



Low-cost ion generator to combat Covid-19 or similar highly infectious diseases



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Introduction

- ❖ Ion generating devices are known for a long time to kill bacteria and viruses and they are used in various places from operating room to air conditioning units. It is known that up to 5kV high voltage could be suitable to generate charged particles without generating ozone, which is believed to be harmful to the body when a certain concentration is exceeded. The project will be about to develop a low-cost version of ion generator with air blowing unit to clean odors, smoke and harmful cells in a living room.

Application Areas



Office

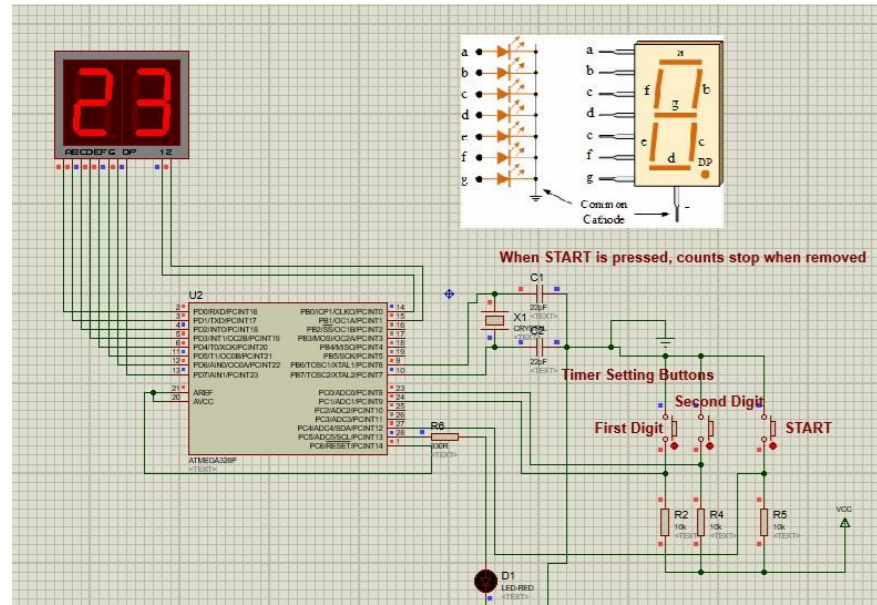


Home

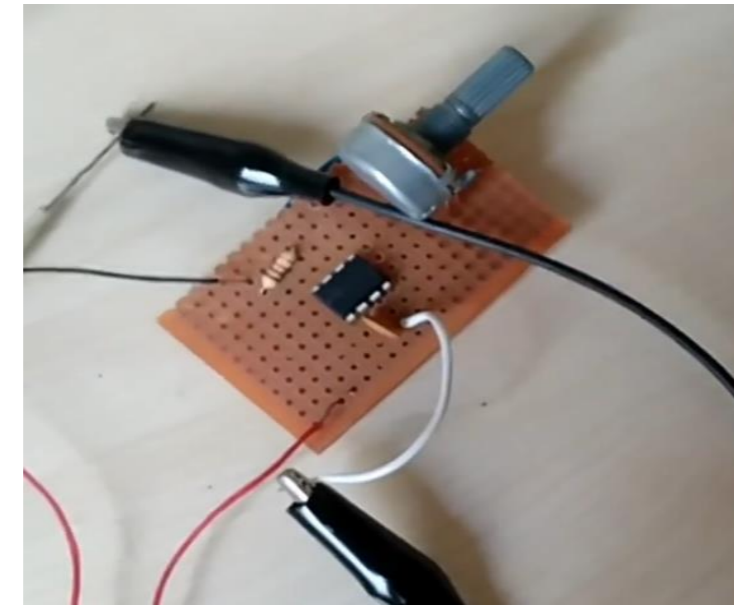


Hospital

Specifications and Design Requirements



Thanks to the down counter timer designed using Arduino and relay, the working time of the ion generator is determined according to the user's request. Thanks to this, it is benefited both in terms of health and economy.



