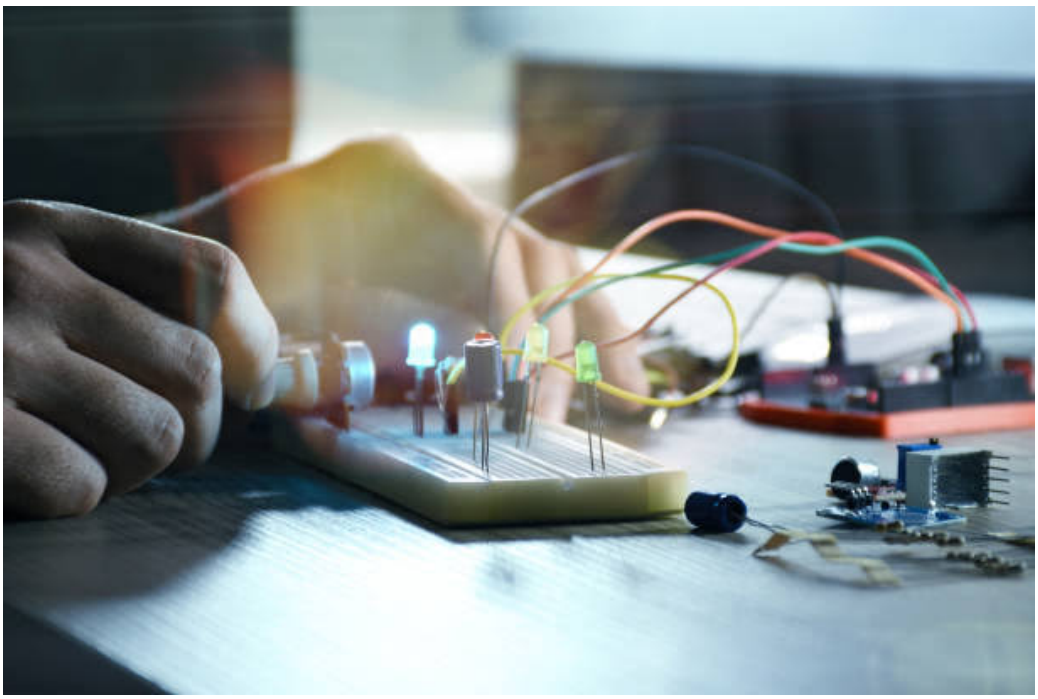
JOY OF ELECTRONICS

PROJECT: PIEZO KNOCK SWITCH



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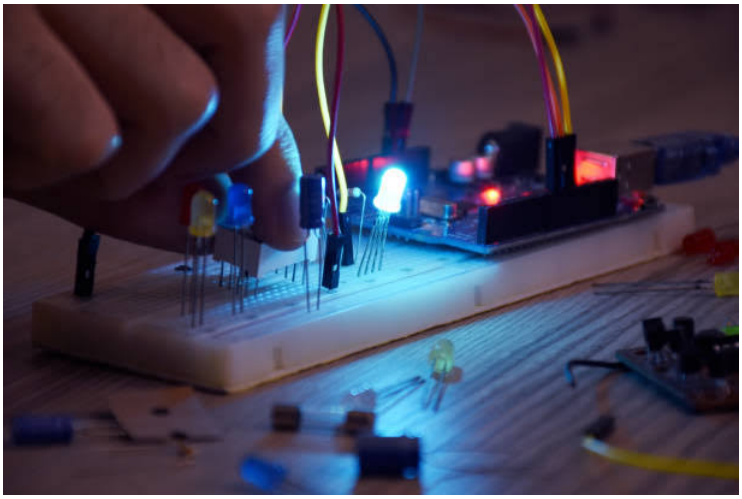
INTRODUCTION



