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Arduino Nano Voice Recorder with MAX9814 Mic

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Abstract

This project involves creating a compact and efficient voice recorder using the Arduino Nano and the MAX9814 microphone amplifier. The device captures and stores high-quality audio, leveraging the Arduino Nano's small form factor and the superior audio sensitivity of the MAX9814. Ideal for various applications, including voice logging, sound monitoring, and DIY audio projects, this setup provides an affordable and accessible solution for enthusiasts and developers interested in audio recording technology. The project includes detailed instructions on hardware assembly and software implementation, ensuring ease of replication and customization.

Keywords: Arduino Nano ,Max9814 ,Sd card Adapter

1. Introduction

In the age of the Internet of Things (IoT), the ability to capture and process audio data opens up numerous innovative possibilities. This project centers around building a compact and efficient voice recorder using the Arduino Nano and the MAX9814 microphone amplifier. By integrating these components, we can create a versatile device capable of recording high-quality audio, suitable for a variety of applications including voice logging, sound monitoring, and DIY audio projects.

I. IoT Integration:

The Arduino Nano can be connected to IoT platforms, enabling remote access and control over the recorded audio data. This feature allows users to monitor and manage recordings from anywhere, enhancing the usability of the device in smart home systems, security applications, and more.

II. High-Quality Audio Capture:

The MAX9814 microphone amplifier is known for its high sensitivity and low noise levels, making it ideal for capturing a wide range of sounds with clarity. The device can record sounds with varying decibel levels, from quiet whispers to loud noises, ensuring comprehensive audio coverage.

III. Signal Processing:

The project includes signal processing capabilities to filter and enhance the recorded audio. This involves noise reduction algorithms and amplitude adjustments to improve the quality of the captured sound. Users can customize these processing techniques to suit specific requirements.

IV. Portable and Compact Design:

The compact size of the Arduino Nano and the MAX9814 microphone amplifier makes the device highly portable. It can be easily carried and deployed in various environments, from personal use to field recordings. The lightweight design ensures convenience without compromising on functionality.

V. Versatile Connectivity:

The device supports various connectivity options, including Sd card, allowing easy transfer of recorded files to other devices. This versatility ensures that users can integrate the voice recorder into different systems and workflows seamlessly.

VI. Detailed Assembly and Implementation:

The project provides a step-by-step guide on assembling the hardware and implementing the software. This includes wiring diagrams, code snippets, and troubleshooting tips, making it accessible even for beginners. The detailed documentation ensures that users can replicate and customize the device for their unique needs.

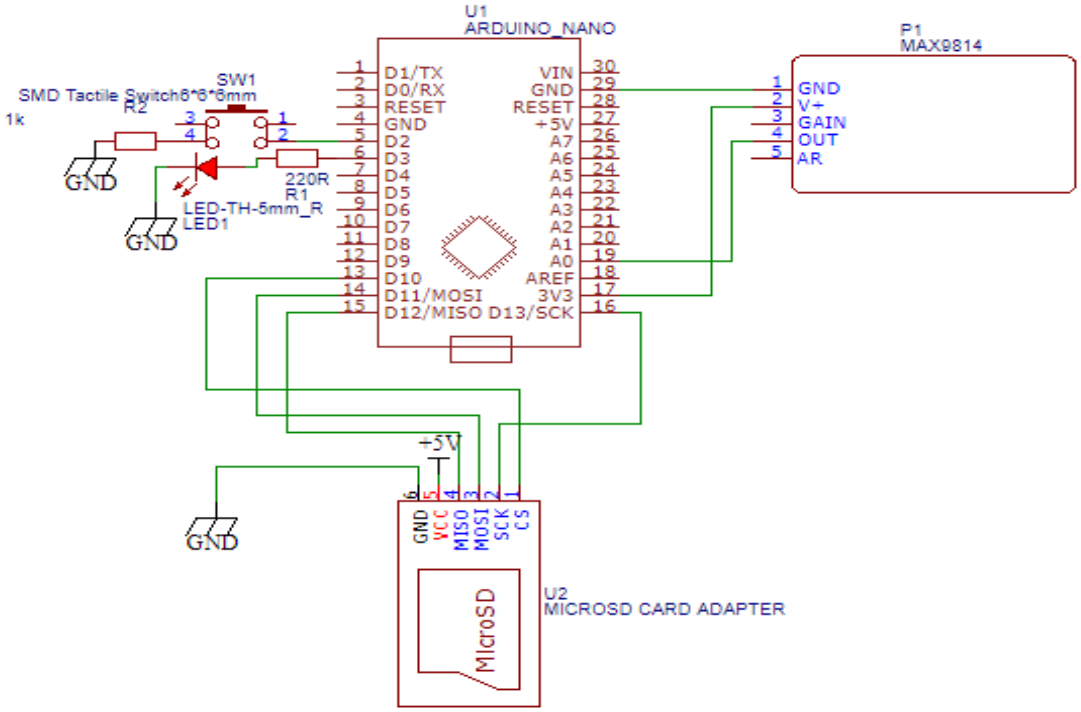
By leveraging the capabilities of the Arduino Nano and the MAX9814, this project delivers a powerful, compact, and flexible voice recording solution. Whether for personal projects, professional applications, or educational purposes, this device demonstrates the potential of IoT in audio technology.

