

Design and Development of Wi-Fi based Wireless Detonator

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Abstract: A prototype of WiFi based wireless blasting system aimed to achieve simple and easy detonation techniques. Since the invention of explosives world has used various detonation techniques, this prototype is developed to further simplify the detonation techniques. The speciality of this detonator is that it can trigger most forms of explosives and can also ignite a controlled fire without any explosive.

Keywords: Detonator, heating coil, WiFi module (ESP-8266), explosion, blast, standby, relay, red and yellow light, PCB (Printed circuit board), transistor, battery.

1. Introduction

Detonation is a technique to trigger or initiate a blast in the respective explosive, it is done through various processes but the simplest of all is to detonate an explosive wirelessly, to do so we used WiFi module ESP-8266 which enables us to operate the device from a distance of 50m, it provides us a safe distance to operate from. This device can ignite most explosives used today and can also initiate a controlled fire without any explosives with the help of the heating coil which makes it a multi-purpose detonator. The detonator works with the help of a WiFi module which is connected to the mobile hotspot of the operator's mobile, it provides total control of the detonator in the hands of user. This enables the user to operate the device easily and removes the load of any external connections device.

2. Discussion

The idea of detonator is not new but the concept of wireless detonator has changed the dimensions of the domain, it has enabled us to extend our limits and has also given birth to new technology. There are various ways to construct a wireless detonator one of the method is generated by us using WiFi based detonator.

A. Process in wireless detonator

1) Designing and layout of the detonator

The initial step was to design a detonator which is based on completely new concept, easy to use and can trigger most explosives. The detonator was then designed in such a manner that it could be controlled using WiFi through a mobile phone and heating coil was used to make it trigger most explosives.

2) Wi-Fi module programming

Selected WiFi module ESP-8266 to make it controllable through a mobile, with that programming was done in the "ARDUINO UNO" application and later uploaded in the WiFi module. The program was designed in such a way that when the WiFi module gets connected to the operator's mobile hotspot the user has to open chrome application in the mobile and enter its mobiles IP address, it will then show two icons "BLAST" and "STAND-BY" which will help the user activate or deactivate the detonator.

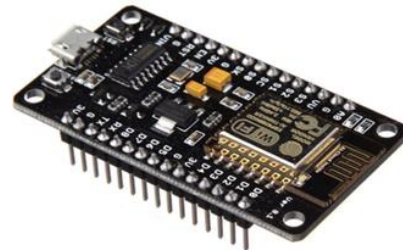


Fig. 1. Wi-Fi module (ESP8266)



Fig. 2. Chrome page

3) Design of PCB

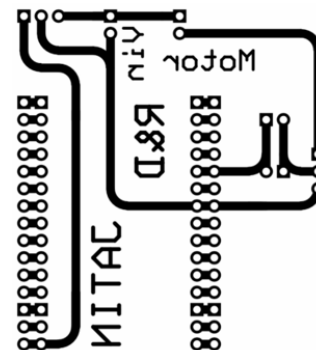


Fig. 3. PCB design

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3. Assembly

For the prototype the assembly was done in such a manner that the electronic part and the heating coil have some distance so that the components does not get damage, the heating coil was connected through a wire to the main circuit.

To support the coil a wooden structure was made and the connections to the coil were made connecting the main circuit. The relay was attached to take multiple inputs from the circuit and deliver it to the heating coil.

In the PCB two LEDs were attached to display the status of the detonator also a switch was attached to turn it on or off. To power the whole system two 3.7V (26000mAh x2) batteries were used.

In addition to all of this a transistor was also used to amplify the power.

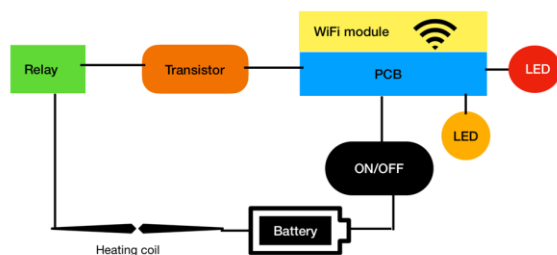


Fig. 4. Virtual representation of the connections in the detonator

4. Process

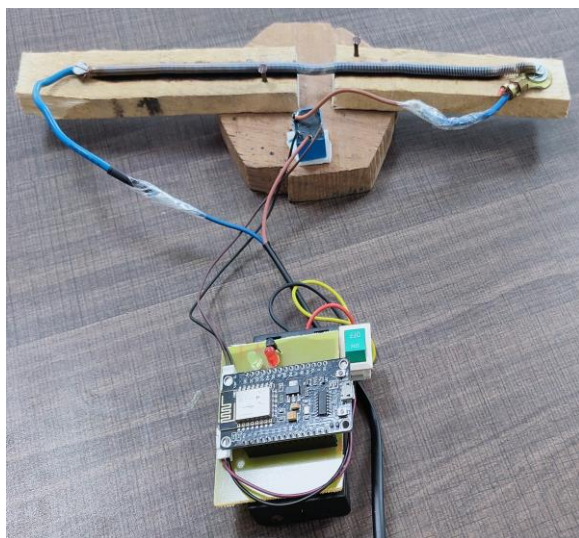


Fig. 5. Final prototype

This prototype is designed to overcome problems faced to operate modern day detonators. It does not involve any complex operation and can be effective for most explosives. It works on the WiFi module based communication, the WiFi module is used to communicate between the detonator and the user. The PCB is involved to provide all necessary connections between devices like transistor, LEDs, relay, switch, WiFi module and batteries. The LEDs are used to display the status of the detonator, yellow LED is for standby and red LED is for activation of the process. The coil is of at most importance in the detonator, it gets heated and the explosive attached to it

ignites. It can also cause controlled fire without any explosive just by heating.

The detonator works as we give order of blast from our smartphone the WiFi module receives the signal and initiate the process the yellow light goes off and the red LED glows which means the process has started, the power from the battery gets transmitted to the relay which then provide it to the heating coil, due to overpower the coil heats and ignites the explosive which than causes the blast.

5. Working

Note: Instructions provided here are only to be followed during experimental trials.

1. Place the detonator at a place away from any kind of flammable materials.
2. Insure that the wire connecting coil to other circuit is long enough, so that the circuit does not gets damaged.
3. The quantity of explosives should be less for exponential trial.
4. The explosive should touch the heating coil to get ignited.
5. Turn on the switch on the detonator.
6. Observe if the yellow LED is glowing.
7. Turn on the Internet and hotspot on your smartphone.
8. Connected the WiFi module to your mobile hotspot.
9. Ones connected open the chrome page and enter the IP address of your mobile phone.
10. The page will show two icons "BLAST" and "STAND-BY" (Currently detonator is on standby mode).
11. Click on blast when you want to detonate. (There will be a delay of 5 seconds in the process).

6. Conclusion

The detonator designed to overcome detonation problems brought us new solutions during research and design of the system. The main aim was to remove complexity in the operation, also to make it multipurpose for most explosives and make it easy to use. All of these problems were at most priority during the design and development of the prototype.

The problem of complexity was resolved using simple devices and detonation techniques, the system used heating coil so that most flammable explosives can be ignited also a controlled fire can be generated without any explosive.

The research and analysis gave an idea is to how the system is going to function and also we made our own hypothesis based on our design and development.

Based on our hypothesis we made some standards and the prototype was capable of matching them all.

Our prototype is able to generate controlled fire, simplify detonation techniques and can be used to trigger multiple explosives, it is one of the kind system capable of all these abilities.

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