

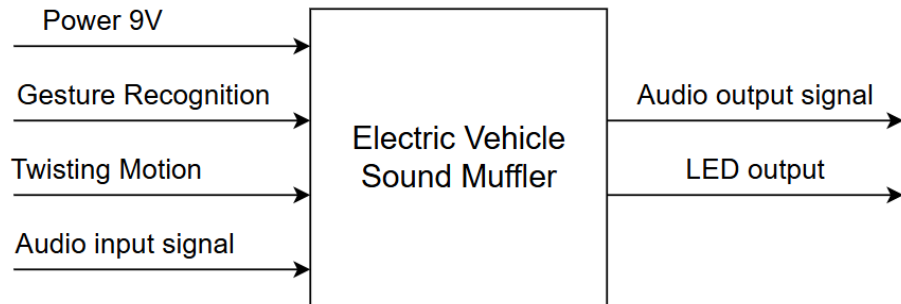
## Functional Decomposition

### Team 14

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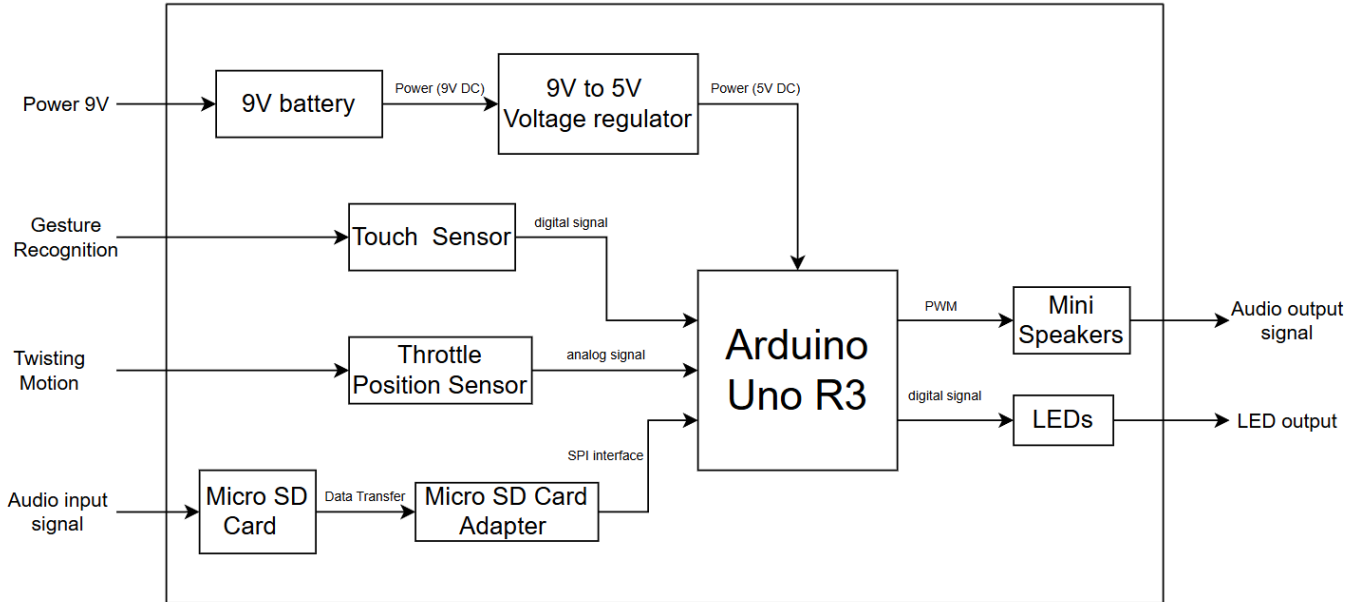
Nov 10, 2024

# Electric Vehicle Sound Muffler: Level 0



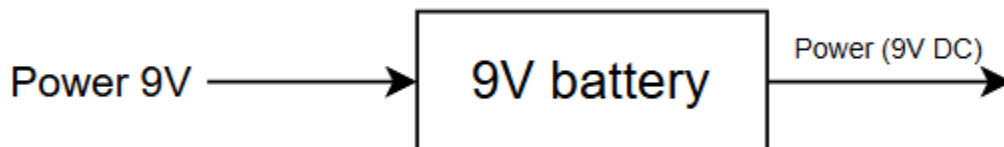
Module	Electric Vehicle Sound Muffler
Inputs	Power 9V: 9V battery Gesture Recognition: Touch Sensor Twisting Motion: TPS (Throttle Position Sensor) Audio input signal: Micro SD Card
Outputs	Audio output signal: Amplifiers LED output: LEDs
Functionality	Plays pre-stored audio files from an SD card, which are output through the base amplifier to simulate engine sounds. This volume of the secondary amplifier is dynamically adjusted based on the throttle position, which is detected by the Throttle Position sensor (TPS) using a twisting motion. Additionally, the system allows switching between different engine sounds (e.g., V6, V8) via gesture recognition with a touch sensor, with the selected sound displayed through LEDs.

