# Project Report

## Title: Clap Switch Using Arduino and Sound Sensor

## Abstract

Automation in everyday life has become a key application of microcontroller-based systems. This project implements a simple clap switch using an Arduino Uno, a sound sensor module, and an LED. The system detects a clap sound and toggles the LED state (ON or OFF). This project demonstrates the practical use of digital sensors, debouncing techniques, and Arduino programming. It can be expanded to control household appliances and enhance energy efficiency.

## Objectives

1. To design a simple sound-activated switch using Arduino.
2. To understand how to interface a sound sensor with Arduino.
3. To demonstrate the concept of debouncing for reliable sensor readings.
4. To apply microcontroller programming to real-life applications.

## Materials Required

- Arduino Uno (or compatible board)
- Sound sensor module (digital output type)
- LED (built-in pin 13 LED or external)
- Jumper wires
- Breadboard (if external LED is used)
- USB cable for programming

## Methodology

**1. Circuit Setup:** Connect the digital output pin of the sound sensor to Arduino pin D2. Use the built-in LED on pin 13, or connect an external LED with a resistor. Power the circuit via USB.

**2. Program Logic:** The sound sensor detects claps and sends a HIGH signal. The Arduino reads the sensor input. A debouncing delay of 500 ms prevents multiple triggers from a single clap. On each valid clap, the LED toggles ON or OFF.

**3. Code Implementation:** The Arduino program is written in C++ using the Arduino IDE.

## Arduino Code

```
const int soundSensor = 2;
const int ledPin = 13;
bool ledState = false;
unsigned long lastClapTime = 0;
int debounceDelay = 500;

void setup() {
```

```
pinMode(soundSensor, INPUT);
pinMode(ledPin, OUTPUT);
Serial.begin(9600);
}

void loop() {
int sensorValue = digitalRead(soundSensor);
if (sensorValue == HIGH) {
unsigned long currentTime = millis();
if (currentTime - lastClapTime > debounceDelay) {
ledState = !ledState;
digitalWrite(ledPin, ledState);
Serial.println(ledState ? "LED ON" : "LED OFF");
lastClapTime = currentTime;
}
}
}
```

## Results and Discussion

When the project was implemented, a single clap turned the LED ON, and a second clap turned it OFF. The debounce delay successfully prevented false triggers from noise or echo. The LED provided a clear visual indication of the sensor's detection. With modifications, the circuit can control relays, allowing real appliances (like lights or fans) to be switched using claps.

## Conclusion

The clap switch project shows how microcontrollers can make interactive, user-friendly devices. Using a sound sensor and Arduino, we achieved a reliable toggle mechanism for an LED. The project also emphasizes the importance of debouncing in digital electronics. This system can be extended to home automation, energy saving, and accessibility technologies.