



TrainerEyes

By IRONBRICK | ComputerGr



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For more info:

<https://www.cschool.gr/trainereyes/>

Team



1

Vaggelis Kiosoglou

3

Pechlivanidis Thanasis

2

Litsetselidis Nikolas

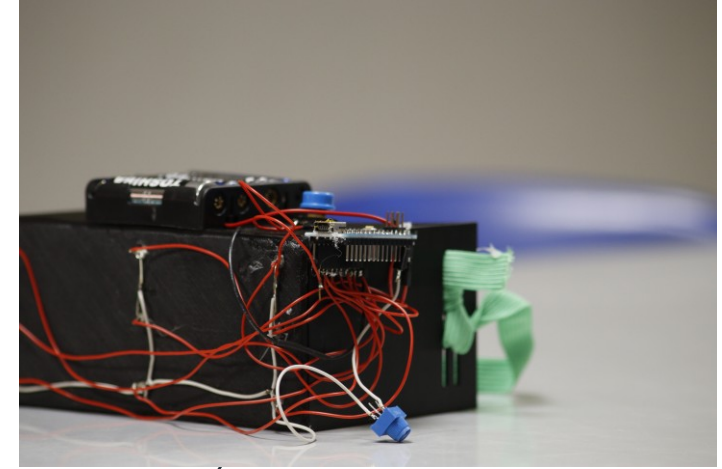
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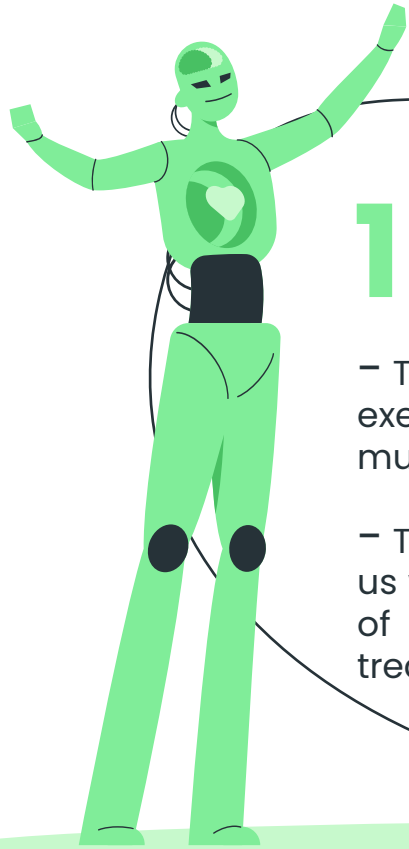
Mitrakas Stelios

Our Project

-First of all, our project isn't considered a robot. It's a device made to help people with Strabismus.

-It is a VR shaped device with 9 LEDs on the front. The users wear the device on their head and have to follow the LEDs that flash in a sequence, which the users choose in the beginning.





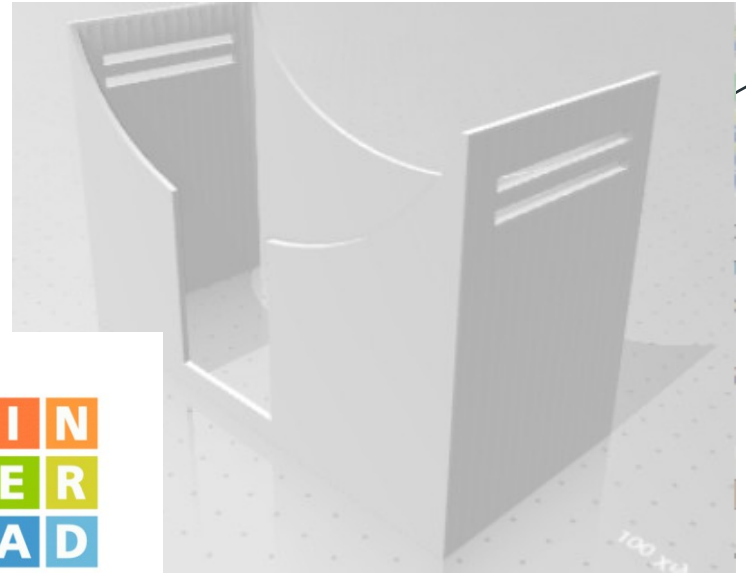
1 Our Idea

- The purpose of this device is to help exercise the user's/patient's ocular muscles.
- The idea of making this project came to us when we found out about the difficulties of strabismus and how expensive treatment surgery is.