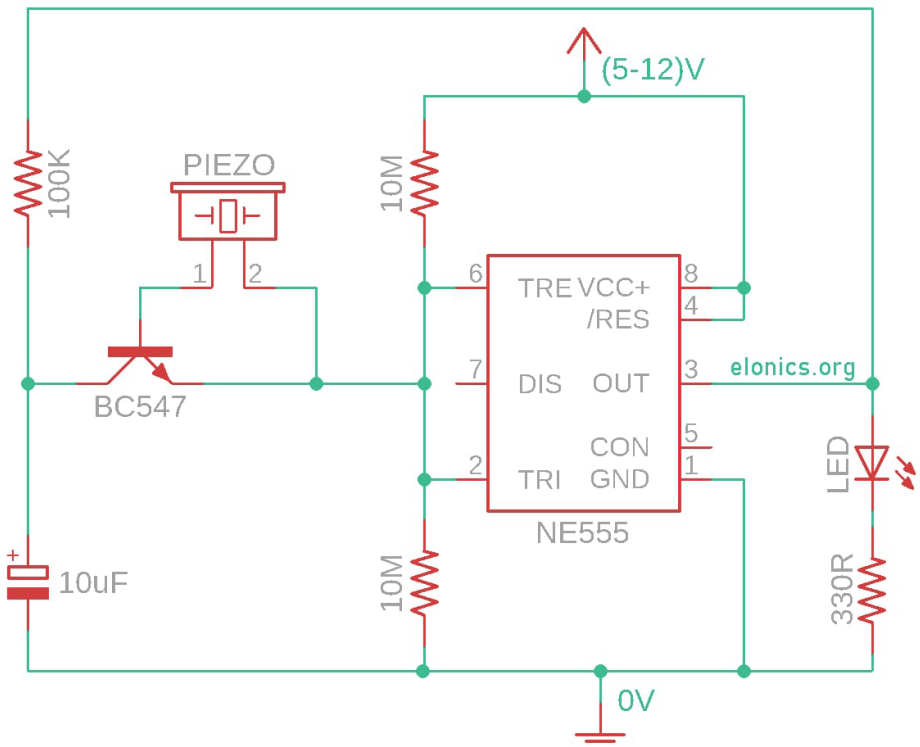
A piezo knock switch experiment involves the use of a piezoelectric sensor to detect mechanical vibrations or knocks and trigger a response or action. In a piezo knock switch experiment, we explore how piezoelectric sensors can detect knocks or vibrations and trigger responses.

Piezoelectric sensors are special materials that generate electricity when they're squeezed or bent. In this experiment, we connect a piezo sensor to a circuit that amplifies the electrical signal it produces in response to knocks. When we tap or knock on the sensor, it generates a small electric pulse. By amplifying and measuring this pulse, we can detect the knock and use it to activate other components in a circuit, like turning on a light or sounding an alarm.

LIST OF COMPONENTS

1. 555 Timer IC
2. NPN Transistor – BC547
3. Piezo Buzzer
4. LED / any Output device
5. Resistors – 1 x 100KΩ, 2 x 10MΩ, 1 x 330Ω
6. 10uF Capacitor
7. Breadboard
8. PCB
9. Copperboard
10. Soldering wire
11. Soldering rod
12. Soldering flux
13. Soldering stand
14. Few breadboard connectors
15. (5-12) V Power Supply