# Electric Vehicle Sound Muffler: Level 1



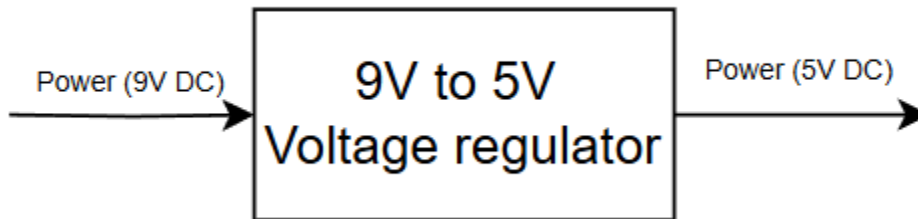
Rev 2

## 9V battery: Level 1



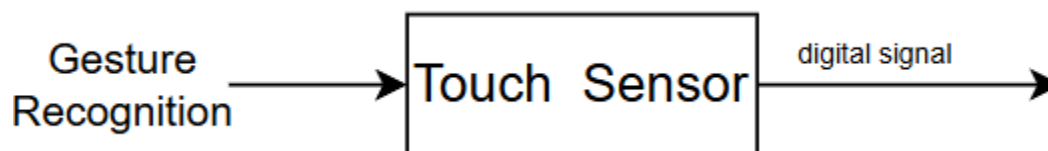
Module	9V battery
Inputs	Power 9V
Outputs	Power (9V DC)
Functionality	The 9V battery serves as a portable power source, providing a constant DC voltage to the circuit.

## 9V to 5V Voltage Regulator: Level 1



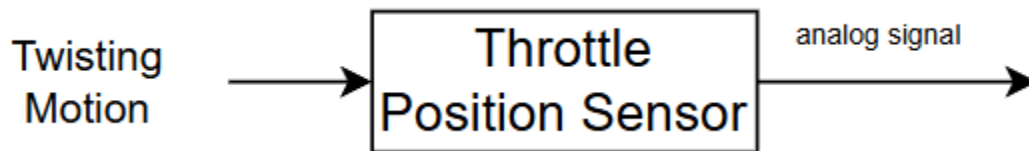
Module	9V to 5V Voltage Regulator
Inputs	Power (9V DC)
Outputs	Power (5V DC)
Functionality	Convert the 9V DC from the battery to a stable 5V DC using a voltage regulator, providing the necessary power to the microcontroller. The regulator steps down the 9V from the battery to 5V, ensuring a consistent voltage for the microcontroller to operate reliably. This conversion helps protect the microcontroller from voltage fluctuations and ensures it receives the correct voltage for proper functionality.

## Touch Sensor: Level 1



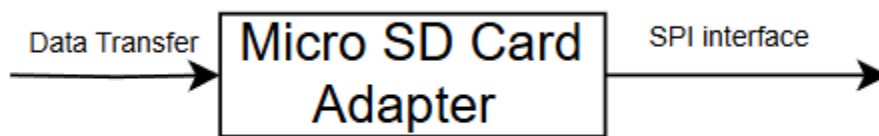
Module	Touch Sensor
Inputs	Gesture Recognition
Outputs	Digital signal
Functionality	The touch sensor with gesture recognition detects a touch and sends a digital signal to the Arduino. Based on the input, the Arduino sets the LED to HIGH (on) or LOW (off).

## Throttle Position Sensor: Level 1



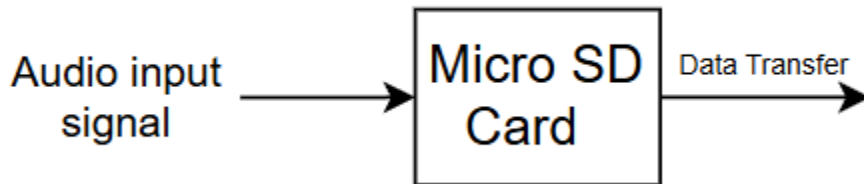
Module	Throttle Position Sensor
Inputs	Twisting Motion
Outputs	Analog signal
Functionality	The throttle position sensor detects the twisting motion of the throttle and provides an analog output that varies based on the position. As the throttle is twisted, the sensor generates a voltage signal corresponding to the position, which is sent to the Arduino.