Design Part

Our "mask" was designed exclusively by us at TinkerCAD. The design was chosen for the following reasons:

- Comfort
- Enough space to integrate the necessary equipment
- Isolation of eyes from external light



Mechanical Part



Arduino NANO



Potentiometer



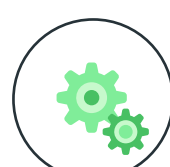
A Button



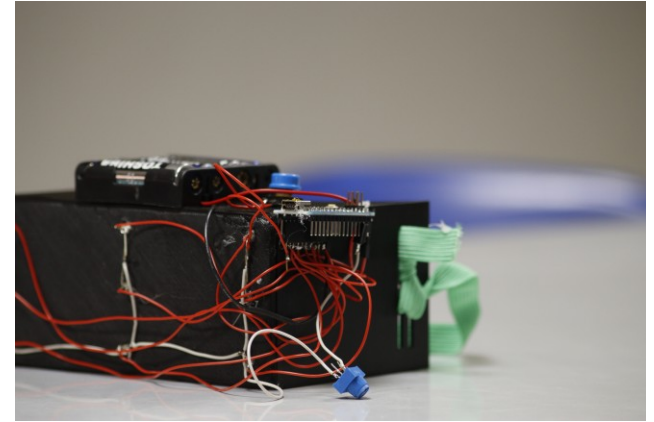
LEDs



On/Off switch

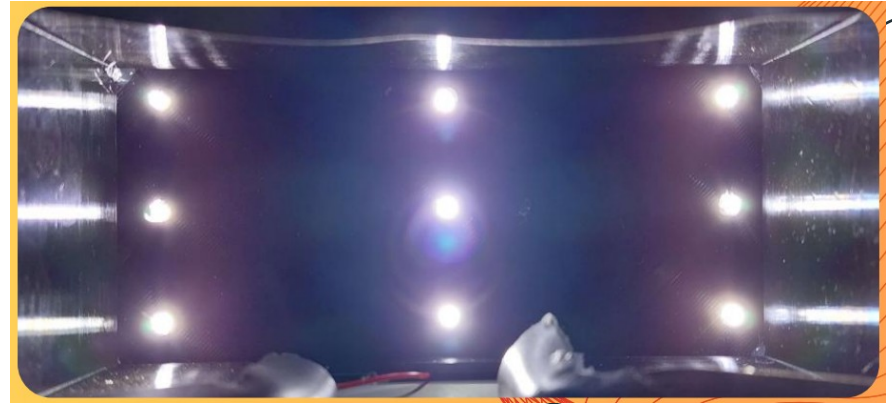


Wires and a battery holder



Electronic Part

- The board that is used in our device is the Arduino Nano which runs on 4 batteries placed on top of the device.
- It is programmed to accept input from the user in order to choose the desired function.
- After that the LEDs flash in a specific frequency of many, also called, "MODES"



Programming

1. The TrainerEyes is programmed on the Arduino IDE.
2. The code is based on 2 basic functions.
 - ❑ The 'Button' function that registers how many times the button is pressed and the 'Menu' function, the user interface menu by which is used to choose between modes.
 - ❑ Despite the portability and functionality of the Arduino Nano board, it's CPU is not powerful enough for multithreading, therefore it can't run more than one function at a time. Now, in comparison to the Arduino UNO, it could solve our problem, however it would bring other problems due to it's size and the limited space we have to organize everything on.
3. In the end we managed to overcome this obstacle by using an alternative method which is viable and ensures that the possibility of failure and errors is low.

