

# The Challenges

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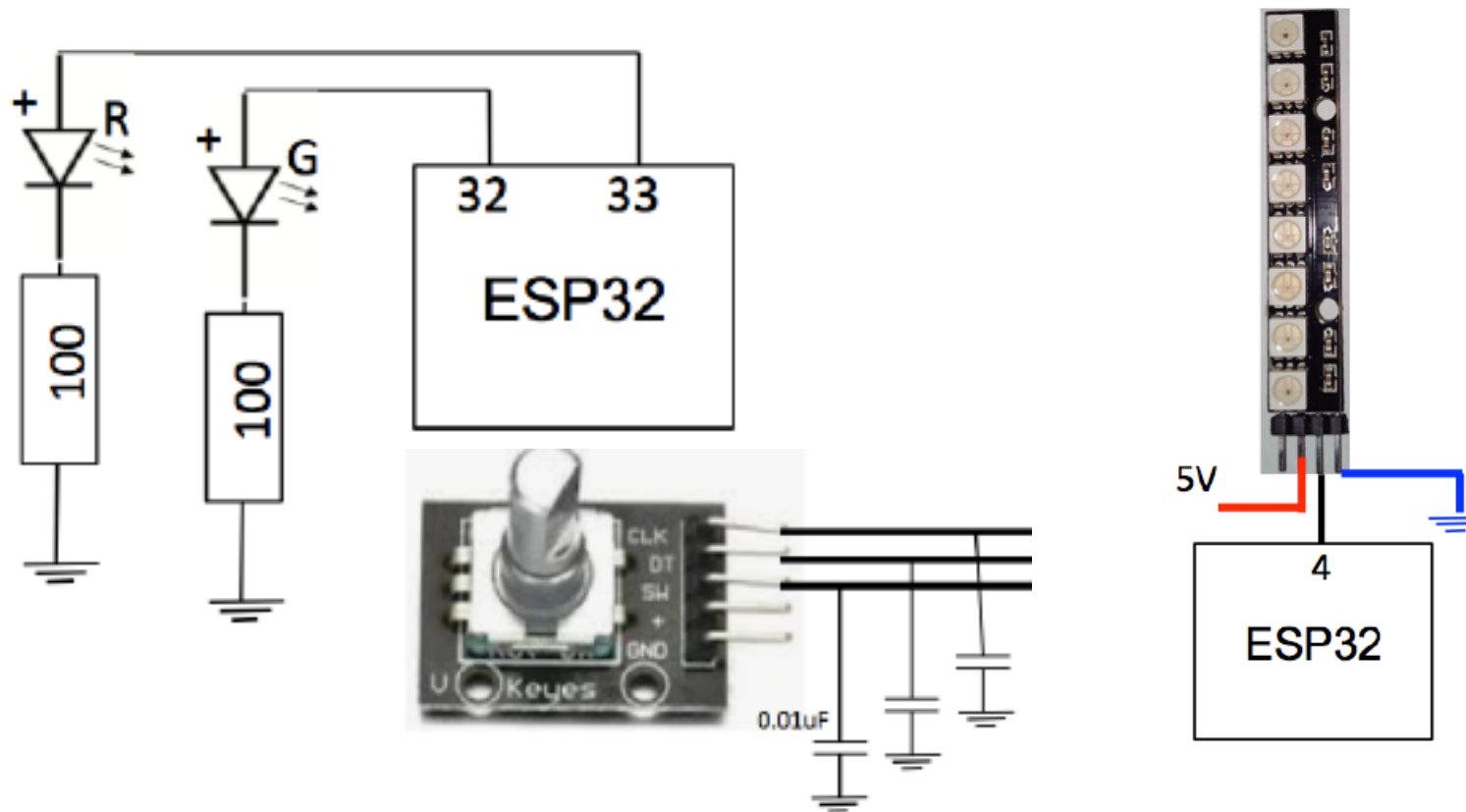
# Purpose

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- ◆ Provide a chance for you to demonstrate what you have learned
- ◆ Open-ended – solution require your own effort and no answer provided
- ◆ Opportunity to apply what you have learn in Lab 0 to Lab 4
- ◆ A chance for you to “show off” during your Lab Oral Assessment next week
- ◆ 10 suggestions provided
- ◆ Don’t expect you to do more than one or two
- ◆ Graded at four different levels of difficulties
- ◆ Choose the one that you are most confident first before attempting a hard challenge (i.e. put something in the bag!)

