

EEE3096S Practical 4:

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Declaration

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This report is our own work.

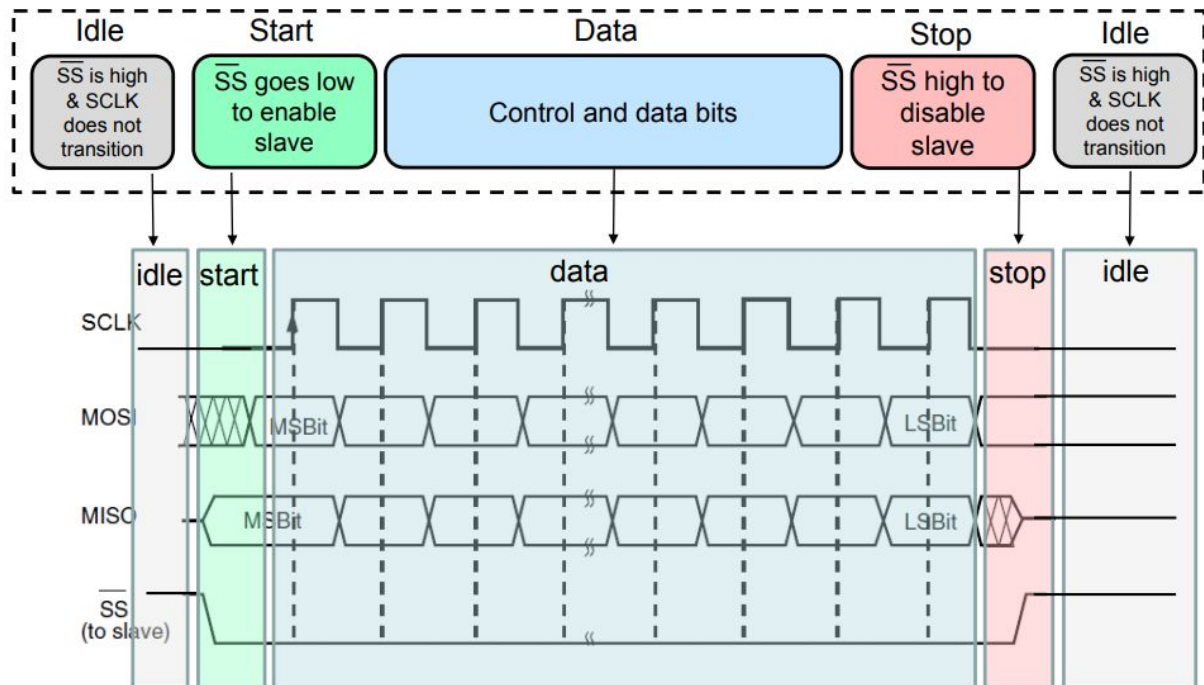
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Signatures *James Irvine; Martin Flanagan*

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1. Answer the following questions (15):

a. Explain the SPI communication protocol with a timing diagram. (2)



[1]

SPI uses four lines to communicate with a slave device, namely chip select, MOSI (Master Out Slave In), MISO (Master In Slave Out) and a clock line since SPI is a synchronous communication protocol. To start a data transfer, the chip select line is held low, following which the master and slave exchange one bit per clock cycle as is characteristic of full-duplex communication protocols. After a defined number of bits have been exchanged, the chip select line is held high to disable the slave and end the data transfer.

b. Define interrupt and threaded call-back in the context of an embedded system. (2)

An interrupt is a signal that is sent to the processor communicating that an event has occurred (either hardware or software) that requires immediate attention. This causes the processor to stop its current task and enter an interrupt service routine which is a function that has been specified beforehand to run when the interrupt triggers. A threaded call-back is an interrupt that runs in a separate thread to the main function, allowing them to run in parallel and avoiding delaying the main function.

c. Write a function that converts a 10-bit ADC reading from the potentiometer to a 3V3 limited voltage output. (2)

```
def convertToVolts(data):
    v = (data*3.3) / float(1023)
    v = round(v,1)
    return v
```

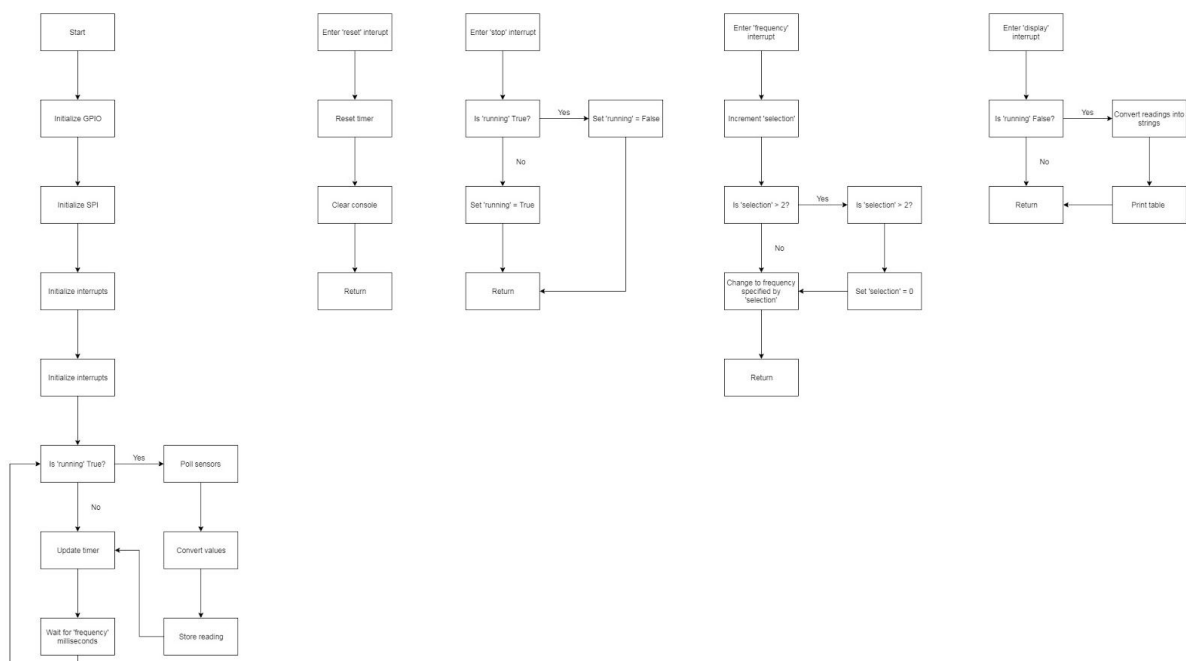
d. Write a function that converts a 10-bit ADC reading from the temperature sensor to a reading in degree Celsius (Have a look at the datasheet). (3)

```
def convertToDegreesCelsius(data):
    t = (((data)*3.3 / float(1023)) - 0.5)/0.01
    t = round(t,0)
    return t
```

e. Write a function that converts a 10-bit ADC reading from the LDR to a percentage representing the amount of light received by the LDR. (2) The flashlight from a smartphone could be used as the maximum amount of light received by the LDR.

```
def convertToLight(data):
    t = ((data) / float(1023))*100
    t = round(t,0)
    return t
```

f. Draw a flowchart of the system. (4)



References:

[1] R. Verrinder and Y. Abdul Gaffar, "Embedded Communication Serial Peripheral Interface (SPI)," University of Cape Town, Cape Town, 2018.