CS 145/145L ~ Embedded Software & Associated Lab

Project 5

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Date 06/14/2024

Objective

The objective of this project is to develop an interactive LED collar for a toy cat, capable of changing colors and playing musical notes based on user input via a keypad and touch sensor. The system is designed to allow users to record and play back color sequences with corresponding musical notes, enhancing the toy's interactivity. Additionally, the project aims to integrate a toggle feature for the touch sensor, enabling and disabling touch-activated color and sound changes through keypad commands.

Procedure

Setting up the hardware

Prepare the Components:

- AVR microcontroller (ATMega32)
- WS2812B LED strip (50 LEDs)
- 4x4 Keypad
- Touch sensor
- LCD display
- Speaker
- Necessary resistors, wires, and power supply

Connect the LED Strip:

- Connect the data pin of the WS2812B LED strip to PA0 on the AVR microcontroller.
- Connect the power and ground lines of the LED strip to the appropriate power source.

Set Up the Keypad:

- Connect the rows of the keypad to PORTC pins 0-3 on the AVR microcontroller.
- Connect the columns of the keypad to PORTC pins 4-7 on the AVR microcontroller.

Integrate the Touch Sensor:

- Connect the output of the touch sensor to PA1 on the AVR microcontroller.
- Ensure the touch sensor is properly powered and grounded.

Attach the LCD Display:

- Connect the data pins of the LCD display to appropriate pins on the AVR microcontroller.
- Connect the control pins (RS, RW, E) of the LCD to designated pins on the AVR microcontroller.
- Ensure the LCD display is properly powered and grounded.

Connect the Speaker:

- Connect the positive lead of the speaker to PA3 on the AVR microcontroller.
- Connect the negative lead of the speaker to the ground.
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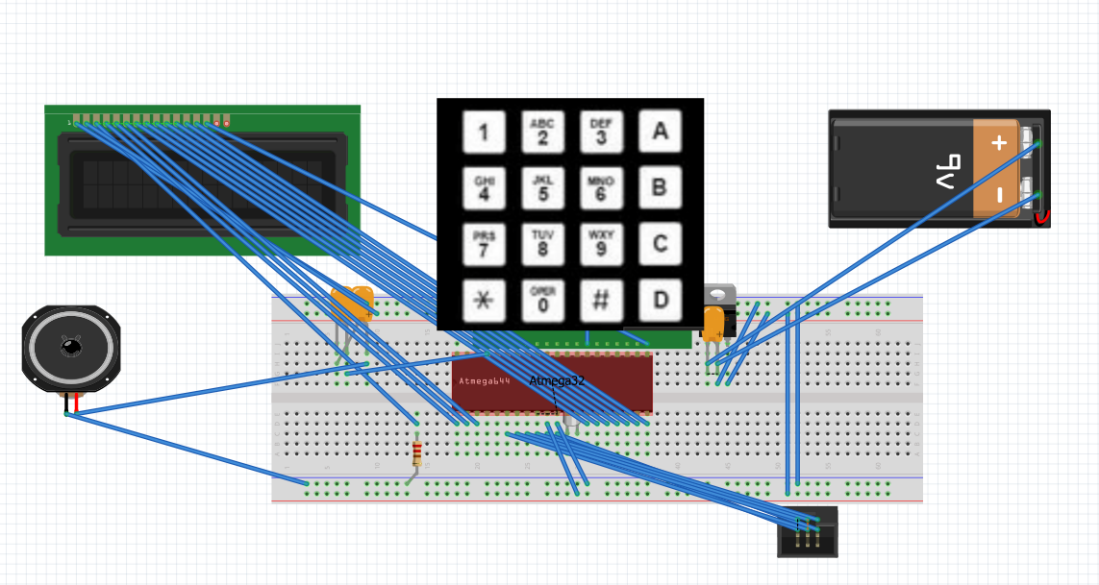

Power the Circuit:

- Ensure all components are connected to a common ground.
- Connect the power supply to the AVR microcontroller and other components.

Verify Connections:

- Double-check all connections to ensure they are secure and correct.
- Make sure there are no short circuits or loose wires.

Software Implementation

Define Constants and Include Libraries:

- Set the clock speed and include necessary AVR and utility libraries.

- Define constants for the number of LEDs and the maximum color sequence length.

Declare Data Structures and Variables:

- Define enums for musical notes.
- Create structures for playing notes and color-note combinations.
- Initialize variables for color sequence, touch sensor state, and other controls.

Initialize Keypad and Touch Sensor:

- Define functions for keypad input detection and key mapping.
- Implement functions to enable and disable the touch sensor.

Implement LED Control Functions:

- Write functions to control the WS2812B LEDs, including setting colors and sending data bits and bytes.

Implement Note Playing Functions:

- Define functions to play individual notes and sequences of notes, with controls for stopping and starting.

Main Loop and Keypad Interaction:

- Implement the main loop to handle keypad inputs for recording colors, playing notes, enabling/disabling the touch sensor, and controlling other functionalities.