowledge on how can we hack a drone controller and give brainwave signals as input. And give a command to drone to work accordingly on our concentration level, also using Arduino MKR 1000. This experimentation will show you how to make other additional features to lift the drone on and off the land.

REFERENCES

Books/Papers:

- [1] R. Maskeliunas, R. Damasevicius, I. Martisius, and M. Vasiljevas, "Consumer-grade EEG devices: are they usable for control tasks?," PeerJ
- [2] D. Bright, A. Nair, D. Salvekar, and S. Bhisikar, "EEG-based brain controlled prosthetic arm," in 2016 Conf. Adv. Signal Process. (CASP 2016)
- [3] A. I. N. Alshbatat, P. J. Vial, P. Premaratne, and L. C. Tran, "EEG-based brain-computer interface for automating home appliances," J. Comput., vol. 9
- [4] K. S. Sim, K. D. T. Kiang, and L. Z. You, "EEG Controlled Wheelchair," in 2016 Int. Conf. Mech. Manuf. Model. Mechatron. (IC4M 2016)
- [5] A. Nijholt, D. Tan, G. Pfurtscheller, C. Brunner, J. d. R. Millán, B. Allison, et al., "Brain-Computer Interfacing for Intelligent Systems," IEEE Intell. Syst., vol. 23
- [6] J. d. R. Millán, R. Rupp, G. R. Müller-Putz, R. Murray-Smith, C. Giugliemma, M. Tangermann, et al., "Combining Brain-Computer Interfaces and Assistive Technologies: State-of-the-Art and Challenges," Front. Neurosci., vol. 4
- [7] H. Azmy, N. Mat Safri, F. K. Che Harun, and M. A. Othman, "EEG Patterns for Driving Wireless Control Robot," in 5th Kuala Lumpur Int. Conf. Biomed. Eng. 2011
- [8] L. Bi, X. A. Fan, and Y. Liu, "EEG-Based BrainControlled Mobile Robots: A Survey," IEEE Trans. Hum.-Mach. Syst., vol. 43

Websites:

1. www.wikipdeia.org
2. www.researchgate.net
3. www.huckster.io
4. www.arduino.cc
5. www.learn.sparkfun.com
6. www.neurosky.com
7. www.instructables.com
8. www.youtube.com

APPENDIX A: CODE (PROCESSING MASTER)

Processing Master:

```
/*
 * Drone mind control
 *
 * This sketch sends Serial values to a receiver
 *
 * The input is generated via a Neurosky MindSet Mobile headset
 */

// import Serial library
import processing.serial.*;

// Define receiver Serial
Serial receiver ;

// Import MindSet library
import pt.citar.diablu.processing.mindset.*;
MindSet mindSet;

// Set initial values
int throttle = 0;
int yaw      = 127;
int pitch    = 127;
int roll     = 127;

void setup() {

    size(150, 500);

    // Initiate Serial communication at COM10
    receiver = new Serial(this, "COM10", 115200);

    // Initiate MindSet communication
    // The MindSet uses Bluetooth Serial communication,
    // Check the COM-pot in the ThinkGear Connector in your Device Manager
    mindSet = new MindSet(this, "COM5");
```

```

// Enable anti-aliasing
smooth();

// Set stroke properties
strokeWeight(5);
stroke(255);
strokeCap(SQUARE);

// Set line colour
fill(255);

} // setup()

void draw()
{
    // Start with a black background
    background(0);

    // Draw horizontal line to at 40% from bottom
    // This line indicates the minimum (40%) attention needed
    line( 0, height*0.60, width, height*.60);
    // Draw a line from the horizontal center upwards
    // This line gives an indication of your attention
    // The height is mapped in reverse to get a percentage from top
    // Example: by 40% (0.4) attention the height value is (100 - 40) 60% (0.6) from top
    line( width*.5, height, width*.5, height*map( float( attentionLevel ) / 100, 0, 1, 1, 0 )
    );

    // Push the attention level to the throttle variable
    // 40 = minimum attention needed to do something
    // 100 = maximum attention
    // 30 = 8-bit min value for Arduino
    // 255 = 8-bit max value for Arduino
    throttle = int( map( attentionLevel, 40, 100, 30, 255 ) );
}

```

```

// Constrain values to 8 bit values to prevent errors
throttle = constrain( throttle, 0, 255);
pitch    = constrain( pitch,   0, 255);
roll     = constrain( roll,    0, 255);
yaw      = constrain( yaw,     0, 255);

// When there is communication possible send the values to the Arduino receiver
if ( receiver .available() > 0)
{
  println( "attentionLevel: "+attentionLevel+" throttle: "+throttle+" yaw: "+yaw+"
pitch: "+pitch+" roll: "+roll );
  receiver .write( "throttle: "+throttle+" yaw: "+yaw+" pitch: "+pitch+" roll: "+roll );
}
} // draw()

// Killswitch, press K to reset and close the program
void keyPressed() {
  if (key == 'k' || key == ESC) {
    if ( receiver .available() > 0)
    {
      receiver .write("throttle: "+0+" yaw: "+127+" pitch: "+127+" roll: "+127);
      exit();
    }
  }
}

// MindSet variables and functions
int signalStrenght = 0;
int attentionLevel = 0;

public void attentionEvent( int attentionLevel_val )
{
  attentionLevel = attentionLevel_val;
}

// This function is activated when the connection with the MindSet is not optimal
public void poorSignalEvent( int signalNoise )
{
  // MindSet is adjusting

```

```
if ( signalNoise == 200 ) {  
    println( "Mindset is not touching your skin!" );  
}  
  
// Map the signal strength to a percentage  
signalStrength = int( map( ( 200-signalNoise ), 200, 0, 100, 0 ) );  
println( "Signal strength: " + signalStrength + "%" );  
}
```


APPENDIX B: CODE (DRONE CONTROL)

Drone Control:

```
/*
 * Drone control
 *
 * This sketch receives Serial input values (from processing) and sends these values to the
hacked controller.
 * Use this program only with the Arduino MKR1000 (or another 3.3 volt output based
Arduino)
 *
 * The circuit:
 * - 4 Low Pass filters with 100  $\mu$ F capacitors and 220 $\Omega$  resistors
 * - Hacked drone controller
 *
 */

// Set initial values
int throttle = 0;
int yaw = 255/2; // 3.3v / 2
int pitch = 255/2; // 3.3v / 2
int roll = 255/2; // 3.3v / 2

int throttlePin = 2; // PWM
int yawPin = 3; // PWM
int pitchPin = 4; // PWM
int rollPin = 5; // PWM

void setup() {

// Begin Serial communication at 115200 baud
Serial.begin( 115200 );

// Set pinModes
pinMode( throttlePin, OUTPUT );
pinMode( yawPin, OUTPUT );
pinMode( pitchPin, OUTPUT );
pinMode( rollPin, OUTPUT );

}
```

```

void loop() {
  // When there is an Serial connection available, get the values
  if ( Serial.available() > 0 ) {
    throttle = Serial.parseInt(); // Store first interger value from Serial buffer
    yaw      = Serial.parseInt(); // Store second interger value from Serial buffer
    pitch    = Serial.parseInt(); // Store third interger value from Serial buffer
    roll     = Serial.parseInt(); // Store fourth interger value from Serial buffer
  }

  // Write values to the drone controller

  // Use a low pass filter or DAC (digital to analog converter) to convert PWM to an analog
  voltage

  analogWrite( throttlePin, throttle );
  analogWrite( yawPin,     yaw      );
  analogWrite( pitchPin,   pitch    );
  analogWrite( rollPin,    roll     );
}

```

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

PLAGIARISM VERIFICATION REPORT

Date: 26/07/2020

Type of Document (Tick): PhD Thesis M.Tech Dissertation/ Report B.Tech Project Report Paper

Name: PRACHI BEKTA Department: E.C.E. Enrolment No 161679

Contact No. 98162 63096 E-mail. prachibehta98@gmail.com

Name of the Supervisor: MR. MUNISH SOOD

Title of the Thesis/Dissertation/Project Report/Paper (In Capital letters): _____

MIND CONTROLLED DRONE

UNDERTAKING

I undertake that I am aware of the plagiarism related norms/ regulations, if I found guilty of any plagiarism and copyright violations in the above thesis/report even after award of degree, the University reserves the rights to withdraw/revoke my degree/report. Kindly allow me to avail Plagiarism verification report for the document mentioned above.

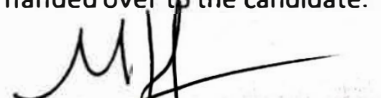
Complete Thesis/Report Pages Detail:

- Total No. of Pages = 59
- Total No. of Preliminary pages = 8
- Total No. of pages accommodate bibliography/references = 1

Prachi Bekta
(Signature of Student)

FOR DEPARTMENT USE

We have checked the thesis/report as per norms and found **Similarity Index** at12.....(%). Therefore, we are forwarding the complete thesis/report for final plagiarism check. The plagiarism verification report may be handed over to the candidate.


