

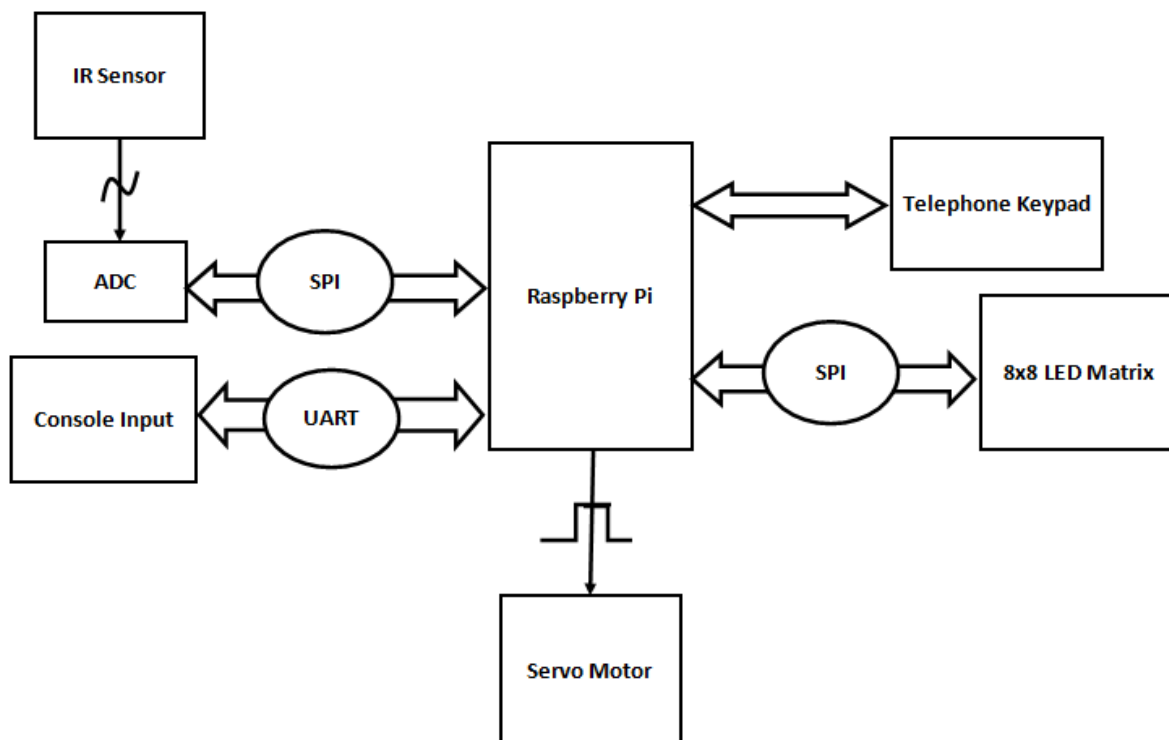
Integration Project Documentation

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Overview

The following circuit is based on the idea of a simple door lock, broken down into the components of a telephone keypad, servo motor, IR sensor, 8x8 LED matrix and raspberry pi. Using our software loaded on the pi, the user is prompted to input a passcode on the console. Once created, the IR sensor looks for a consistent string of values greater than 1.5, which tells us that something is in fact present in front of the keypad. When 3 values in sequence are over 1.5, the user can use the keypad to input their code to try and unlock the door (this is symbolized by the servo motor rotating from 0 to 90 degrees). If the correct input on the keypad is made, our LED matrix lights up with a 'O' and the servo flips to the 90 degrees position. If an incorrect input is made, the LED will light up with an 'X' and the servo locks to 0 degrees. You also have the option to enter '*' on the keypad when entering a code to lock the door as well.

Block Diagram



Block Descriptions

Device name: Servo Motor

Model number: SG-90

Supply voltage range: [3.3V, 5V, ?V-??V, N/A] 5V

Input type(s): [digital, analog, PWM, N/A]

Input is PWM Signal. At locking position, the motor points to 0 degrees with a duty cycle of 6.25, and when opened pulses to 90 degrees at 10.25.

Output type(s): [digital, analog, PWM, N/A]

N/A

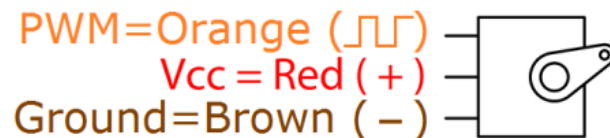
Interface: [UART, SPI, I2C, 1-WIRE, other, N/A]

1 wire input to GPIO pin #18.

Description:

The servo motor acts as our door lock for this story. The motor is on a 90 to -90 degree scale (180 total), and starts off in the 0 degree position. When a code is input correctly the motor activates high and moves to 90 degrees (symbolizing the lock opening). By entering '*' or the incorrect code the motor activates and returns to the locked position.