Coding

1



What the user sees

2

```
52 void menu() {
53   flag=false;
54   blank();
55   flash();
56   wait(300);
57   blank();
58   bClicks=0;
59   DtClick=0;
60   while(bClicks==0) {
61     Button();
62     digitalWrite(2,HIGH);
63     wait(300);
64     digitalWrite(2,LOW);
65     wait(300);
66   }
67
68   Button();
69   if(bClicks==1) {
70     blank();
71     digitalWrite(2,HIGH);
```

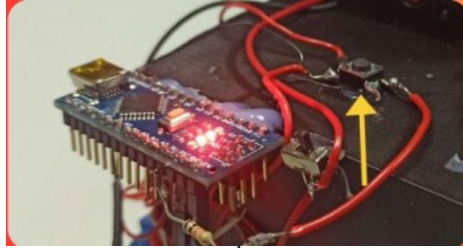
Part of the code

□ Until now the coding was the hardest part before finishing the project. This is because of the pre-mentioned obstacle that we found in the process. As the Arduino Nano can't run simultaneously both the 'Button' and 'Menu' function, in order for the button to be "active" throughout all the process, we tried blending together those functions, to seem that they run at the same time

How to use

Step 1 | StartUp

Turn on the switch next to the board.



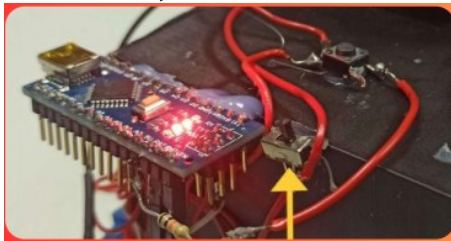
Step 3 | Action

When the LED of your desired mode is reached, wait 4 seconds. Then the selected mode will start

1

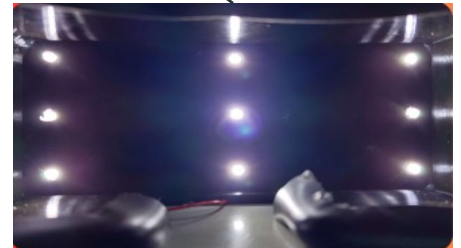
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3



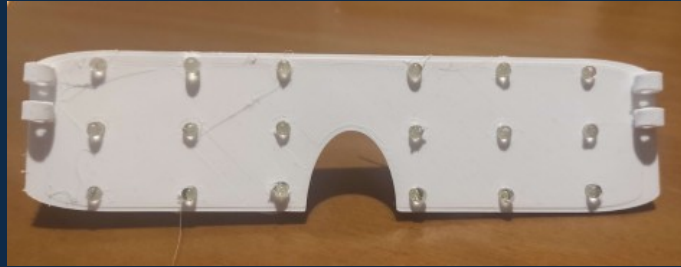
Step 2 | Operation

While on the menu, choose which mode you want by pressing the black button until the desired mode is reached.

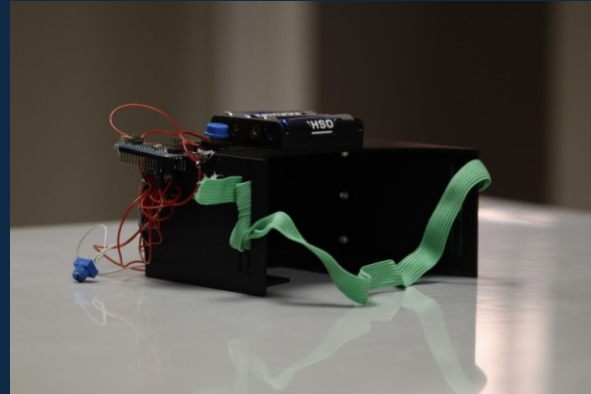


The Procedure

The project took some months to finalize. As you could imagine we started by questioning our project's functionality. After getting ensured from an optician(eye doctor) that the project was feasible, we begun developing it. Our first invention were some glasses with a lot of LEDs on them. This of course wouldn't work since the LED's illumination would blend in with the outside light. Afterwards we came up with the design that would look like a VR-Headset and it turned out as the right solution. Then, when we were writing the code for the project, we had just one function which would turn on all the lights in a row, but we upgraded it to a menu with more functions that the user can choose from.



