EE230- Analog Lab Project

Touchless Gesture Recognition

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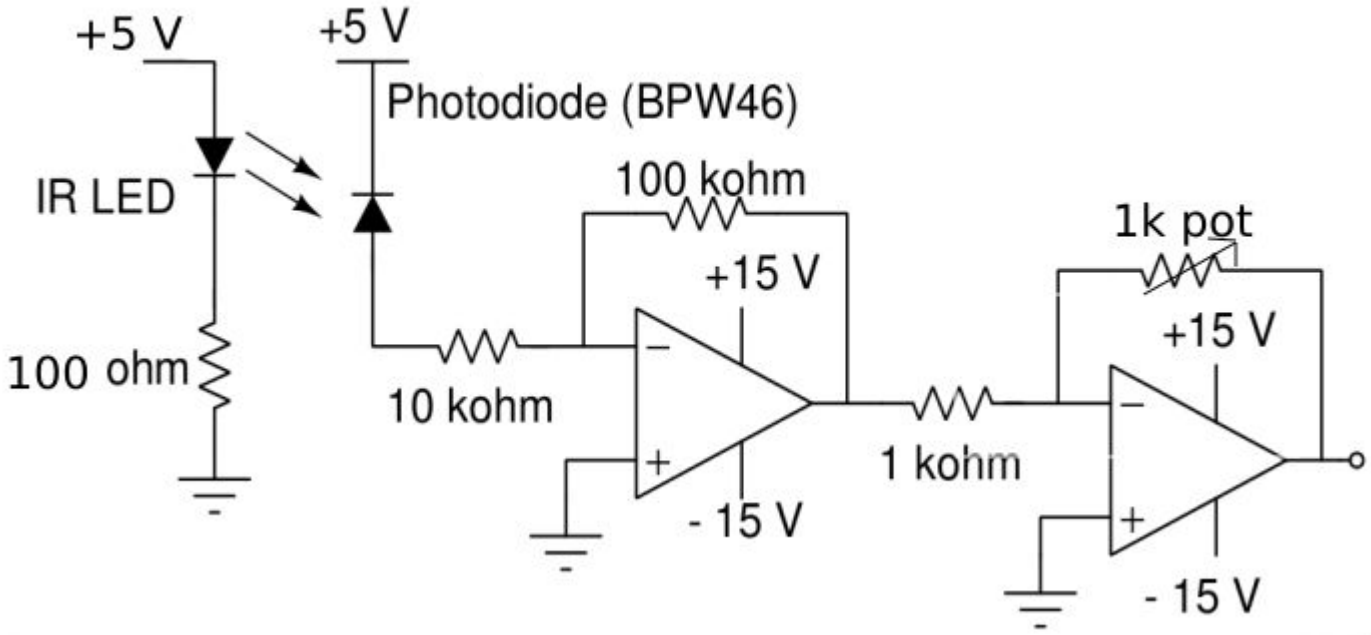
Table of Components

Component Name	Quantity
IC- TCRT5000- Reflective Optical IR Sensor	4
Krypton CPLD board	2
8x8 LED Matrix	1
IC- TL072- Dual Operational Amplifiers	5
IC- CD4006- Quad Bilateral switch	1
Headphones	1
Aux cable	1
Potentiometer	5

