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Interfacing LDR with Raspberry Pi using MCP3008



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Introduction:

Raspberry Pi is a credit card sized computer that plugs into a computer monitor or TV, and uses standard keyboard and mouse. It's capable of doing everything you'd expect a desktop computer to do, from browsing the internet and playing high-definition video, to making spreadsheets, word-processing, and playing games. Here we are going to do interface with LDR with Raspberry pi by using MCP3008(ADC) IC.

Hardware Requirements:

1. Raspberry Pi board.
2. Tenet Power supply breakout board
3. Hookup wires.
4. MCP3008 IC (ADC).
5. Tenet LDR breakout board.

MCP 3008 IC:

The MCP3008 10-bit Analog-to-Digital Converter (ADC) combines high performance and low power consumption in a small package, making it ideal for embedded control applications. The MCP3008 features a successive approximation register (SAR) architecture and an industry-standard SPI serial interface. The MCP3008 features 200k samples/second, 8 input channels, low power consumption (5nA typical standby, 425μA typical active), and is available in 16-pin PDIP and SOIC packages. Applications for the MCP3008 include data acquisition, instrumentation and measurement, multi-channel data loggers, industrial PCs, motor control, robotics, industrial automation, smart sensors, portable instrumentation and home medical appliances.

Pin diagram:

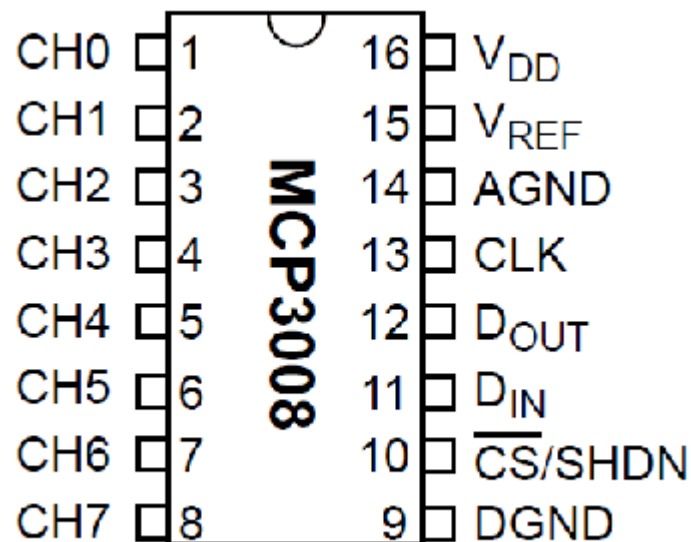


Figure 1

LDR (Light Dependent Resistor):

A **Light Dependent Resistor** (LDR) or a photo resistor is a device whose resistivity is a function of the incident electromagnetic radiation. Hence, they are light sensitive devices. They are also called as photo conductors, photo conductive cells or simply photocells. They are made up of semiconductor materials having high resistance.

Working Principle of LDR:

A light dependent resistor works on the principle of photo conductivity. Photo conductivity is an optical phenomenon in which the materials conductivity (Hence resistivity) reduces when light is absorbed by the material.

Tenet LDR breakout board:



Figure 2

SPI Interface:

The Serial Peripheral Interface (SPI) bus was developed by Motorola to provide full-duplex synchronous serial communication between master and slave devices. The SPI bus is commonly used for communication with flash memory, sensors, real-time clocks (RTCs), analog-to-digital converters, and more.

As shown in Figure , standard SPI masters communicate with slaves using the serial clock (SCK), Master Out Slave In (MOSI), Master In Slave Out (MISO), and Slave Select (SS) lines. The SCK, MOSI, and MISO signals can be shared by slaves while each slave has a unique SS line.