(Signature of Guide/Supervisor)

Signature of HOD

FOR LRC USE

The above document was scanned for plagiarism check. The outcome of the same is reported below:

Copy Received on	Excluded	Similarity Index (%)	Generated Plagiarism Report Details (Title, Abstract & Chapters)	
	<ul style="list-style-type: none"> • All Preliminary Pages • Bibliography/Images/Quotes • 14 Words String 		Word Counts	
Report Generated on			Character Counts	
		Submission ID	Total Pages Scanned	
			File Size	

Checked by
Name & Signature

Librarian

Please send your complete thesis/report in (PDF) with Title Page, Abstract and Chapters in (Word File) through the supervisor at plagcheck.juit@gmail.com

PLAGIARISM VERIFICATION REPORT

Date: 26/07/2020...

Type of Document (Tick): PhD Thesis M.Tech Dissertation/ Report B.Tech Project Report Paper

Name: UDAY SOOD Department: E.C.E. Enrolment No 161648

Contact No. 8091 333 093 E-mail. sood.udaysood@gmail.com

Name of the Supervisor: MR. MUNISH SOOD

Title of the Thesis/Dissertation/Project Report/Paper (In Capital letters): _____

MIND CONTROLLED DRONE

UNDERTAKING

I undertake that I am aware of the plagiarism related norms/ regulations, if I found guilty of any plagiarism and copyright violations in the above thesis/report even after award of degree, the University reserves the rights to withdraw/ revoke my degree/report. Kindly allow me to avail Plagiarism verification report for the document mentioned above.

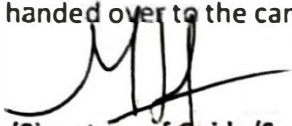
Complete Thesis/Report Pages Detail:

- Total No. of Pages = **59**
- Total No. of Preliminary pages = **8**
- Total No. of pages accommodate bibliography/references = **1**

Uday Sood
(Signature of Student)

FOR DEPARTMENT USE

We have checked the thesis/report as per norms and found **Similarity Index** at12.....(%). Therefore, we are forwarding the complete thesis/report for final plagiarism check. The plagiarism verification report may be handed over to the candidate.



(Signature of Guide/Supervisor)

Signature of HOD

FOR LRC USE

The above document was scanned for plagiarism check. The outcome of the same is reported below:

Copy Received on	Excluded	Similarity Index (%)	Generated Plagiarism Report Details (Title, Abstract & Chapters)	
Report Generated on	<ul style="list-style-type: none"> • All Preliminary Pages • Bibliography/Images/Quotes • 14 Words String 		Word Counts	
			Character Counts	
		Submission ID	Total Pages Scanned	
			File Size	

Checked by
Name & Signature

Librarian

Please send your complete thesis/report in (PDF) with Title Page, Abstract and Chapters in (Word File) through the supervisor at plagcheck.juit@gmail.com

PLAGIARISM VERIFICATION REPORT

Date: 26/07/2020

Type of Document (Tick): PhD Thesis M.Tech Dissertation/ Report B.Tech Project Report Paper

Name: SURBHI GARG Department: E.C.E. Enrolment No 161073

Contact No. 82194 15207 E-mail. surbhigrg7@gmail.com

Name of the Supervisor: MR. MUNISH SOOD

Title of the Thesis/Dissertation/Project Report/Paper (In Capital letters): _____

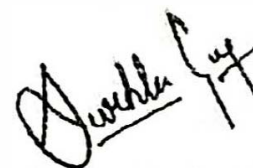
MIND CONTROLLED DRONE

UNDERTAKING

I undertake that I am aware of the plagiarism related norms/ regulations, if I found guilty of any plagiarism and copyright violations in the above thesis/report even after award of degree, the University reserves the rights to withdraw/ revoke my degree/report. Kindly allow me to avail Plagiarism verification report for the document mentioned above.

Complete Thesis/Report Pages Detail:

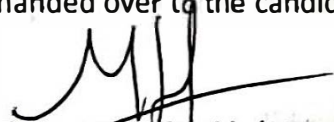
- Total No. of Pages = 59
- Total No. of Preliminary pages = 8
- Total No. of pages accommodate bibliography/references = 1



(Signature of Student)

FOR DEPARTMENT USE

We have checked the thesis/report as per norms and found **Similarity Index** at12....(%). Therefore, we are forwarding the complete thesis/report for final plagiarism check. The plagiarism verification report may be handed over to the candidate.



(Signature of Guide/Supervisor)

Signature of HOD

FOR LRC USE

The above document was scanned for plagiarism check. The outcome of the same is reported below:

Copy Received on	Excluded	Similarity Index (%)	Generated Plagiarism Report Details (Title, Abstract & Chapters)	
	<ul style="list-style-type: none">• All Preliminary Pages• Bibliography/Images/Quotes• 14 Words String		Word Counts	
Report Generated on			Character Counts	
		Submission ID	Total Pages Scanned	
			File Size	

Checked by
Name & Signature

Librarian