NE-555 Circuit triggers the automotive ignition coil driver, causing it to generate square waves. It also determines the frequency range (120Hz) in which the system will operate.



Thanks to the air cleaner fan, the negative ions formed on the electrodes are transported to the environment and clean air is provided to the environment.

Results and Discussion

- ❖ Automotive ignition coil was used as a high voltage transformer. About 15kV was obtained from the output of the transformer. Afterwards, a voltage divider was made to obtain a voltage below 4kV to get the negative ion without producing ozone. A down-counter timer has been designed for this system to run as long as the user wants. It is connected to the 5v relay from Arduino. When a 5v signal came from the Arduino, the system was active, when a low signal came, the system became passive.

- ❖ Negative ions are important in preventing harmful bacteria, viruses and Covid-19 virus in the pandemic in nowadays. The average price of negative ion generators in the market is 1000-1500 TL. This project has shown that it is more economical against these high prices. The total cost of the project is 280 TL.

- ❖ The whole system works with only 12V adapter. Negative ions formed at the end of the 4kV signal at the output were collected in the prepared electrode. The negative ions collected here are transferred to the environment with the help of a fan operating with a 12V input signal.

- ❖ A remote control can be made to be used for the timer. An ozone sensor can be added to the system to shut down the system in the production of harmful ozone and a sensor can be added to measure the quality of the air.