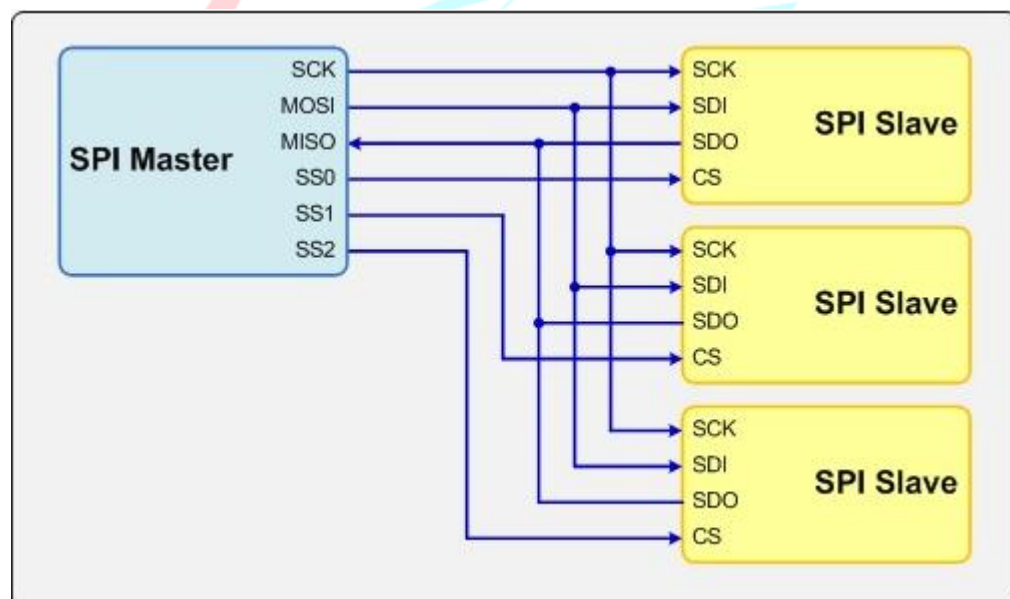


Figure 3

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Step 1: Start by running the following command :

Sudo raspi-config

Step 2: This will launch the raspi-config utility. Select option 8 “Advanced Options”.

[illegible]

Figure 4

Step 3: Select the “SPI” option.

[illegible]

Figure 5

Step 4: Set the option to “Yes”.

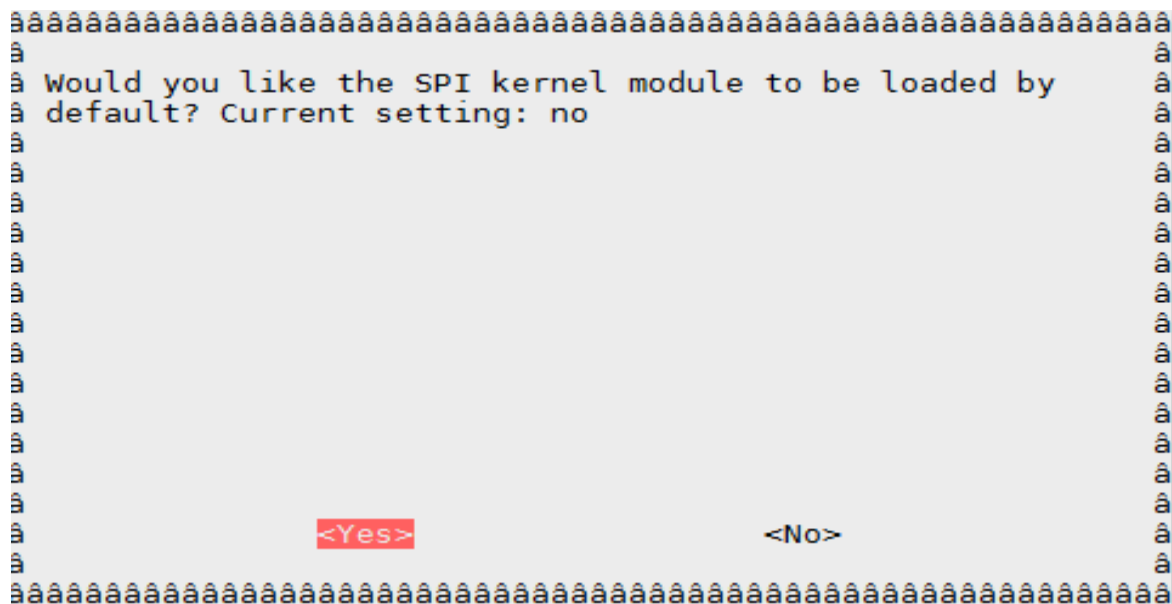


Figure 6

Step 5: Select “OK”.