DESCRIPTION OF THE CIRCUIT



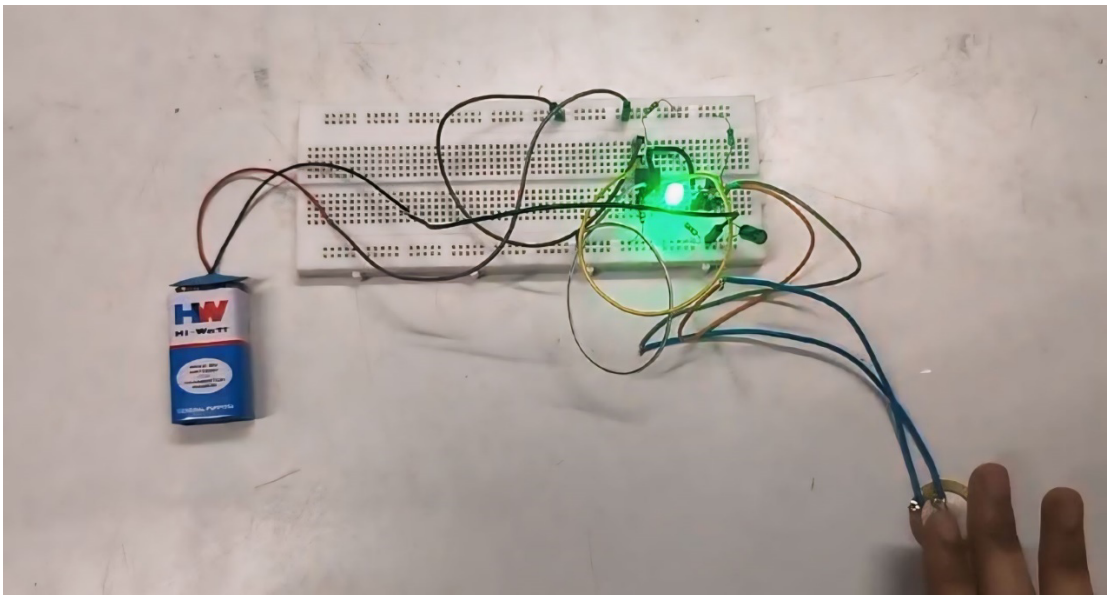
PIEZO KNOCK SWITCH SCHEMATIC*

- The circuit uses a 555 timer IC.
- Pin-2 (Trigger Pin) detects voltage less than 1/3 of supply voltage to turn ON the output.
- Pin-6 (Threshold Pin) detects voltage more than 2/3 of supply voltage to turn OFF the output.
- Both Pins 2 & 6 are connected to each other to control the output.
- The circuit controls output toggling by regulating voltage at the common point between Pins 2 & 6 of the 555 IC.

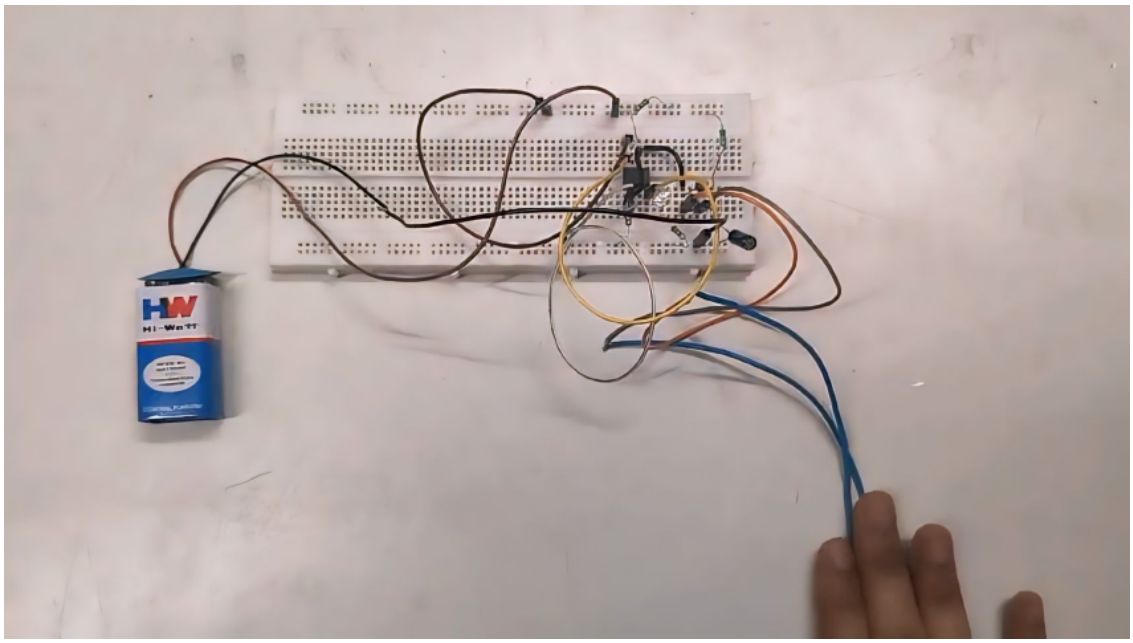
- Two 10M resistors are employed on either side of this common point to stabilize voltage during idle periods, preventing unwanted triggers caused by stray electrostatic charges.
- An NPN transistor, coupled with a 100K resistor, establishes a feedback loop for flip-flopping the output upon activation.
- When the output is On and the transistor is activated, it applies a positive voltage, causing Pin-6 to turn off the output.
- Conversely, when the output is Off and the transistor is activated, it applies a negative voltage, turning on the output by triggering Pin-2.
- The transistor is triggered either by tapping/knocking on a piezoelectric speaker (for a knock sensor circuit) or by touch (for a latching touch switch circuit).
- A 10uF capacitor helps prevent multiple triggers by deactivating the transistor for about 1-2 seconds after each tap on the piezo sensor.