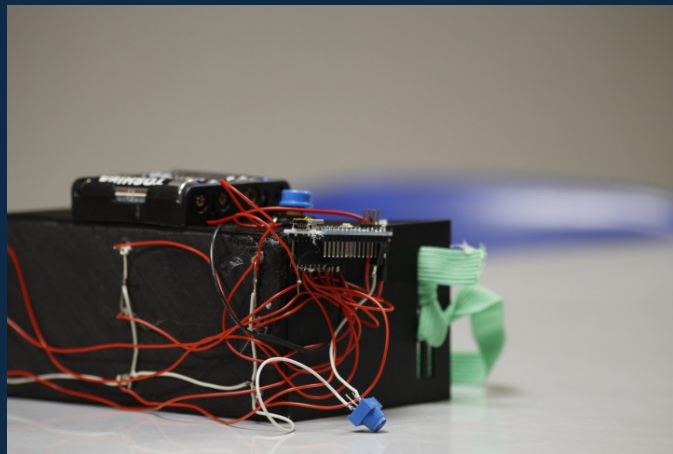
1st Model



Prototype V1.0

The final outcome

- ❑ After all the experiments and failures, we managed to make a sort of “prototype”.
- ❑ We are using the Arduino™ Nano board, since it's not only the smallest and lightest Arduino™ board, but practical and functional enough. On it there are some LEDs, a switch, a button, a battery socket (it can also function wired to a charger or computer) and a potentiometer (adjusting the brightness of the LEDs).
- ❑ Even if these sound like a lot and confusing, the device is very comfortable and easy to use



Cost

1 | ARDUINO NANO

1

10€ - 20€

2

2 | 3D Printed base

2€ per piece

3

3 | Cables and other components

Fewer than 2€

Total | 25€ - 35€
Sold | 40€ - 50€

Human Resources

Doctors:

who will reassure us
that our product is
viable and safe.

Technicians:

who will help us
develop the final
version of our product
for commercial use.

Testers:

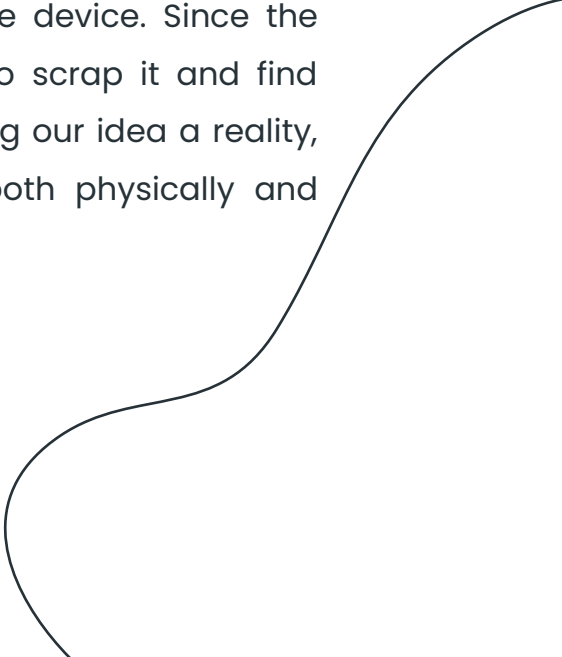
who will test our
product and give us
reviews about their
experience and
ways to upgrade
our product.