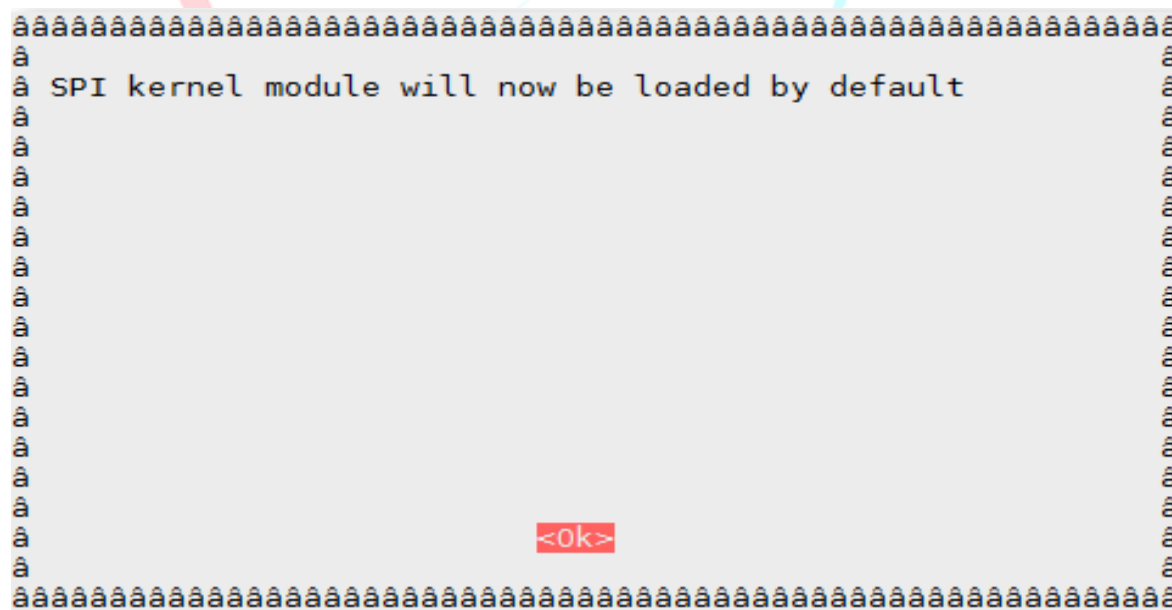


Figure 7

Step 6: Select “Finish”

```

##### Raspberry Pi Software Configuration Tool (raspi-config) #####
à Setup Options
à
à 1 Expand Filesystem           Ensures that all of the SD card storage
à 2 Change User Password       Change password for the default user (p
à 3 Enable Boot to Desktop/Scratch Choose whether to boot into a desktop e
à 4 Internationalisation Options Set up language and regional settings t
à 5 Enable Camera              Enable this Pi to work with the Raspber
à 6 Add to Rastrack             Add this Pi to the online Raspberry Pi
à 7 Overclock                  Configure overclocking for your Pi
à 8 Advanced Options           Configure advanced settings
à 9 About raspi-config         Information about this configuration to
à
à                               <Select>                               <Finish>
à
#####

```

Figure 8

Step 7: Reboot for the changes to take effect .

Sudo reboot

➤ SPI is now enabled.

Step 8: In order to read data from the SPI bus in Python we can install a library called ‘py-spidev’. To install it we first need to install ‘python-dev’ .

Sudo apt-get install python2.7-dev

Step 9: Then to finish we can download ‘py-spidev’ and compile it ready for use .