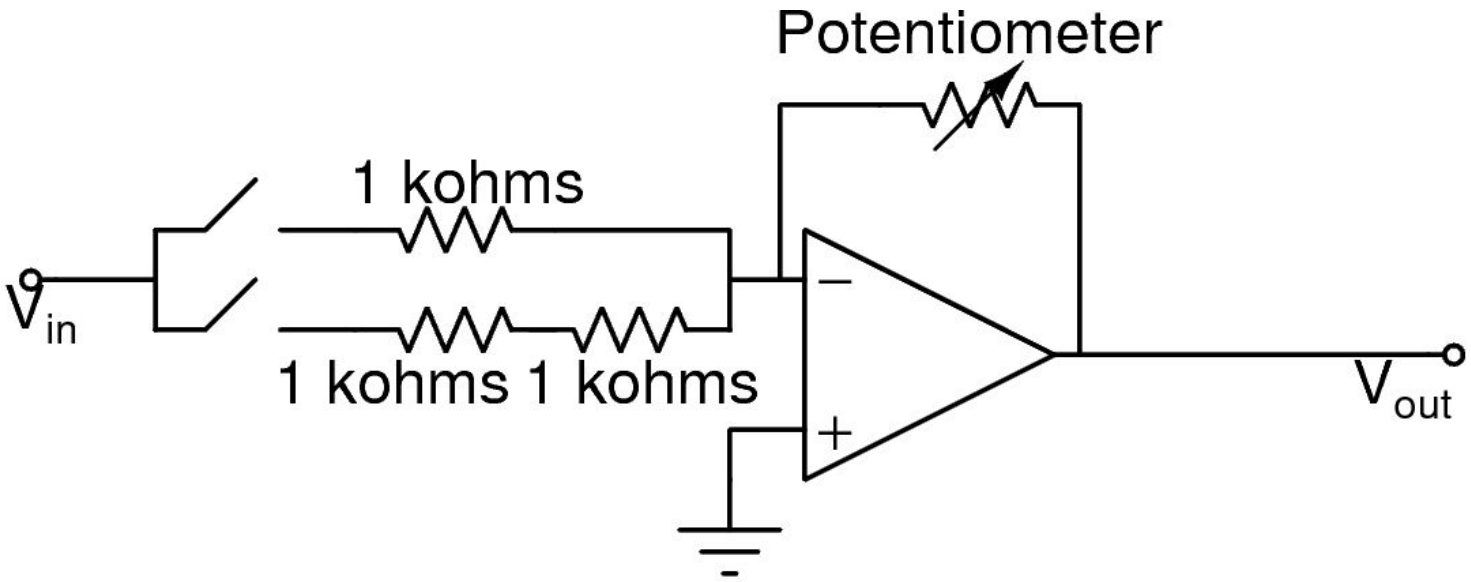
Components used

Resistors (0.1k, 0.47k, 1k, 10k, 100k)
Jumper wires (Male-to-Female)
Wires
Breadboards

Circuit diagram of one of the four IR emitter-detector pairs



Circuit diagram of the summer for Demo 3

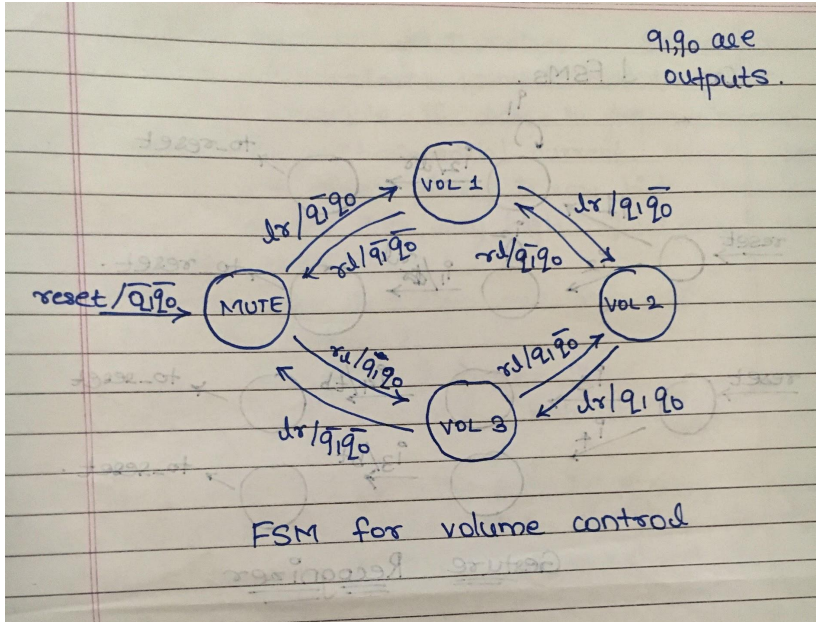


Basic Functioning of IR Emitter-Sensor Circuit

- Using the circuit from ‘How Dark is Dark’ experiment, we implemented 4 IR-emitter-sensor circuits.
- The TCRT5000 IC is a reflective optical sensor. If there is an obstacle in the path of the emitted light, it is reflected onto the inbuilt photo-diode and so there's a voltage spike.
- When we move move our finger over the sensor, and using a I to V converter and an amplifier with variable gain, we amplify the signal so that its peak value is less than 3.3 V (as Krypton Board specification is stated).
- In this way, using these 4 pairs, we can successfully recognize 4 gestures.
- Then, after we have successfully achieved in detecting the gesture through voltage changes, we use this to make finite-state machines for different applications and implement them.
- We have tried 3 applications like ‘LED Matrix Tracker’, ‘Gesture Lock’ and ‘Touchless Volume control’ using the Krypton Board to implement our FSMs.

