Digital Security Alarm

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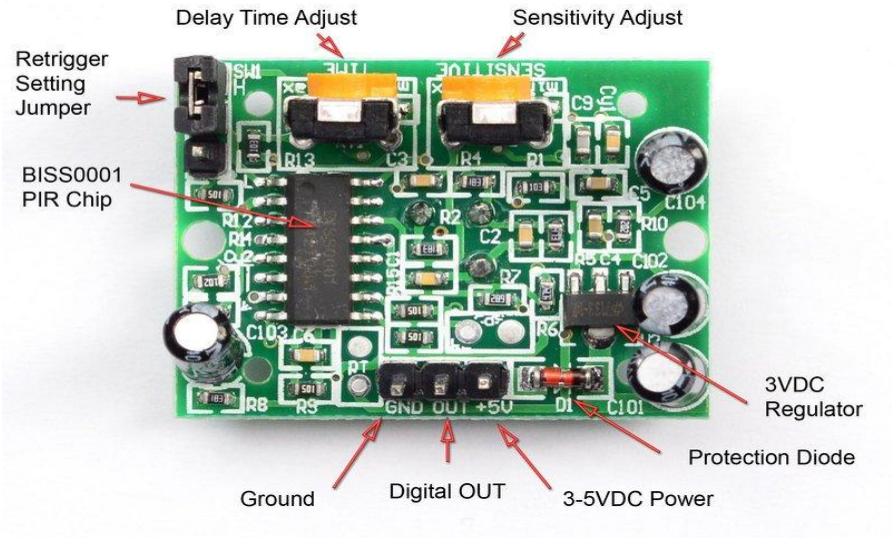
What's the purpose?

- Protect a home from any intruders or burglars
- Detect the presence of any unwanted intruders through motion sensors

Physical Components Used

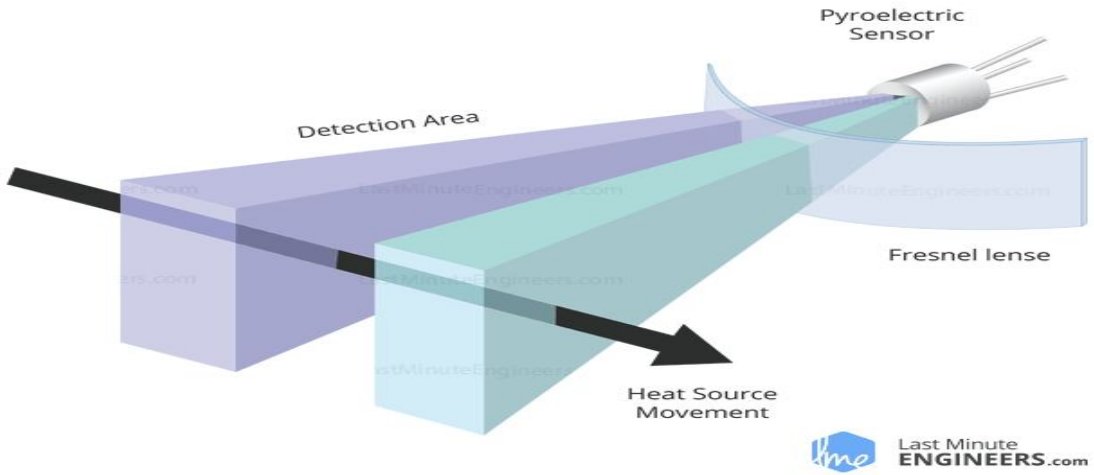
- NEXYS A7 100T FPGA board
- Arduino UNO board
- Breadboard
- PIR sensor
- Active Buzzer
- LED
- Jumper Wires