Testing

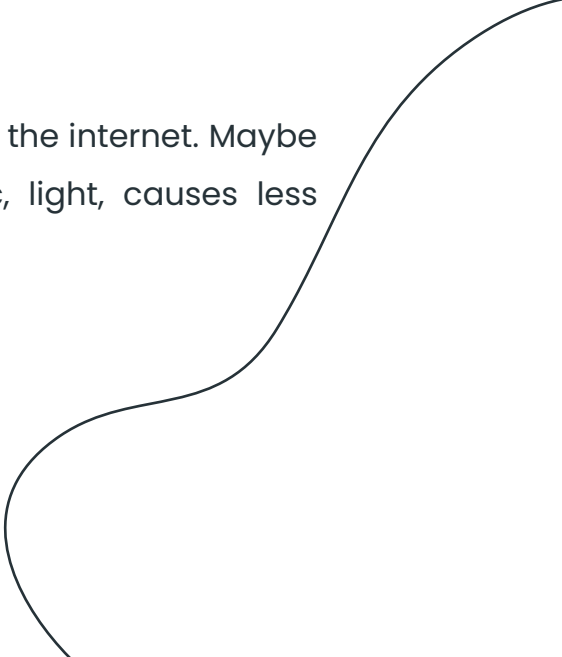
- Coding Error: Not so likely, but we wouldn't take it seriously. We all understand the code so we have no problem collaborating to fix it.
- Hardware Problem: A scenario where a piece of equipment doesn't work as intended or gets loose. This is also easy to fix, since we always carry the gear to fix our device: soldering, gluing, output measuring.
- Electrical breakdown: A LED or a wire stops working. This would be a more serious problem, however the chances are quite low, since we use a potentiometer and resistors that regulate the amperage.
- Fracture problem: Since our device has every spec on it's outside, it's very sensitive and has to be handled with caution. A way we found to counter this is by covering the device with a soft material, which protects it on a very promising level

Performance Evaluation

- We are very proud of the prototype version of the glasses. It's working as intended and doesn't have any major flaws that ruin the experience or affect the usage of the device. Since the beginning we didn't trust our project and thought that we would have to scrap it and find something else to work on. However, after putting in all the work and making our idea a reality, we can say otherwise. The version we currently have is much better both physically and internally (software)

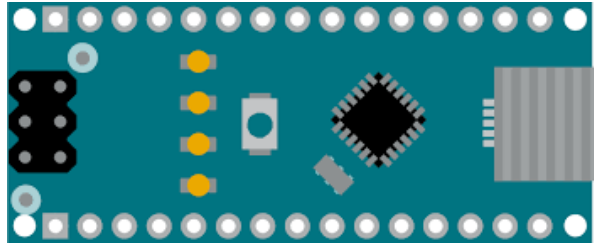


Comparison with other solutions

- Our product doesn't have much competition in the market since it's original. However we analyzed how our customers could imitate our project's idea.
 - One way is to use a phone VR-Headset and play videos of eye exercises on the internet. Maybe this is better for some people, but our project is much more economic, light, causes less eyestrain and most importantly easy to setup and use.
- 

Hardest tech challenge

- Something that bothered us for a long time is a problem with the user operation. Even if Arduino nano is a light and small-sized board, it comes with limited functionality. We had to adapt to the board's capabilities in order for the device to work out and it turned out well. At first we thought that it would be easy to run more than one functions simultaneously. It turned out that it wasn't possible. So, we tried blending all the functions to seem as they work at the same time..



Further Improvements

- We could improve our project in many ways, however it's main structure is good enough for a prototype. First of all we could make the aesthetic design more presentable and eye-catching. Afterwards we could develop more modes for the user to choose from other than the default ones, e.g. custom made sequences: this however would demand more input > more hardware and programming that isn't needed for the main purpose of the project but for a more amateur/educational use.





Thank you for your patience! We hope you found our project interesting!