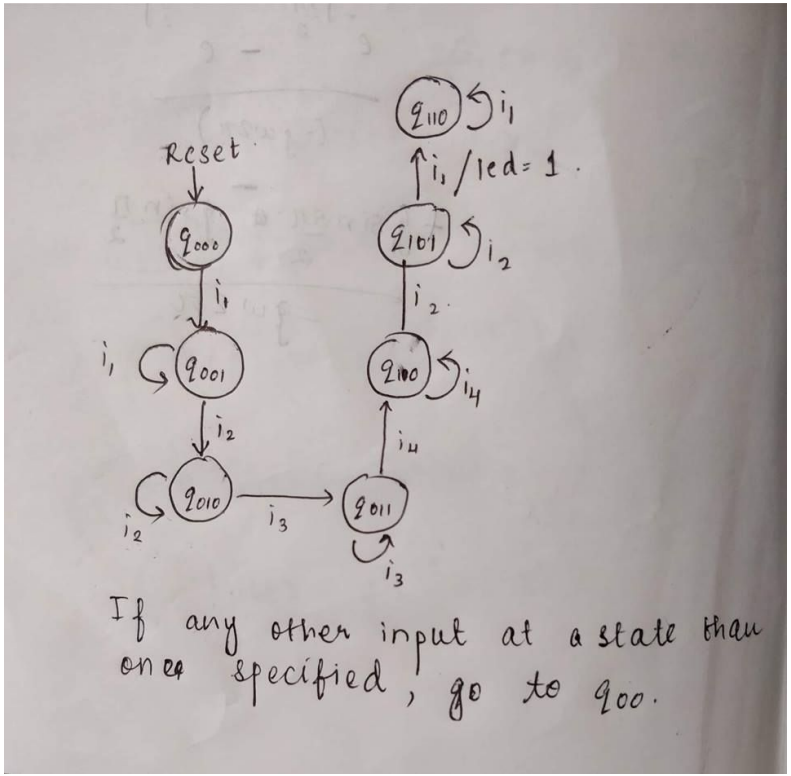
Demo 1- Volume Control of Audio

- We give the output of the Krypton Board FSM to a summer circuit with two switched. This gives us 4 volume levels.
- We make an FSM with 4 states (including mute), and a button to switch off the song entirely.
- We use two gestures for this, left to right for increasing the volume, and right to left to decrease it.
- From our phone, we give the input to the inverting summer whose output is then fed to the speaker or headset which then outputs the variable audio audio output.



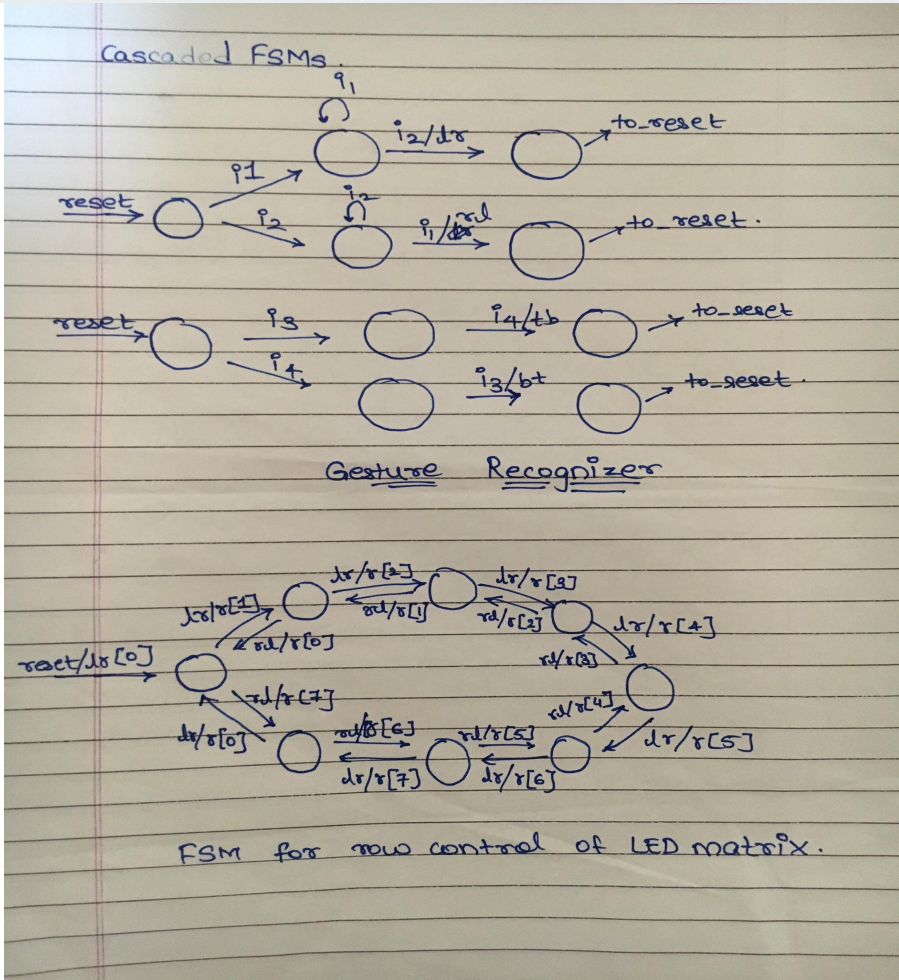
Demo 2- Touchless Gesture Lock

- This is basically a pattern recognition fsm.
- The unlock pattern is: On the first breadboard-left to right. On the second -left to right. On the first again, right to left. Basically, lr1-lr2-rl1.
- We make an FSM for the above which lights the LED on the Krypton board if the correct gesture is made.



Demo 3- LED Matrix Tracker

- We use 4 IR circuits, to recognize 4 gestures.
- Using gestures like forward and backward, up and down, we can move which LED is lighted up on the LED matrix provided.
- This has been done using two Finite- State Machines, one for the forward-back, and a another one used as left and right.
- Each gesture is recognized on passing the finger over two LEDs at a distance of 0-3 cms above them.



Problems Faced And Proposed Solutions

- The IR LEDs are very sensitive to the infrared present in sunlight. Hence , out circuit doesn't work in or in the vicinity of direct sunlight.
- One of our future prospects include rectifying this drawback. We plan to place another photodiode whos output we will then compare with those of our original LEDs to get the actual value.