PIR (Passive Infrared) Sensor

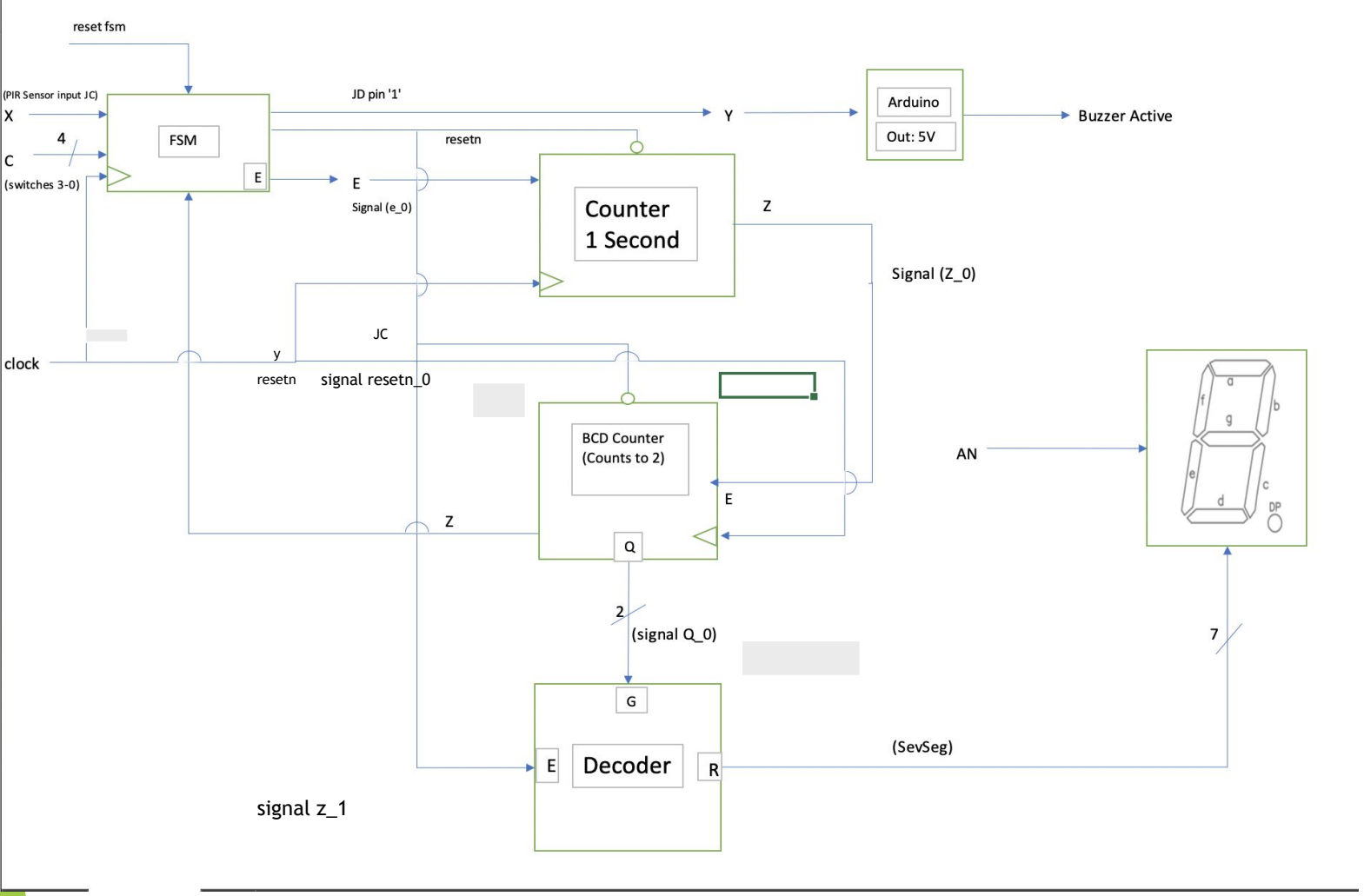


- PIR sensors are used to detect motion through infrared waves
- PIR sensors are used to detect whether a human or object has moved in the sensors range
- PIR sensors are commonly used in security alarms and automatic lighting applications.
- Delay time: 3 seconds to 300 seconds
- Sensitivity: 3 to 7 meters