Solution Methodology

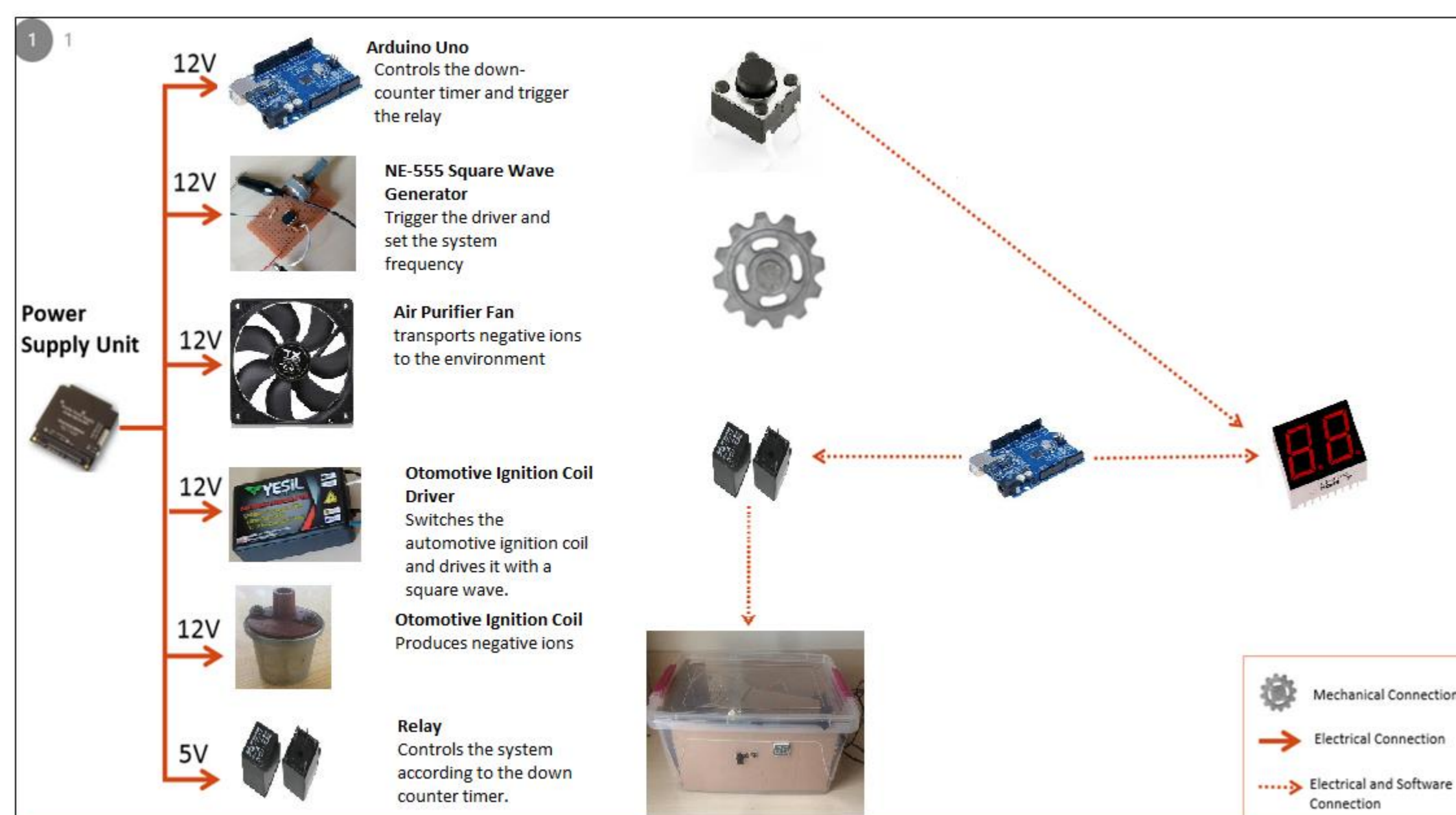


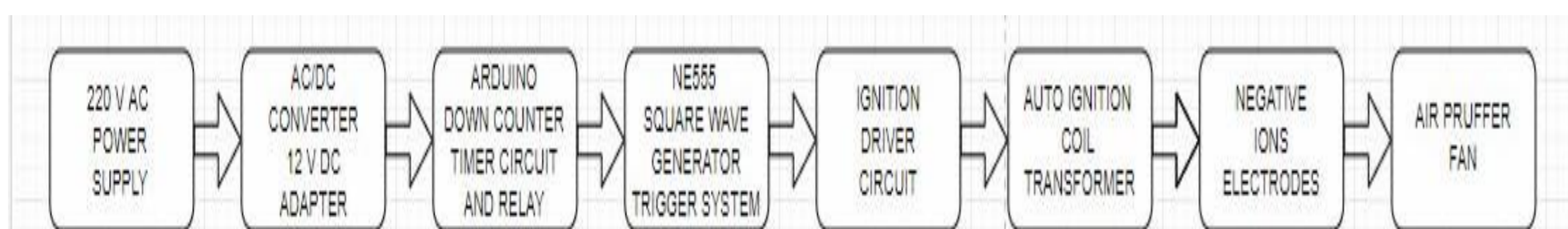
Figure: An overall description of the project components.



- It was learned that negative ions were formed as a result of high voltage. The usage areas of the required high voltage transformer were researched. As a result of the researches, the most accessible automotive ignition coil was provided.
- Since the output voltage of the coil cannot be measured directly with a multimeter, a circuit was designed to measure it indirectly. 666k ohms in series to the AC 12.8 V adapter and the multimeter is connected in series. As a result of the measurements and calculations;

- $12.8 - 5.1 = 7.7V$ 666k resistor's voltage value is $7.7V \cdot AC.5.1 \times 666k / 7.7 = 441.11k$ ohm. Voltmeter internal resistance is 441.11k ohm.
- 190M ohm serial and 10M ohm series were connected to the high voltage transformer in series. The voltage above 10M ohm was measured with a multimeter.
- Between Multimeter and 10 M ohm Parallel Resistance :
- $(10 M * 441 k) / (10M + 441 k) = 422 k$ Ohm
- Total series resistance = 190,422 M ohm
- 33V was measured in the multimeter. As a result, the voltage measured at the high voltage transformer was calculated as 14.89kV.
- 14.89kV was connected in series with 4 pieces of 53M ohm resistors and the voltage was reduced below 4kV.

Flow Diagram



References

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