## Suggestion 1: Rotary encoder controlling intensity (1)

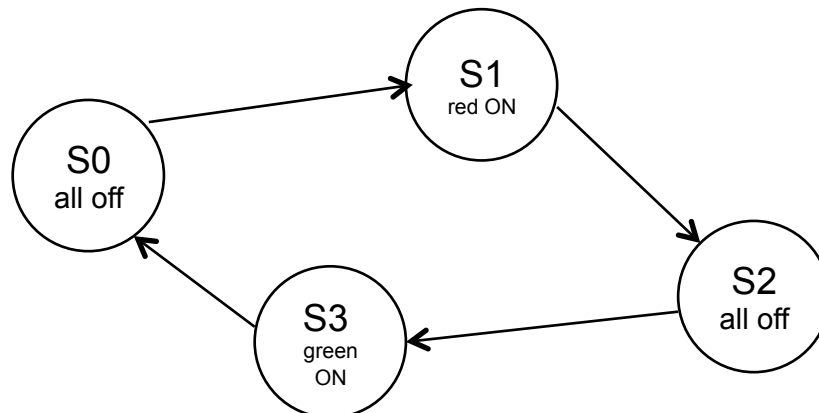
- ◆ Essentially task 3 in Lab 4B with option of using individual LEDs and/or neopixel strip.
- ◆ Turn the rotary encoder and adjust the light intensity of the LED or neopixels.



# Suggestion 2: Traffic Light (1)

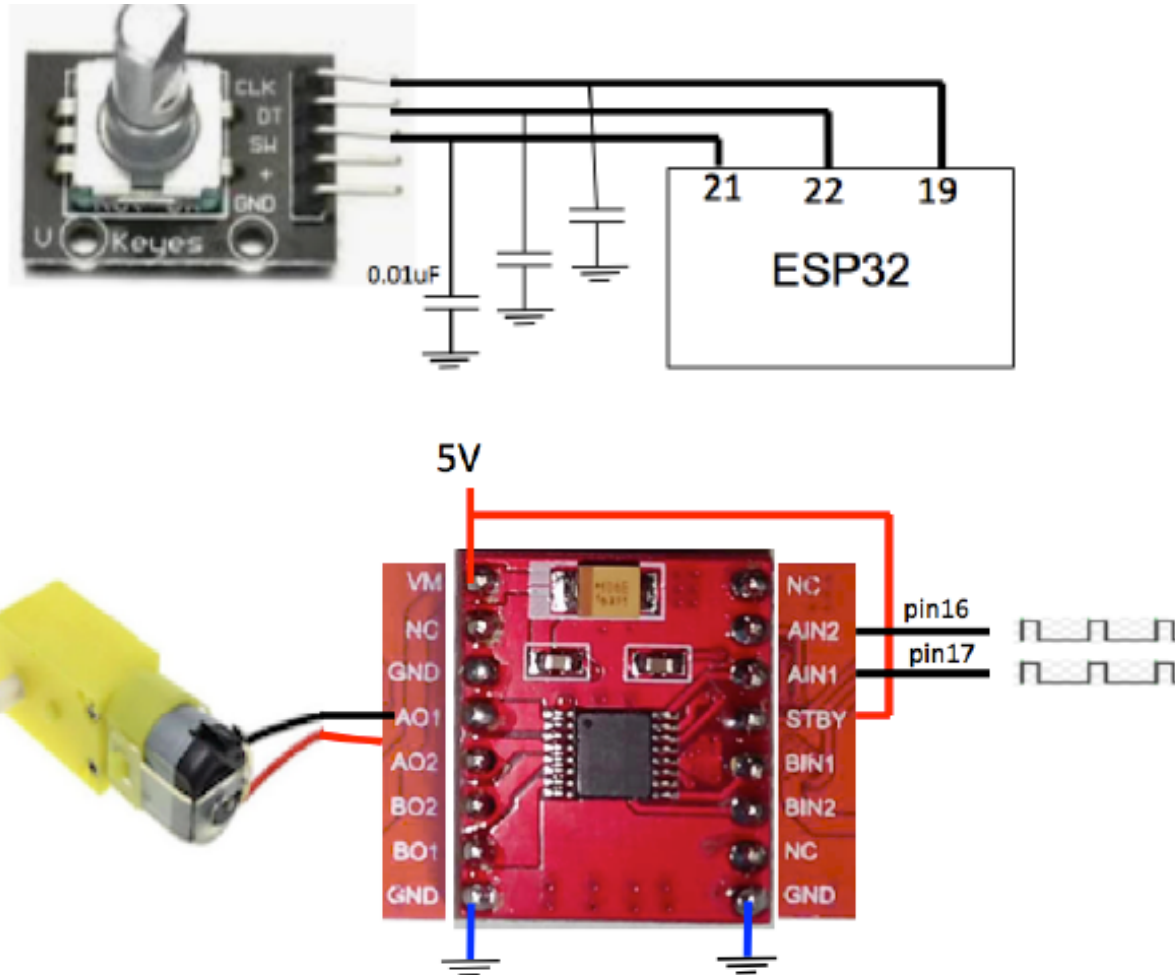
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- ◆ Each time pressing the rotary switch, go through the sequence:
  1. S0 – starting state, both off
  2. S1 – came from S0, turn on red LED
  3. S2 – came from S1, turn off red LED
  4. S3 – came from S2, turn on green LED
- ◆ This may sound easy. However, you would need to implement something known as a finite state machine:



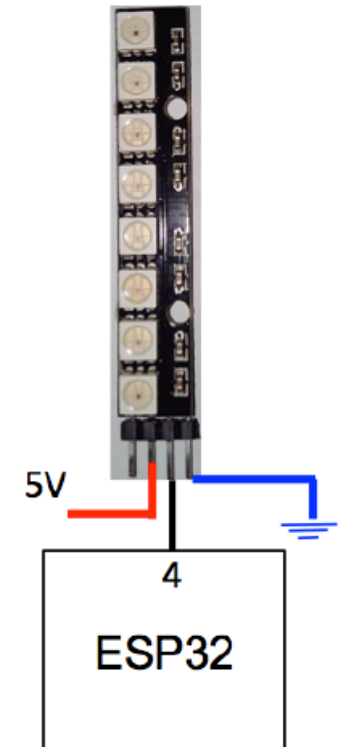
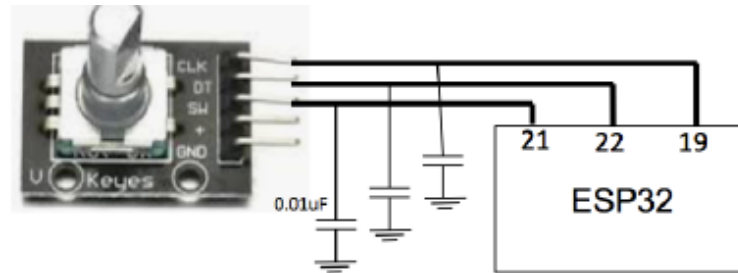
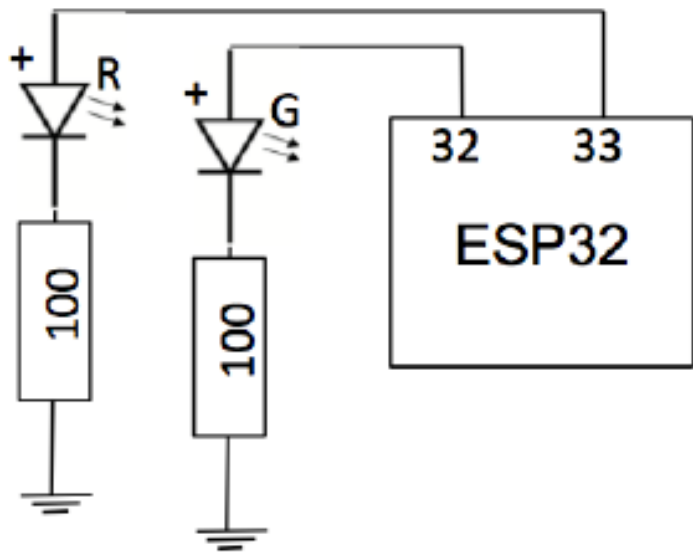
# Suggestion 3: DC Motor Control (1)

- ◆ Similar to Suggestion 1, but use rotary encoder to control speed of DC motor in both directions.