How do PIR sensors work

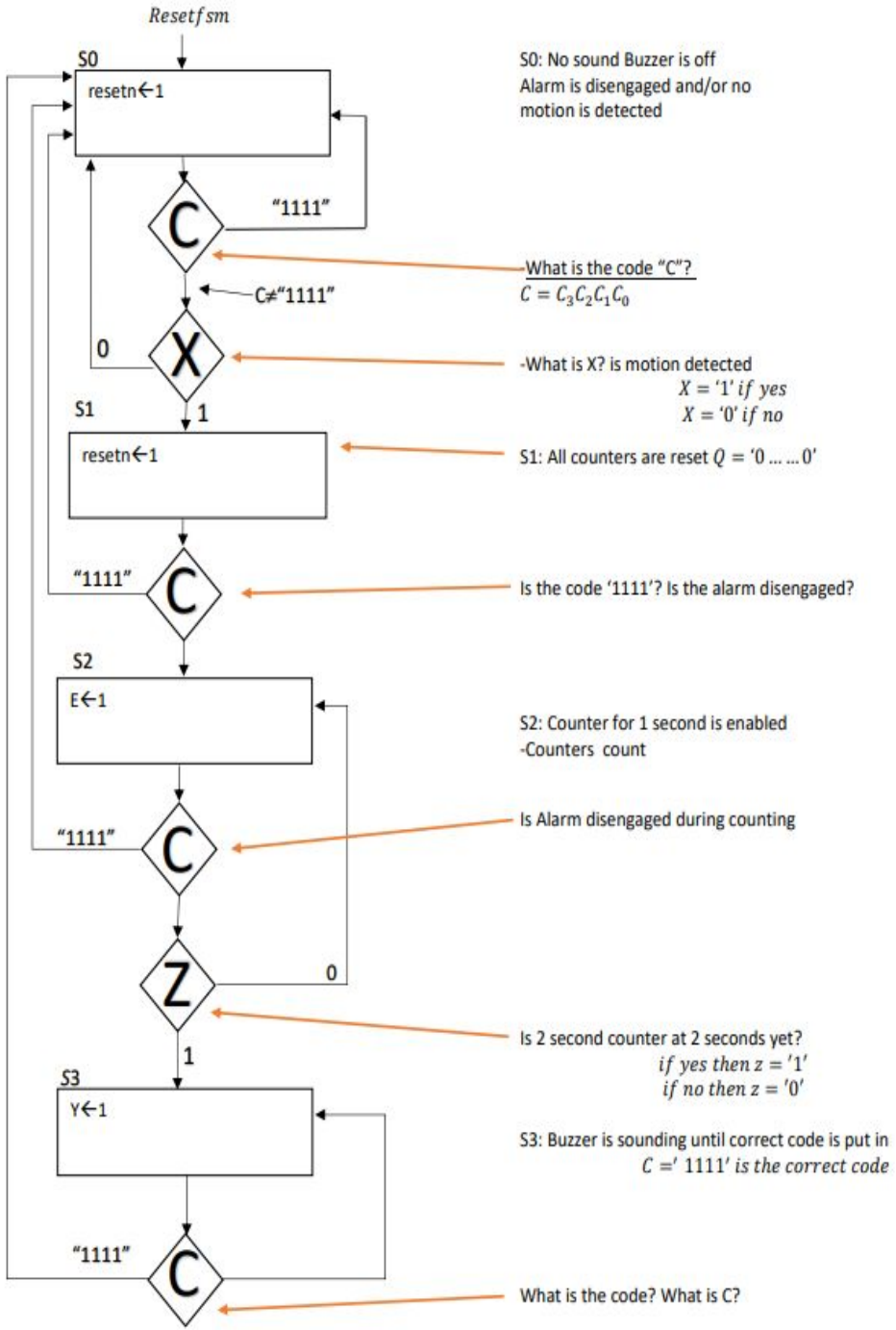


- All objects emit heat energy in the form of infrared radiation
- A PIR sensor is designed to detect certain levels of infrared radiation
- It consists of two main parts: A Pyroelectric Sensor and a special lens called Fresnel lens which focuses the infrared signals onto the pyroelectric sensor.