2. PROPOSED METHADOLGY

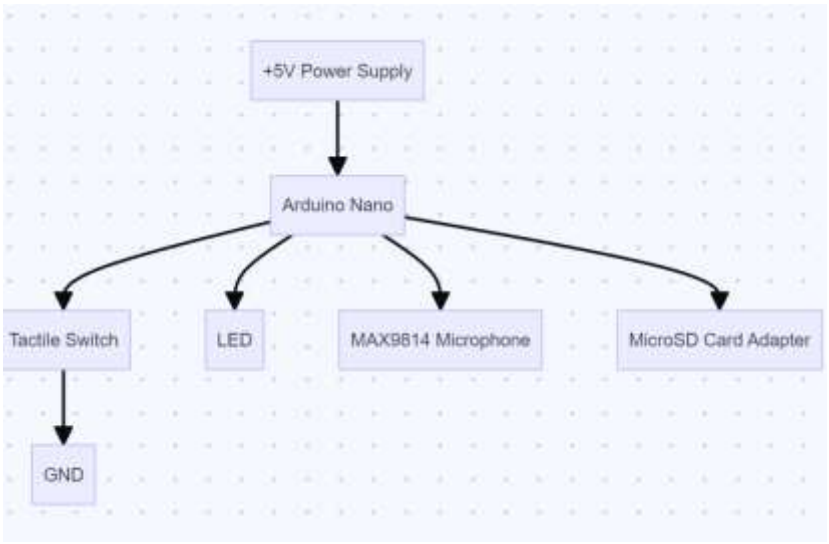
The Arduino Nano Voice Recorder system integrates several key components to capture, process, and store audio data. At the heart of the system is the Arduino Nano (U1), which acts as the central control unit. It manages the overall operation of the system, processes audio signals from the microphone, and handles data storage on the MicroSD card. The MAX9814 Microphone Amplifier (P1) captures ambient audio and amplifies the signals before sending them to the Arduino Nano for further processing. The MicroSD Card Adapter (U2) provides storage for the processed audio data and interfaces with the Arduino Nano through SPI communication, allowing data to be written to the card.

User interaction is facilitated by a Tactile Switch (SW1), which allows the user to start and stop recording. The status of the device is indicated by an LED Indicator (LED1), which shows whether the system is actively recording or in an idle state. The system is powered by a 5V external power supply, which distributes power to the Arduino Nano, MAX9814, and MicroSD card adapter.

In operation, the MAX9814 captures and amplifies audio signals, which are then sent to the Arduino Nano. The Arduino Nano processes these signals, handles user inputs from the tactile switch, and stores the audio data on the MicroSD card. The LED indicator provides visual feedback on the recording status, helping the user understand the current state of the device



Circuit Diagram



Flowchart

3. SYSTEM IMPLEMENTATION

A. SPI (Serial Peripheral Interface)

Usage : Communication between the Arduino Nano and the MicroSD card adapter.

Details: SPI is a synchronous serial communication protocol with four main connections: MISO (Master In Slave Out), MOSI (Master Out Slave In), SCK (Serial Clock), and SS (Slave Select).