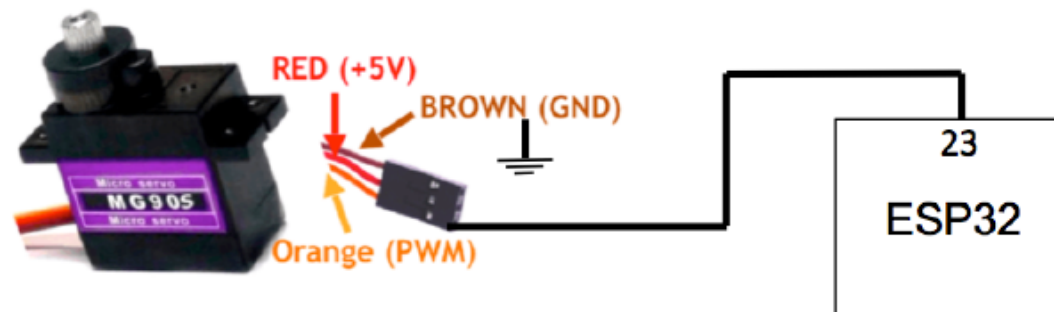
# Suggestion 4: Reaction Meter (2)

- ◆ Similar to Suggestion 1, but use rotary encoder to control speed of DC motor in both directions.



## Suggestion 5: Message to Mars (2 to 4)

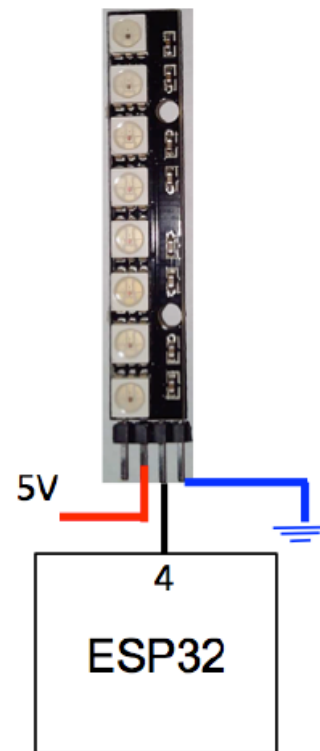
- ◆ Movie “The Martian” – NASA send messages to Matt Damon as ASCII code in hexadecimal digits.
- ◆ Emulate this using Servo Motor to send hex digit (angle indicates 1 of 16 possibilities), and send the message “Hello Peter”.
- ◆ You get level 4 achievement if integrate this with Computing 2, send any message over internet!



## Suggestion 6: Light Show (2)

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- ◆ Program neopixel strip to provide a sequence of different colour patterns.

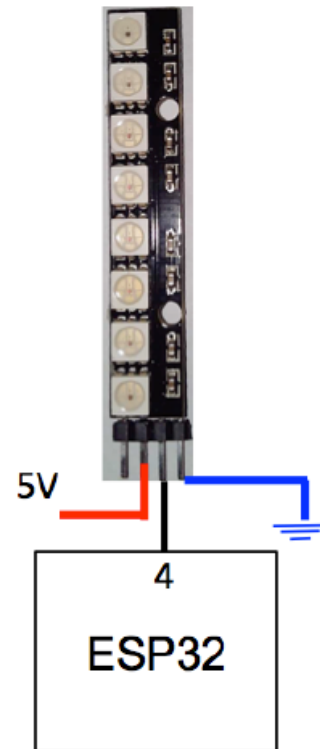




## Suggestion 7: Sound level meter (3 to 4)

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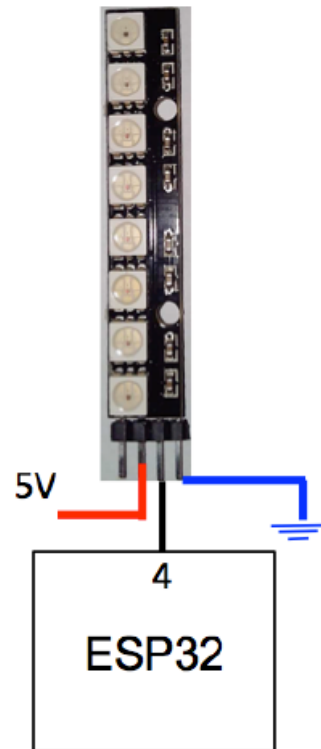
- ◆ Amplify microphone signal and show maximum sound level on neopixel strip



## Suggestion 8: Disco Dancing Light (3 to 4)

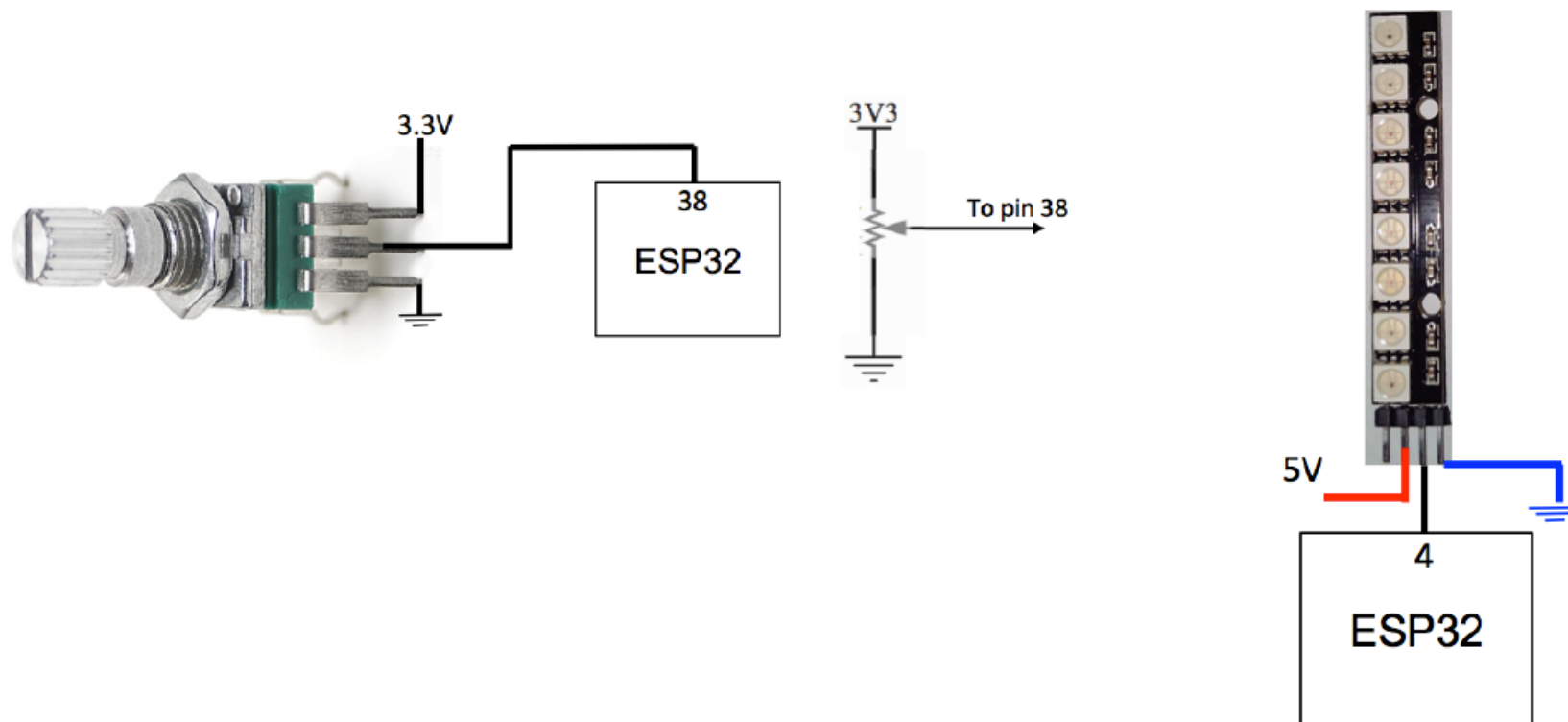
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- ◆ Translate the music received by the microphone and op-amp, produce a dancing light show!



## Suggestion 9: SOS message (4)

- ◆ Mount the neopixel light on a rectangular support pivoting on the axis of the 10k ohm potentiometer
- ◆ Determine the angle of neopixel strip
- ◆ Light up the appropriate pixel so that when you manually rotate the strip, you spell out the message “SOS”.



# Suggestion 10: Musical Instrument (4)

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- ◆ Use any input method to determine the note being played
- ◆ Can use pressure sensor (as suggested by Robert Field)
- ◆ You can also use the touch sensor inputs of ESP32 (learn this by yourself) and use bananas on a wire to change capacitance.
- ◆ Play note on speaker via audio amplifier