EXPERIMENTATION

ON BREADBOARD:

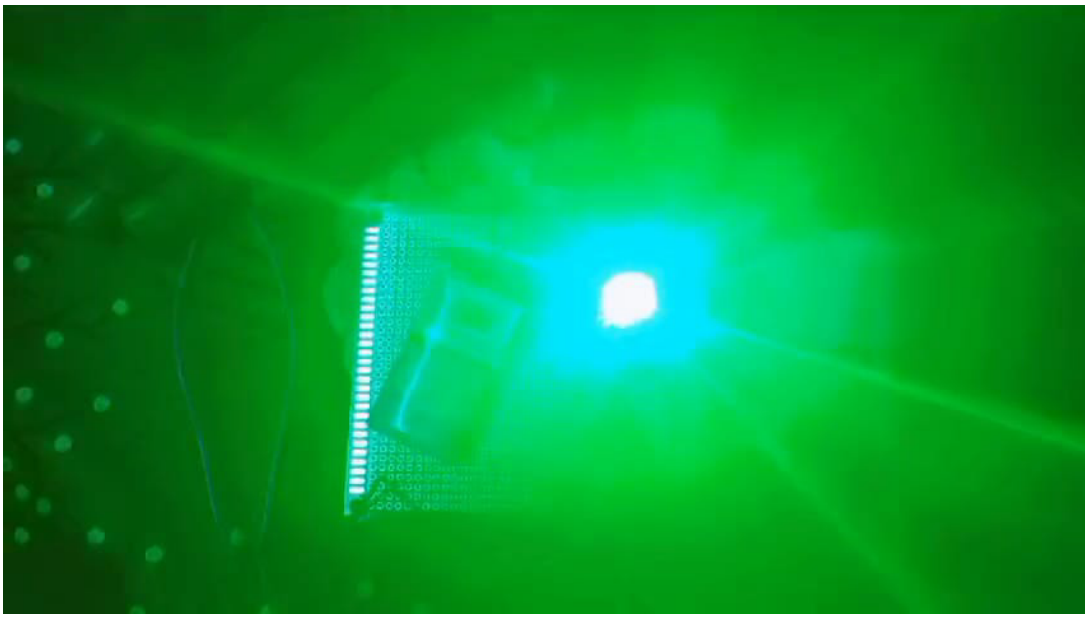


LED glows upon tapping

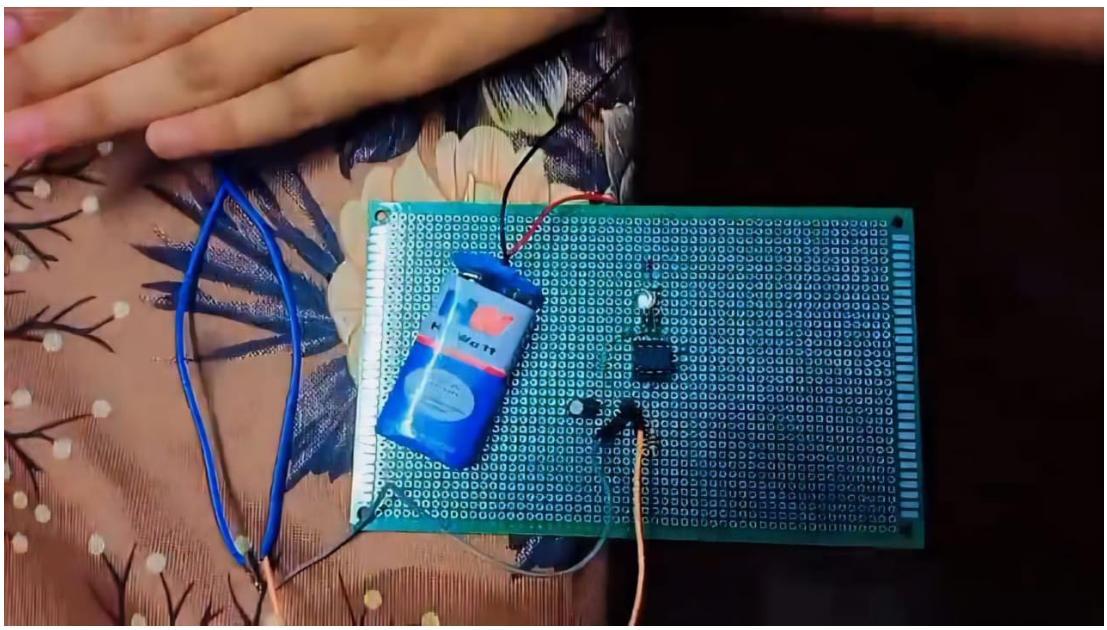


LED ceases with subsequent knock

ON PCB:



LED glows upon tapping

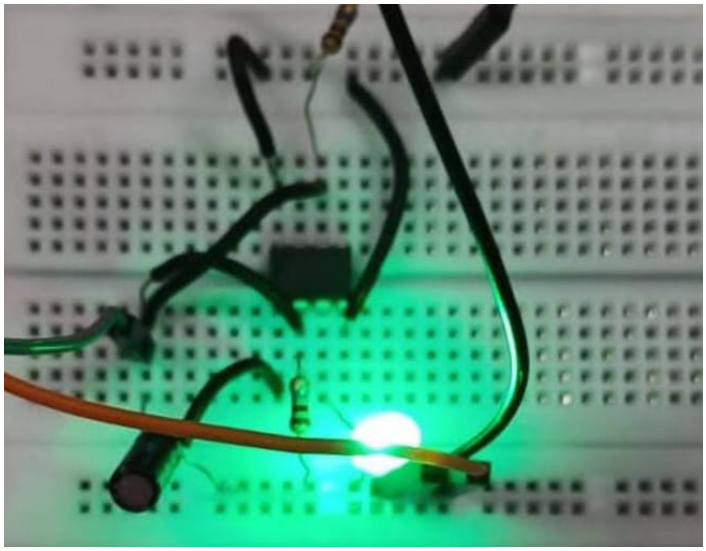


LED ceases with subsequent knock

APPLICATIONS

- Used in earthquake detectors (The analog output of Piezo speaker is used)
- Used in automatic doorbell systems
- Used as a replacement for modern concealed switch systems (One just need to tap on a particular area to turn an appliance on)
- Another transistor can be cascaded to the existing npn transistor to increase the tap/knock detection sensitivity
- It can display the number of people who walked on the piezoelectric sensor.
- It can be integrated into security systems to detect unauthorized entry, triggering alarms or alert notifications.
- It can monitor machinery for vibrations, providing early warning of potential equipment failures or maintenance needs.

CONCLUSION



In conclusion, the piezo knock switch experiment demonstrates the effectiveness of using a piezoelectric sensor to detect knocks and trigger a response. By integrating this sensor with an LED, we created a simple yet responsive system that illuminates upon detecting a knock and deactivates upon subsequent knocks. This experiment highlights the practical applications of piezoelectric sensors in detecting physical stimuli and activating electronic responses.

REFERENCES

https://elonics.org/piezo-electric-knock-switch-using-555-ic/

https://elonics.org/