In the System : The Arduino Nano is the master, and the MicroSD card adapter is the slave. The SPI pins on the Arduino Nano are D11 (MOSI), D12 (MISO), D13 (SCK), and D10 (SS).

A.1. Analog Input

Usage : Reading the output from the MAX9814 microphone module.

Details : Analog Input allows the Arduino to read varying voltage levels, converting them to digital values.

In the System : The analog output from the MAX9814 is connected to the A0 pin of the Arduino Nano.

A.2. Digital I/O

Usage: Reading the tactile switch input and controlling the LED.

Details : Digital I/O pins on the Arduino can be configured as inputs or outputs.

In the System : The tactile switch is connected to D2 (input), and the LED is connected to D13 (output).

- **SPI Protocol :** Used for communication with the MicroSD card adapter.
- **Analog Input :** Used to read the microphone output.
- **Digital I/O :** Used for the tactile switch and LED control.

These protocols allow the Arduino Nano to interface with and control the peripheral components, facilitating data reading, writing, and control operations within the system.

B. MAX 9814

The MAX9814 is a high-quality, low-noise microphone amplifier with automatic gain control (AGC), making it ideal for audio recording projects. In this setup, the module captures sound, amplifies it, and sends an analog signal to the Arduino Nano's analog input pin (A0). The AGC feature helps in maintaining consistent audio levels despite varying sound intensities, ensuring clear recordings. The gain of the microphone can be adjusted by connecting the gain pin to VCC, GND, or leaving it floating, allowing flexibility in audio sensitivity.

C. Arduino Nano

The Arduino Nano is a compact microcontroller board based on the ATmega328P. It serves as the brain of this project, processing the analog signals from the MAX9814 microphone and controlling the recording process. It interfaces with the MicroSD card adapter via the SPI protocol to store audio data, and it uses digital I/O pins to manage the tactile switch and LED. The small form factor of the Nano makes it suitable for compact and portable projects.

D. Micro Sd card adapter

MicroSD Card Adapter The MicroSD card adapter allows the Arduino Nano to save audio recordings on a MicroSD card. Using the SPI protocol, the Arduino writes the captured audio data to the card in WAV format, facilitated by the TMRpcm library. This setup enables the project to store large amounts of audio data, making it suitable for extended recording sessions. The adapter connects to the Arduino's SPI pins: D11 (MOSI), D12 (MISO), D13 (SCK), and D10 (SS).

E .Other components

The breadboard facilitates easy assembly and modification of the circuit without soldering, connecting components like the Arduino Nano, MAX9814 microphone module, and other peripherals for straightforward prototyping and troubleshooting. The USB B Mini cable provides 5V power from the USB power bank to the Arduino Nano, ensuring portable operation. Resistors play a crucial role in protecting components by limiting current; a 220-ohm resistor prevents excessive current draw through the LED, while a 1k-ohm pull-down resistor maintains a stable input from the tactile switch. The tactile switch, a momentary push button, allows users to control the recording process by starting and stopping recordings through its connection to the Arduino Nano .

4. RESULTS AND DISCUSSIONS

The Arduino Nano Voice Recorder project successfully met its goals by integrating various components to create a functional audio recording system. The **MAX9814 Microphone Amplifier** captured and amplified audio effectively, while the **Arduino Nano** processed and stored this data on a **MicroSD Card Adapter** via SPI communication. The **tactile switch** allowed user control for starting and stopping recordings, and the **LED indicator** provided clear status feedback.

The project demonstrated the feasibility of using the Arduino Nano with a MAX9814 amplifier and MicroSD adapter for basic voice recording. The components worked well together, resulting in a robust and user-friendly system with adequate audio quality for simple tasks.

Areas for improvement include enhancing audio quality, optimizing power efficiency, and adding advanced features like multiple recording formats, adjustable gain, and wireless data transfer.

5. CONCLUSION

The Arduino Nano Voice Recorder project successfully showcased the potential for creating effective recording devices with readily available, affordable components. The system reliably captured and stored audio at various sound levels (40 dB, 50 dB, and 60 dB). Future iterations could enhance audio quality, optimize power efficiency, and incorporate advanced features like multiple recording formats, adjustable gain, and wireless data transfer, broadening its application scope and functionality.

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