wget https://github.com/Gadgetoid/py-spidev/archive/master.zip

unzip master.zip

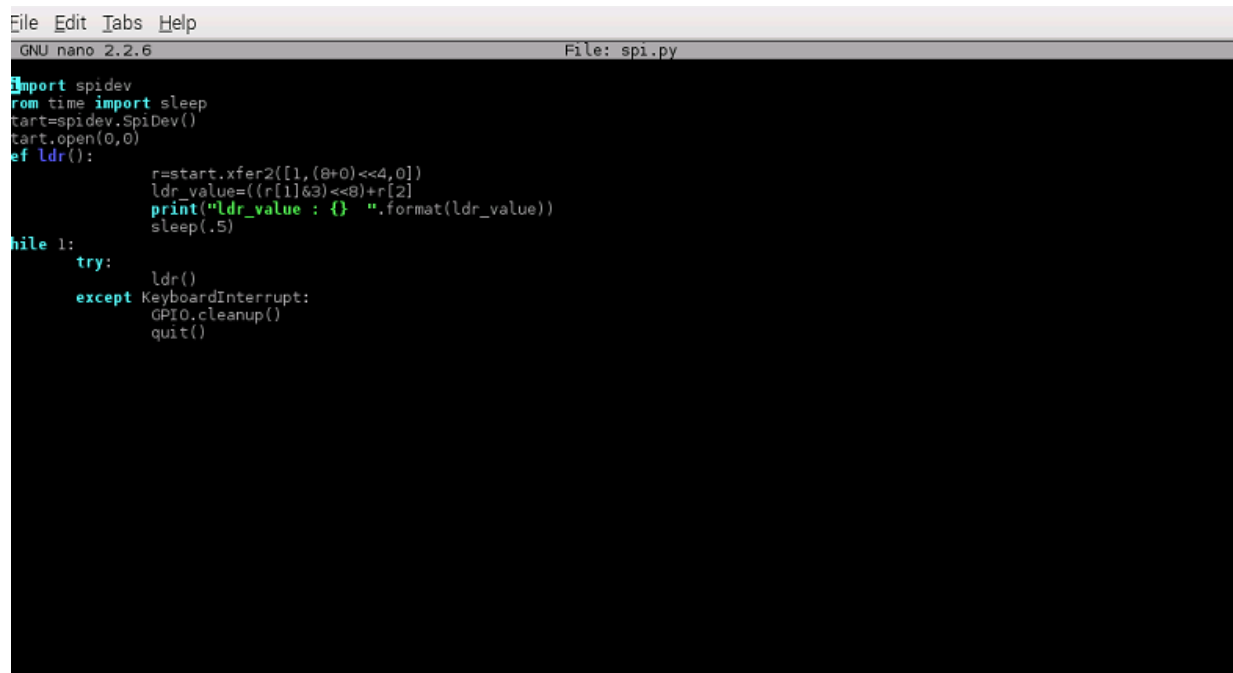
rm master.zip

cd py-spidev-master

sudo python setup.py install

cd ..

Coding:



```
File Edit Tabs Help
GNU nano 2.2.6 File: spi.py

import spidev
from time import sleep
start=spidev.SpiDev()
start.open(0,0)
def ldr():
    r=start.xfer2([1,(8+0)<<4,0])
    ldr_value=((r[1]&3)<<8)+r[2]
    print("ldr_value : {}".format(ldr_value))
    sleep(.5)
while 1:
    try:
        ldr()
    except KeyboardInterrupt:
        GPIO.cleanup()
        quit()
```

Figure 9

Import spidev	//Importing spidev to access SPI
From time import sleep	//import sleep for giving delay
Start=spidev.SpiDev()	//creating object with name start
Start.open(0,0)	//(BUS,channel) since one channel and Bus
Def ldr():	//creating function
r=start.xfer2([1,(8+0)<<4,0])	//enabling SPI and 3 bytes of data stored in r
ldr_value=((r[1]&3)<<8)+r[2]	//Retrieving last 10 bit since MCP3008 is 10 bit
print("ldr_value : {}".format(ldr_value))	//printing ldr_value
while 1:	
try:	
ldr()	//function call
except KeyboardInterrupt:	//when CTRL+C is pressed terminate it
GPIO.cleanup()	
quit()	

Circuit diagram:

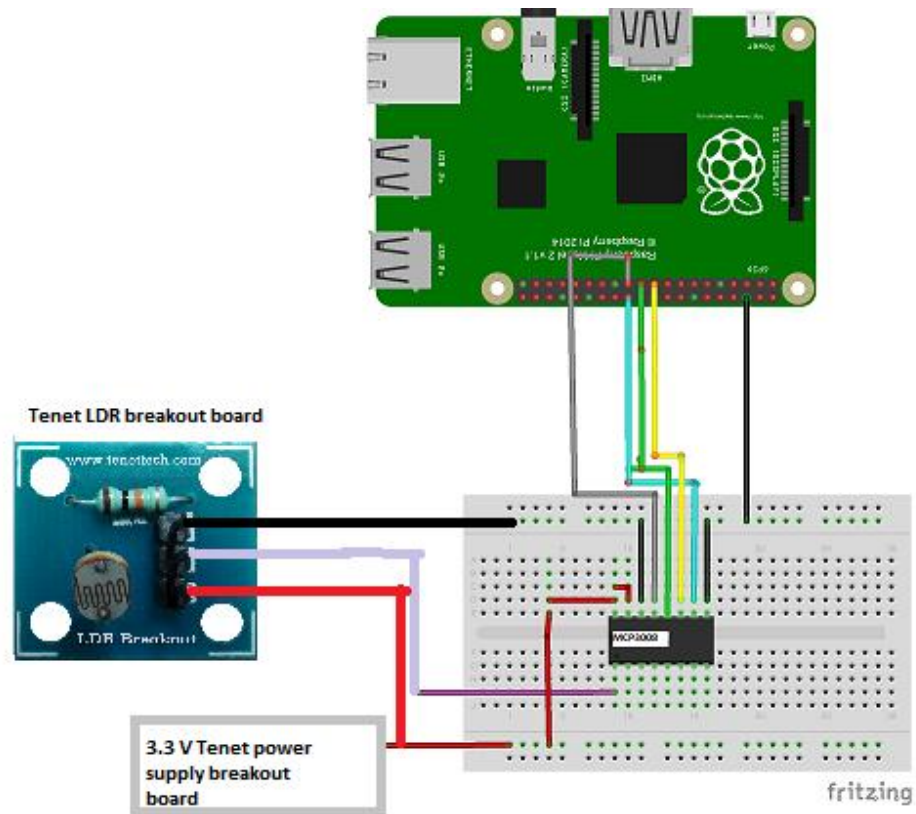
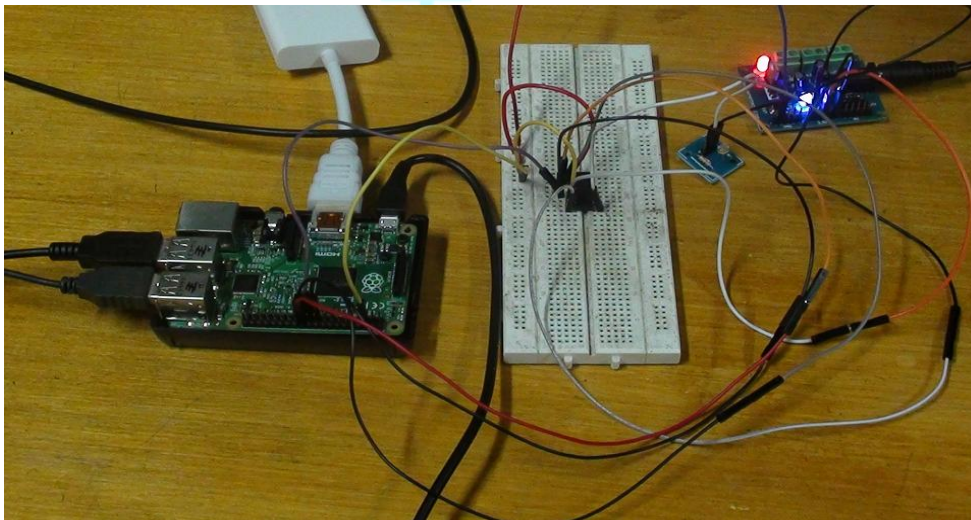
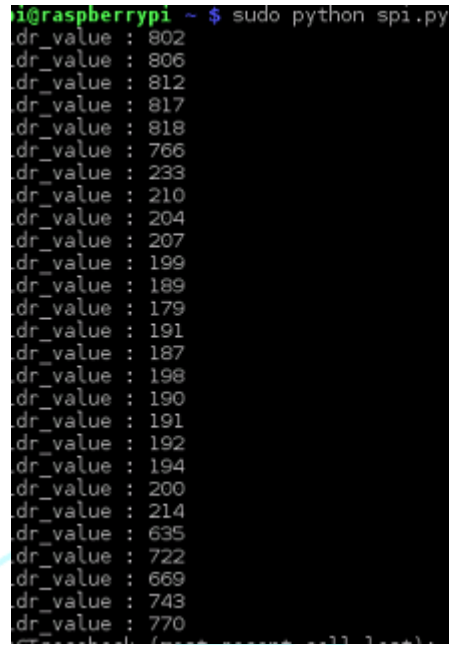


Figure 10

Output:



Output on the screen:



```
i@raspberrypi ~ $ sudo python spi.py
dr_value : 802
dr_value : 806
dr_value : 812
dr_value : 817
dr_value : 818
dr_value : 766
dr_value : 233
dr_value : 210
dr_value : 204
dr_value : 207
dr_value : 199
dr_value : 189
dr_value : 179
dr_value : 191
dr_value : 187
dr_value : 198
dr_value : 190
dr_value : 191
dr_value : 192
dr_value : 194
dr_value : 200
dr_value : 214
dr_value : 635
dr_value : 722
dr_value : 669
dr_value : 743
dr_value : 770
```

Figure 12

For product link:

1. <http://tenettech.com/product/7021/raspberry-pi-2-model-b-basic-kit-tt-sp-19022015>
2. <http://www.tenettech.com/product/6068/power-supply-breakout-board>.
3. <http://www.tenettech.com/product/2985/mcp3008-8-channel-10-bit-adc-with-spi-interface>
4. <http://tenettech.com/product/7039/ldr>

For more information please visit: www.tenettech.com

For technical query please send an e-mail: info@tenettech.com

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