Group 14

ES Project

DAC Using R-2R Ladder Circuit To Implement Piano

Link to Video: [ES_Project_Demo_Group14.mp4]

Course: **Embedded Systems**
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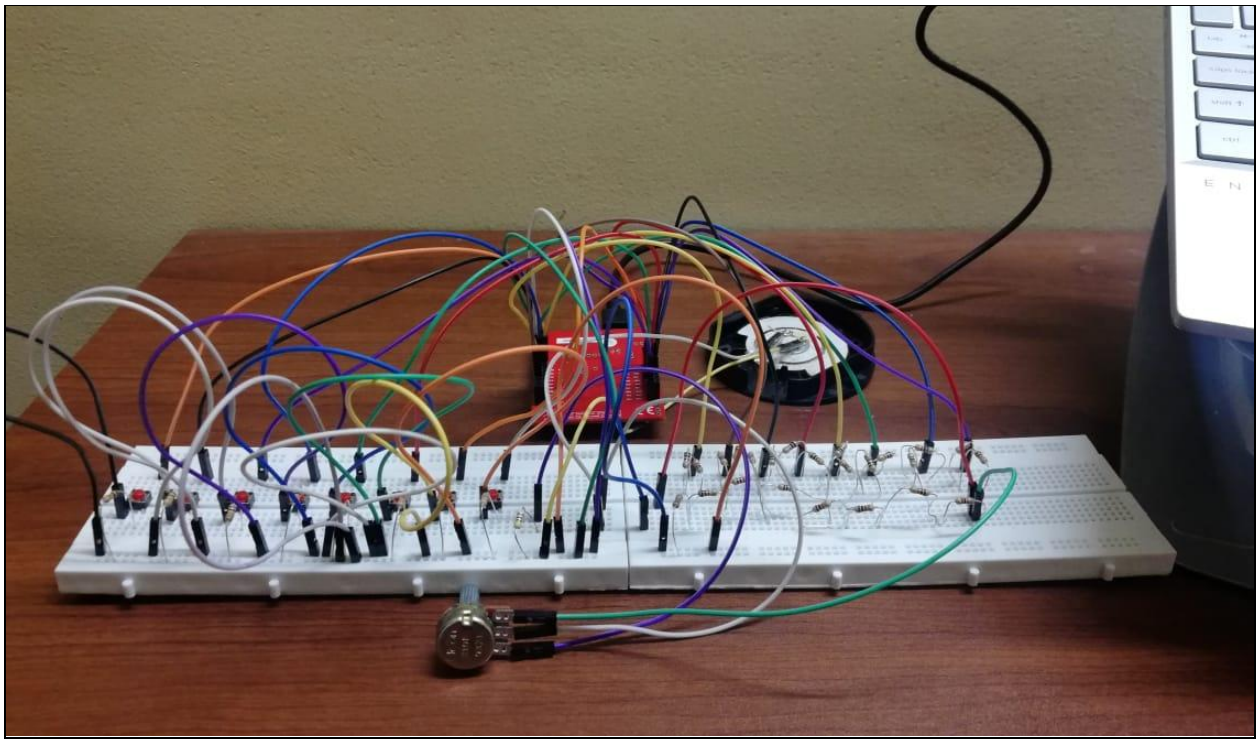
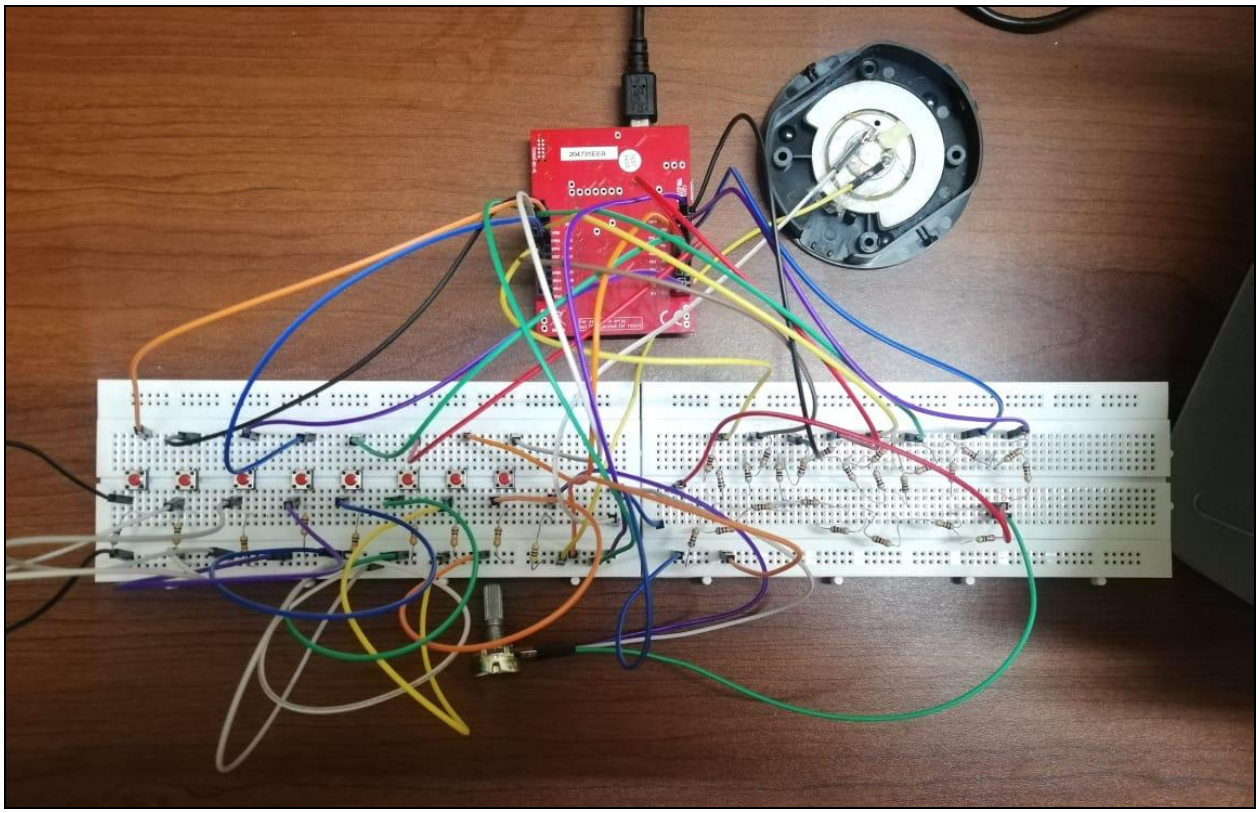
Circuit:





Components Used:

- TM4C123GH6PM
- Buttons - 8
- 10kΩ resistors - 8
- 1kΩ resistors - 24
- 500Ω resistor - 1
- Potentiometer - 1
- Speaker - 1

Pin Configurations:

TM4C Pin	Circuit Connection
PE0	Button 1
PE1	Button 2
PE2	Button 3
PE3	Button 4
PF0	Button 5
PF1	Button 6
PF2	Button 7
PF3	Button 8
PB0	R-2R Bit 1
PB1	R-2R Bit 2
PB2	R-2R Bit 3

PB3	R-2R Bit 4
PB4	R-2R Bit 5
PB5	R-2R Bit 6
PB6	R-2R Bit 7
PB7	R-2R Bit 8

Logic:

- Constructed R-2R Ladder Design for 8-bits in Tivac Board using resistors, wire connectors, and connected Multimeter and in the R-2R Ladder.
- The 8-bit binary value is assigned to 8 ports of Port B
- GPIO Ports (E and F) are initialized as digital pins and set to input mode.
- Unlock PORT E and F and disable the analog function. We also clear the PCTL register for Ports E and F.
- Configured the Tiva C board pin connections for resistors in the R-2R ladder (port B pins).
- Each button corresponds with a different keynote and has a frequency index for each button.
- By reading the corresponding PORTS(Port E and F), the button pressed is found.
- Pushbutton signals are sent to Tiva C pin connections (VCC, GND, taking output signal from push buttons when pressed and feeding the input to Tiva C - 4 port E and 4 port F GPIO pins).
- Binary input values (corresponding frequencies of piano notes) are sent from Tiva C to corresponding R-2R Ladder resistors in the circuit.

- GPIO PE0-PE3 and PF0-PF3 ports are set from Tiva C to R-2R ladder DAC to Piezo to play the specific frequency.
- GPIO Port B in range of PB0-PB7 Pin is read from R-2R Ladder to corresponding Tiva C Button Connected GPIO Port ranging from PE0-PE3 and PF0-PF3 Port.
- Sine Waves are generated by setting frequency for 8 Basic notes in music to get through DAC R-2R Ladder.

Member Contributions:

- Assembled the Circuit did Testing: **CED18I042**
- GPIO Port initialization and handling: **CED18I016**
- Assigned and took care of Ports I/P O/P: **CED18I042**
- Handled interrupt and configured buttons: **CED18I043**
- Wrote functions to play and stop sounds: **COE18B063**
- Calculated the frequencies and configured the buttons: **CED18I050**
- Integrated code modules and circuit design: **CED18I028**