## Micro SD Card Adapter: Level 1



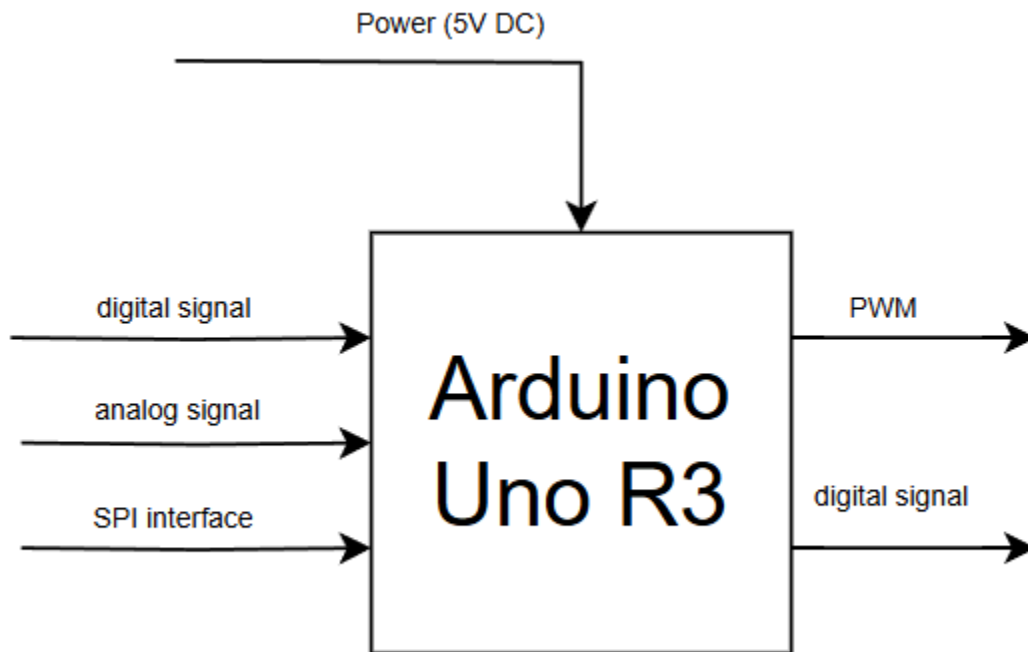
Module	Micro SD Card Adapter
Inputs	Data Transfer
Outputs	SPI interface
Functionality	The microSD card adapter receives data from the SD card via data transfer, which involves reading the stored data from the card. This data is then transmitted to the Arduino through the SPI interface (Serial Peripheral Interface), which includes connections for MISO, MOSI, SCK, and CS pins.

# Micro SD Card: Level 1



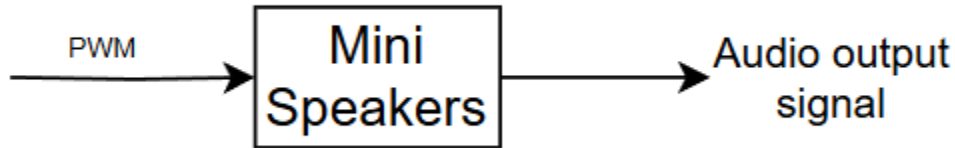
Module	Micro SD Card
Inputs	Audio input signal
Outputs	Data Transfer
Functionality	The microSD card receives an audio input signal from stored MP3 audio files. The data is read from the card and transferred through the SPI interface to the SD card reader.

# Arduino Uno R3: Level 1



Module	Arduino Uno R3
Inputs	Power (5V DC) from Voltage Regulator Digital signal from Touch Sensor Analog signal from TPS SPI interface from Micro SD Card Adapter
Outputs	PWM to mini speakers Digital signal to LEDs
Functionality	The Arduino Uno R3 receives 5V DC power from the voltage regulator. It gets a digital signal from the touch sensor to control the LED, turning it ON or OFF. The Arduino reads an analog signal from the throttle position sensor (TPS) to determine throttle position. It communicates with the SD card adapter via SPI to transfer data, such as audio files. The Arduino outputs a PWM signal to the speaker to play audio, and a digital signal to the LEDs to control their state based on input from the touch sensor and TPS.

## Mini Speakers: Level 1



Module	Mini Speakers
Inputs	PWM
Outputs	Audio output signal
Functionality	The mini speaker receives a PWM input from the Arduino, which modulates sound. The speaker converts the PWM signal into an audio output (sound), with the tone and volume controlled by the PWM frequency.

## LEDs: Level 1



Module	LEDs
Inputs	Digital signal
Outputs	LED output
Functionality	The LEDs receive a digital signal input from the Arduino. Based on this signal, the LEDs are controlled to either HIGH (on) or LOW (off), allowing the Arduino to turn the LEDs on or off.