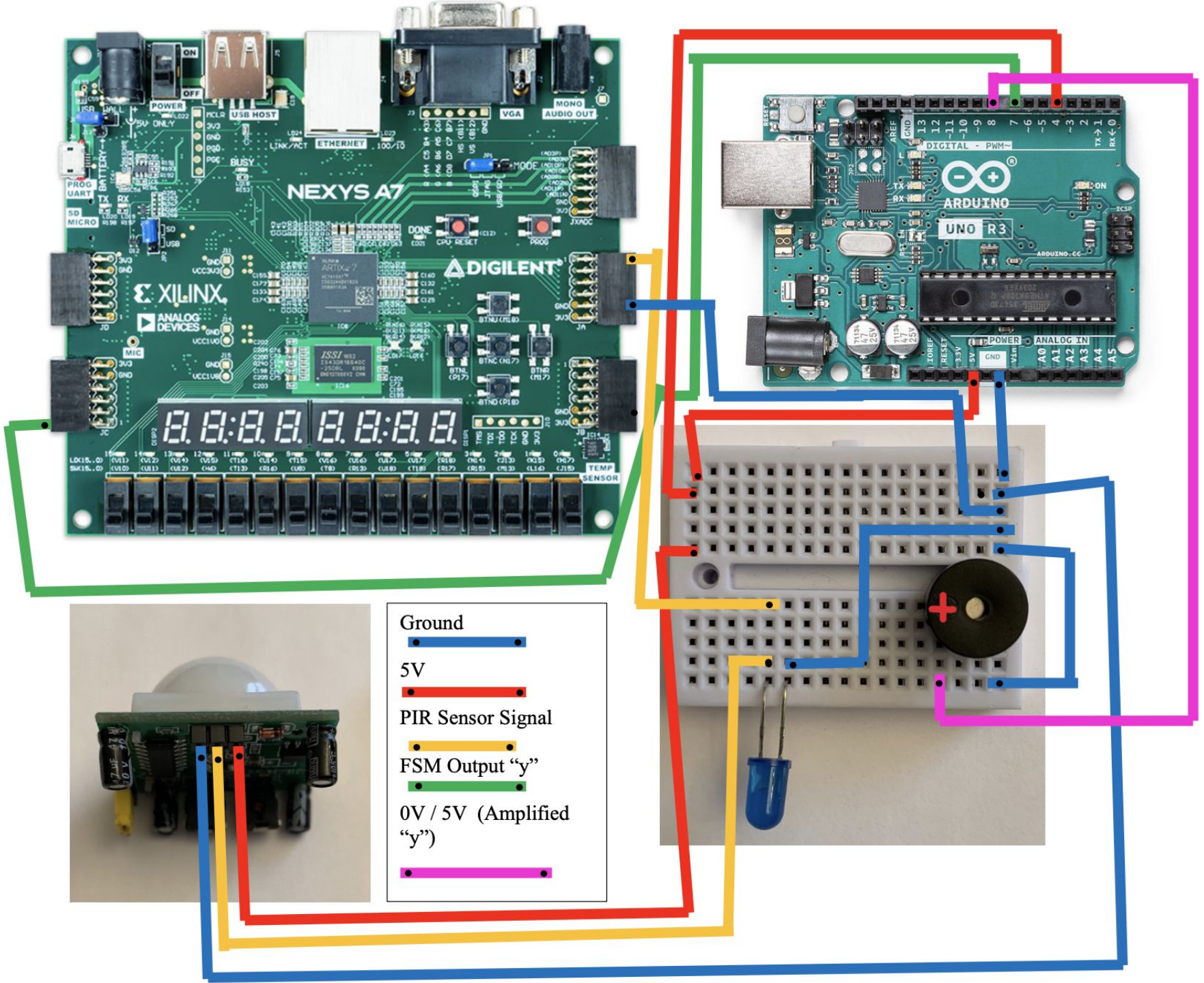


- FSM machine
- Arduino used as power source + amplifier
- Counter counts to 10^8 (1 second delay between display count)
- 2 Second Counter
- Decoder to 7-segment display

ASM Chart



- C: Is the combinational code correct?
  -Switches 3-0 on FPGA C= $C_3C_2C_1C_0$
- X: Did the PIR sensor detect motion?
  - PIR Sensor Output Signal
  -This is inputted into the FPGA Pin JA[1]
- Z: Is maximum count reached on 2 second counter?
  -If the 2 second counter reached 2 (Q="10") then Z=1


NEXYS A7
DIGILENT
XILINX
ANALOG DEVICES
ARDUINO
UNO R3
Ground
5V
PIR Sensor Signal
FSM Output “y”
0V / 5V (Amplified “y”)

Video Demonstration

https://youtu.be/8X0kUgdJ5CU

Sources

https://lastminuteengineers.com/pir-sensor-arduino-tutorial/

(Images for PIR sensor and information)

http://www.secs.oakland.edu/~llamocca/Courses/ECE2700/Boards/NexysA7_rm.pdf (image of FPGA)

http://www.secs.oakland.edu/~llamocca/VHDLforFPGAs.html (miscellaneous)

https://store-usa.arduino.cc/products/arduino-uno-rev3/ (image of arduino)