Symbol:



Device name: IR Sensor

Model number: GP2Y0A21YK

Supply voltage range: 5V

Input type(s): N/A

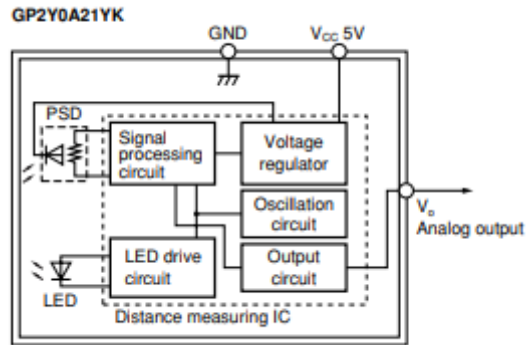
Output type(s): Analog Output to the A/D Converter which in turn outputs digital to pi.

Interface: 1 wire output to the CH1 on the MCP3008 chip.

Description:

Our IR sensor acts as a distance sensor to check that "someone" is in front of the keypad of our door lock. The sensor outputs values roughly between 0 and 2-3, and we determined that you are close enough to the keypad to register around 1.5. Thus, the software looks for 3 consecutive values above 1.5 received from the sensor, and if found, then the keypad is made available to enter a passcode to the door.

Symbol:



Device name: Telephone Keypad

Model number: N/A

Supply voltage range: N/A

Input type(s):

Digital Signal, keys split into columns and rows, with columns corresponding to GPIO pins 16, 20, 21; and rows corresponding to GPIO pins 5, 6, 13, 19.

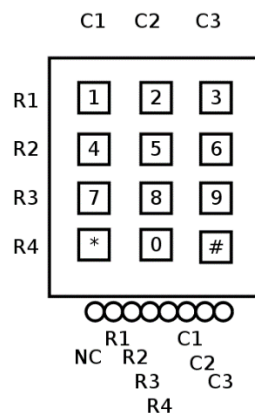
Output type(s): N/A

Interface: 1-wire implementation for each of the 7 row/column inputs.

Description:

The telephone keypad is the external input in our door lock system, which the user uses to input a key code to try and match the set password. The program is set up, as such, that when a row and column are both activated by a key press, based on which row and column we determine the corresponding number that is pressed and compare it to the passcode.

Symbol:



Device name: 8x8 LED Matrix

Model number: MAX7219

Supply voltage range: 5V

Input type(s): N/A

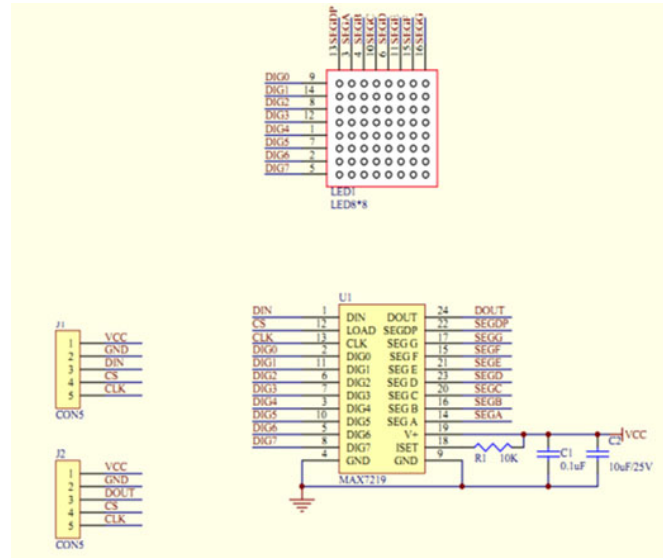
Output type(s): Digital – receives input from master (pi) to display LED's in a certain formation

Interface: SPI (DIN -> MOSI, CLK -> SCLK, CS -> CE0)

Description:

The LED matrix in our door lock system displays an 'O' if the passcode entered is correct, and an 'X' if it is wrong. We accomplish this through the luma.LED_Matrix libraries developed by Richard Hull, and pair it with the telephone keypad functionality to give us conditions for what the matrix will display.

Symbol:



Device name: ADC

Model number: MCP3008

Supply voltage range: 5V

Input type(s): Analog input from infrared sensor

Output type(s): Digital output to the raspberry pi

Interface: SPI/1-wire, with a channel input from the infrared sensor and then SPI communication to the raspberry pi

Description:

The MCP3008 chip is our go between the infrared sensor and the raspberry pi. Because the infrared sensor provides an analog signal, we use the chip as an analog to digital converter so that the sensor can communicate with the pi. In doing so, the values that are being sensed by the sensor are picked up by our software and used to look for 3 consecutive values above 1.5, which for the purposes of the door lock, signal someone is in front of the keypad and about to use it.

Symbol:

