

Q. Explain the LPC2148 Microcontroller Memory Map

|                                |             |                           |
|--------------------------------|-------------|---------------------------|
| AHP peripherals                | 0xFFFF FFFF | LPC2148 memory map modif. |
| VPB peripherals                | 0x1000 0000 |                           |
| Reserved area #1               | 0xE000 0000 |                           |
| Boot block (size: 0x3000)      | 0xDFFF FFFF |                           |
| Reserved area #2               | 0x8000 0000 |                           |
| Boundary #3                    | 0x7FFF FFFF |                           |
| HSL #2a (size: 0xFE000)        | 0x7FFF 0000 |                           |
| Boundary #4                    | 0x7FDF FFFF |                           |
| 8KB SDRAM, USB Dma (LPC2146/8) | 0x7FD0 2000 |                           |
| Boundary #5                    | 0x7FD0 1FFF |                           |
| Reserved area #3               | 0x7FD0 0000 |                           |
| Boundary #6                    | 0x7FCF FFFF |                           |
| 32KB SDRAM (LPC2148)           | 0x4000 8000 |                           |
| Boundary #7                    | 0x4000 7FFF |                           |
| HSL #4a (size: 0x8000)         | 0x4000 0000 |                           |
| Boundary #8                    | 0x3FFF FFFF |                           |
| Reserved area #4               | 0x3FFF 8000 |                           |
| Boundary #9                    | 0x3FFF 7FFF |                           |
| 512KB flash (ROM) (LPC2148)    | 0x8000 0000 |                           |
| Boundary #10                   | 0x8000 7FFF |                           |
|                                | 0x8000 0000 |                           |

- 1) As width of address Bus of LPC2148 is 32 bit hence it can address memory locations of 4GB.
- 2) But physically no ARM Processor has 4GB of memory
- 3) Entire memory that can be addressed is 4GB, hence starting Address is 0.0GB or 0x00000000 . End Address is 4.0 GB or 0x FFFFFFFF
- 4) ARM7 based LPC2148 have 512KB of on chip RAM
- 5) ARM7 based LPC2148 have 132 KB of on chip static RAM
- 6) ARM7 based LPC2148 have 8KB of on chip USB PMA RAM
- 7) ARM7 based LPC2148 have 12KB boot block on chip flash memory
- 8) Next block of memory shows different views of the peripheral area has two main sections, each peripheral address space. Both the AHB and APB peripheral area are 2 megabyte spaces which are divided up into 128 peripherals.

Each peripheral space is 16 kilobyte in size AHB section is  $128 \times 16\text{KB}$  block

3. Explain the LPC2148 GPIO programming registers involved.

Programmable pins and memory

i)  $\text{IoxPin}(x = \text{port number})$ : This register can be used to read or write values directly to the pins. Regardless of the direction set for the particular pin it gives the current state of the GPIO pin when read.

ii)  $\text{IoxDIR}$ : This is the GPIO direction control register. Setting a bit to 0 in this register will configure the corresponding pin to be used as an input while setting it to 1 will configure it as output.

iii)  $\text{IoxSET}$ : This register can be used to drive an output configured pin to logic 1 by writing 1 to it. It does not have any effect and hence it cannot be used to drive a pin to logic 0, i.e., low. To drive pin low  $\text{IoxCLR}$  is used which is 0.

4). TOxCLP : This register can be used to drive an output configured pin to Logic 0 or 1. Writing zero does not have any effect and hence it cannot be used to drive a pin to Logic 1.

4) Explain the types of LED. Explain the interfacing of a single LED with LPC2148

Type of LED using digital output on step function

• Miniature; come at the cost of low current

These are mostly single die LED's and they are

available in various shapes and sizes from 2mm to 8mm

through hole and the surface mount package. And

the current rating ranges lie between 1mA to

above 20mA. The multiple LED's die get attached

to a flexible backing tape from an LED strip

light

• Diffused lighted panel light board

• Light emitting diode panel light

• Light emitting diode panel light

#### \* AC Driver:

Thus an LED is developed by the silicon semiconductor. It can be operated on AC power without a DC converter. For each light cycle the LED's won't emit light which is dark. And this is reversed during the next half cycle.

#### \* High power:

Thus high output or high power LED's can be driven at current from 100 of mA to more than an ampere.

Some can emit over thousands of lumen.

Over heating is provided to be destructive for the LED's

so the HP-LED can often replace an bulb in a flat

Introducing LED with LPC2148

It works by turning on a LED and then turning it off and then looping back to start. However

the operating speed of microcontroller is very high so the flashing frequency will also be very fast to be

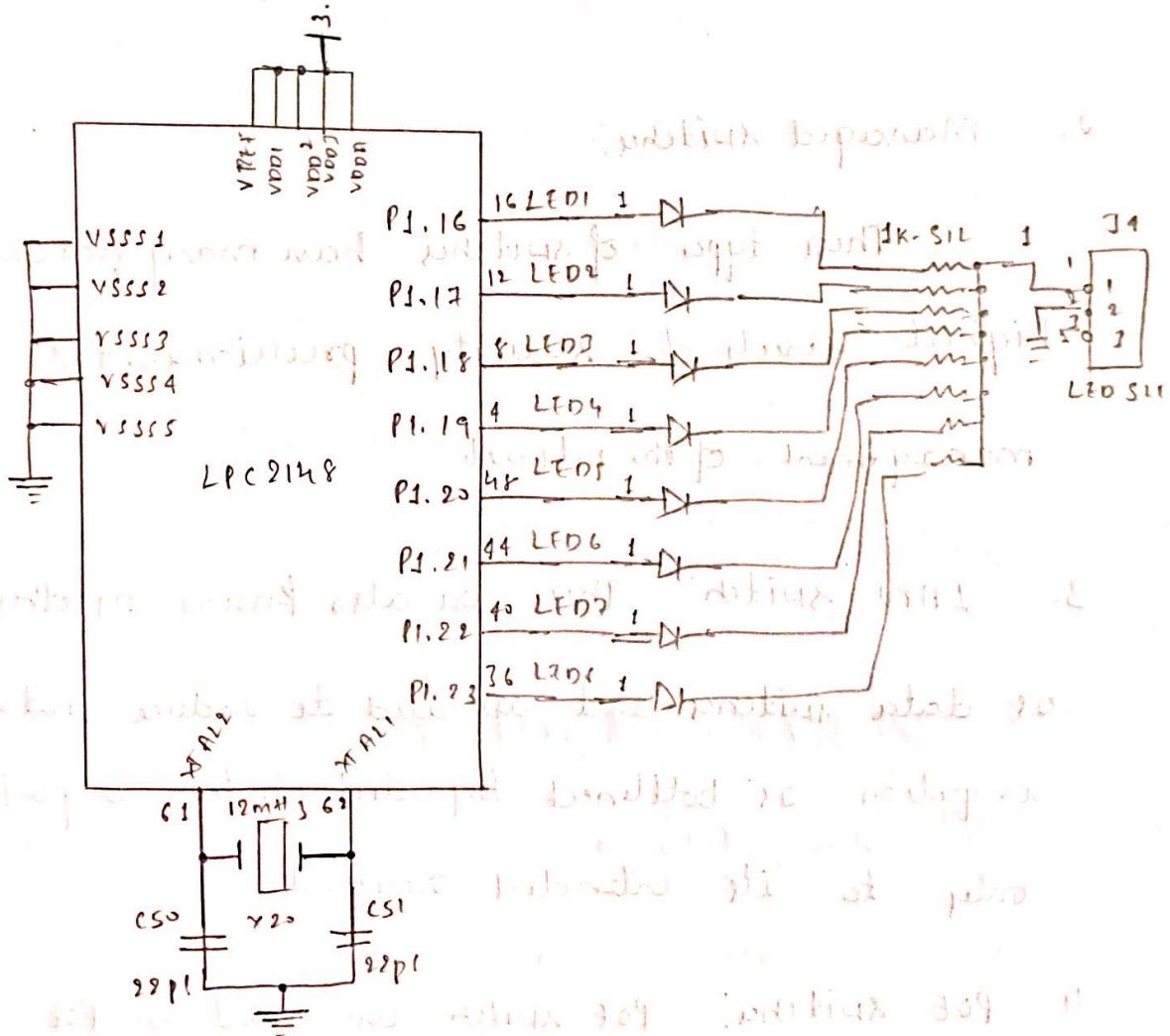
detected by human eye.

The ARM7 LPC2148 Picnic board has eight numbers of panel LEDs connected with I/O port pin (P1.16 - P1.23) to make port pins high (pull up). All pins are high.

Port output port for making them true then false

Circuit diagram to Interface LED with LPC2148

Supply to no backplane at back side



⑤ Explain the types of switch. Explain the interfacing of the switch with LPC2140

#### 1. Unmanaged Switch:

These are the switches that are mostly used in home networks and small business as they plug in and instantly start doing their job and such switches do not need to be watched or configured.

#### 2. Managed Switch:

This type of switches have many features like the highest levels of security, precision control, and full management of the network.

3. LAN switch: These are also known as ethernet switches or data switches and are used to reduce network congestion or bottleneck by distributing a package of data only to its intended recipient.

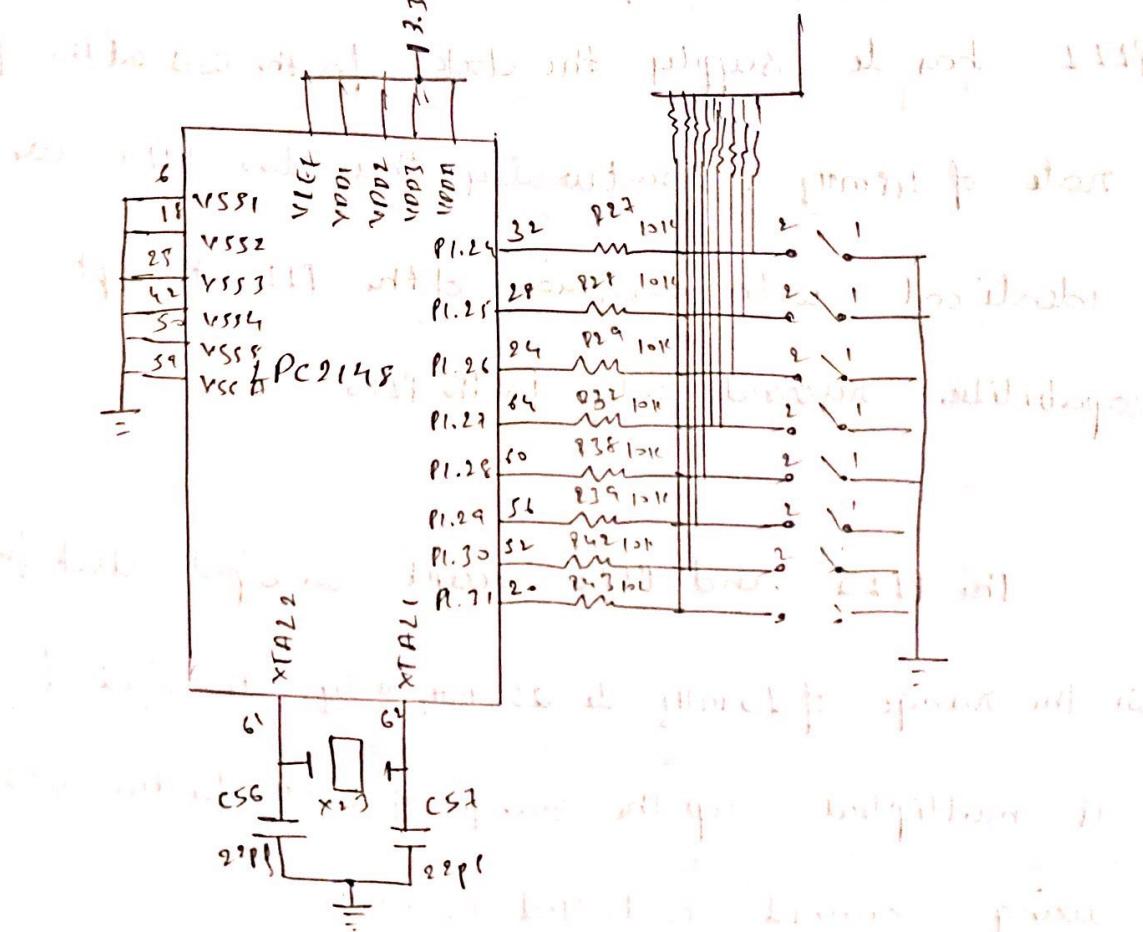
4. POE Switch: POE switch are used in POE technology which stands for power over ethernet that is a technology that integrates data and power devices to receive data in parallel to power

## Interfacing Switch with LPC2148

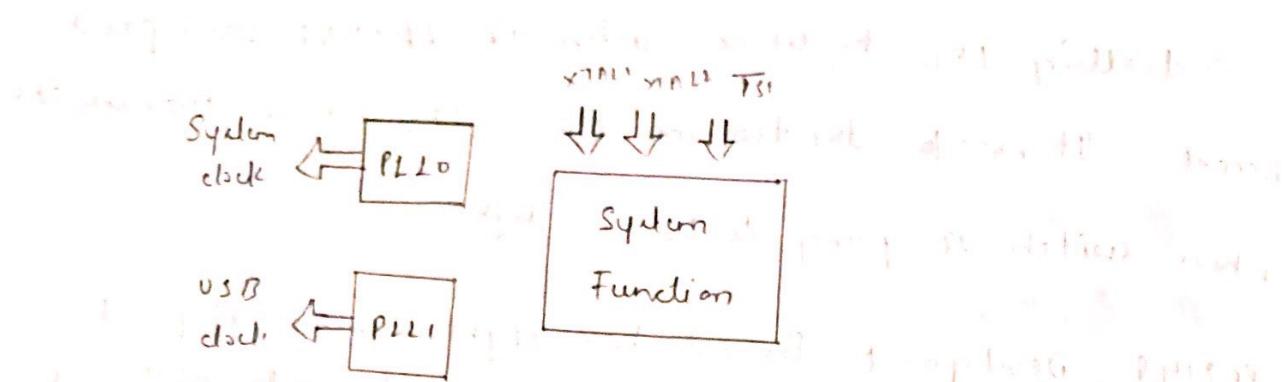
Controlling LED by using switch in LPC2148 development board. It works by turning ON, a LED & then turning OFF when switch is going to Low or High.

LPC2148 Development Board has eight numbers of point LED's connected with 10 port pins to make port pins high. Eight switches, connected with 10 port pins, are

and to control eight LEDs



Q Explain the PLL in LPC2148 with the neat diagram.

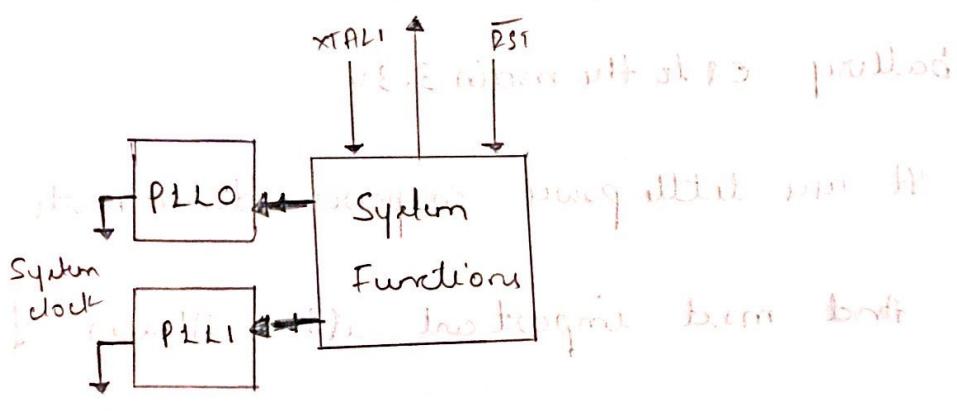


Thus our two PLL modules in the LPC2148 microcontroller. The PLL0 is used to generate the ECLK clock while the PLL1 has to supply the clock for the USB at the fixed rate of 48MHz. Structurally these two PLL's are identical with exception of the PLL interrupt capability, enabled only for the PLL0.

The PLL0 and PLL1 accept an input clock frequency in the range of 10MHz to 25MHz only. The input frequency is multiplied up the range of 10MHz for the USB clock using current controlled oscillator.

ARM7 in LPC2148 microcontroller needs two clocks; one is for its peripherals and the other for its CPU. CPU works faster with higher frequencies whereas peripheral needs low frequency to work with.

Q) Explain the clock working in LPC2148 with a neat diagram



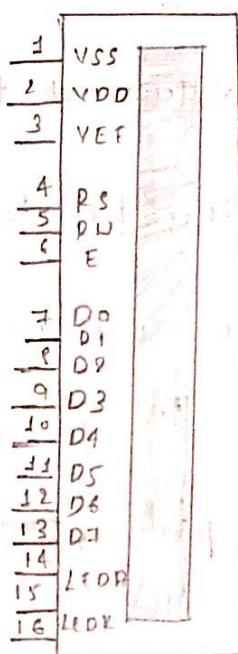
ARM7 LPC2148 microcontroller needs two clocks, one is for

its peripherals and the other for its CPU. CPU works faster with higher frequencies whereas peripheral needs low frequency to work with. The peripheral clock and CPU clock get clock input from a PLL or from external source

LPC2148 has an inbuilt Real time clock. LPC2148 RTC can be clocked by a separate 32.768KHz oscillator or by a programmable prescale divider based on the APB clock.

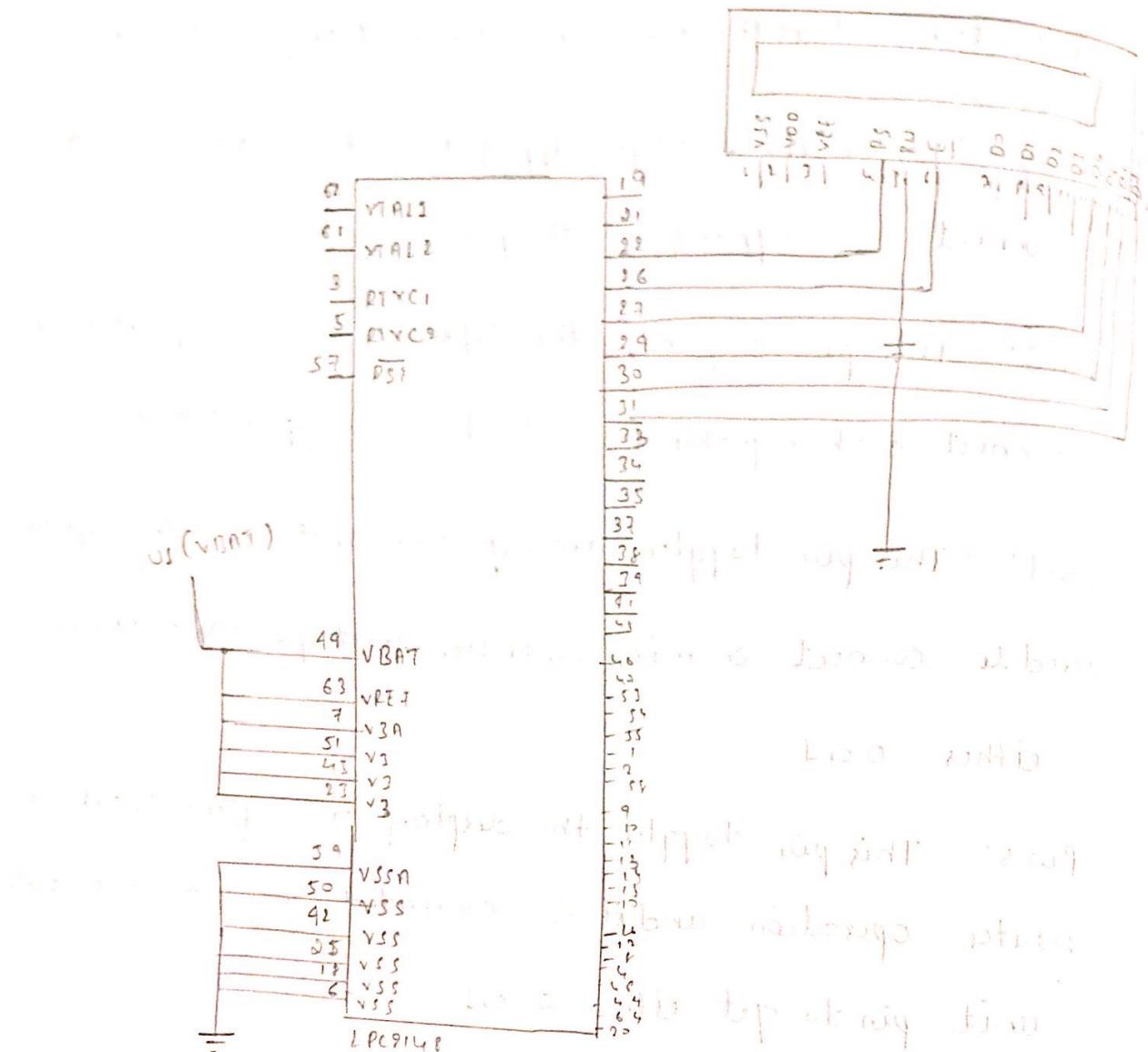
- It maintains a calendar and clock and provides second, minute, hour, month, year, day of week, day of month and day of year.
- It has power supply pins that can be connected to battery or to the main 3.3V
- It uses little power in power-down mode
- And most important it has alarm functionality

### ⑧ Explain the LCD pins with a neat diagram.



- Pin 1: This is a GND pin of display, used to connect the GND terminal of the microcontroller unit or power source.
- Pin 2: This is the voltage supply pin of the display, used to connect the supply pin of the power source.
- Pin 3: This pin regulates the contrast of the display and to connect a changeable pot that can supply 0 to 5V.
- Pin 4: This pin toggles among command or data register, used to connect a microcontroller unit pin and obtains either 0 or 1.
- Pin 5: This pin toggles the display among the read or write operation, and it is connected to a microcontroller unit pin to get either 0 or 1.
- Pin 6: This pin should be held high to execute read/write process, and it is connected to the microcontroller unit and constantly held high.
- Pin 7-14: These pins are used to send data to the display.
- Pin 15: This pin is connected to 5V.
- Pin 16: This pin is connected to GND.

9. Explain the LCD interface with 4 bit mode with ZFC4



In 4-bit mode, the data is sent in nibbles (4 nibble 4-bit) form. first we send the higher nibble and then the lower nibble with some RS, RD and EN

pin functioning as we have done in 8-bit mode

To enable the 4-bit mode of LCD, we need to follow

specified sequence of initialisation that tells the LCD controller that my has selected 4-bit mode.

The LCD can be configured in 4-bit mode by sending appropriate command which is called function set followed by data.

10. Explain the IR sensor working and its interface with LPC2148.

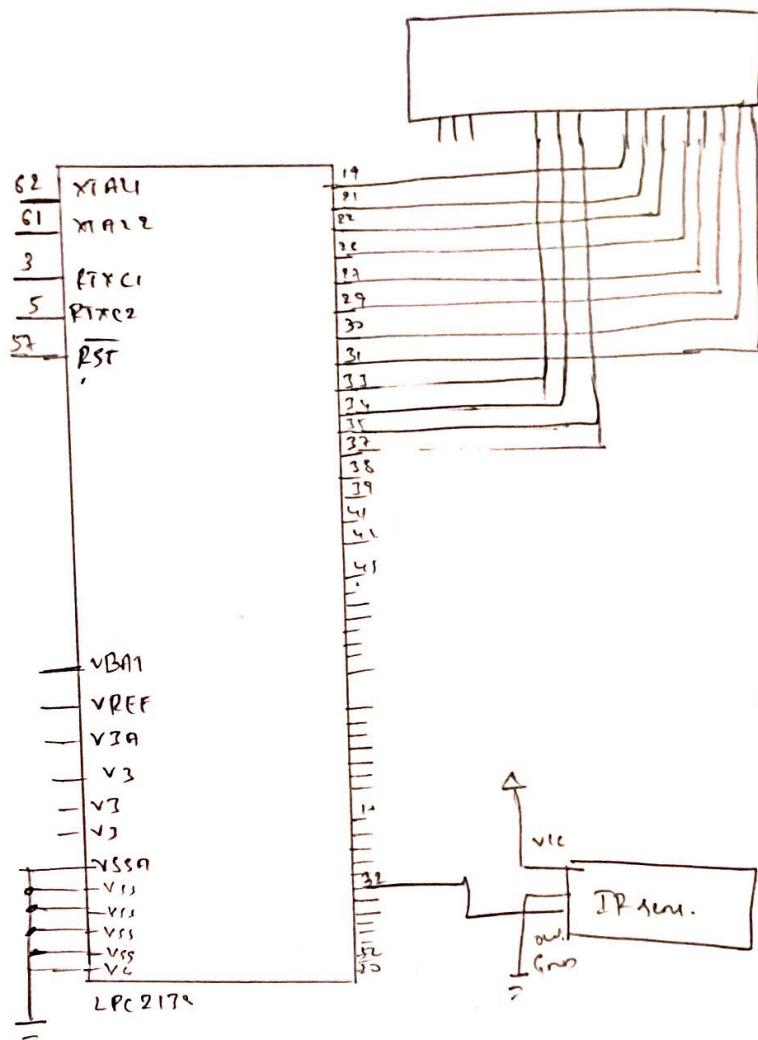
### IR sensor

Vcc - 5V

- GND - Ground
- OUT - P1.24

### LCD

- PS - P0.8
- EN - P0.9
- EN - P0.10
- Data lines - P0.0 - P0.7



An IR sensor consist of an IR LED and IR photodiode; together they are called as photo-coupler or opto-coupler. As ~~said~~ before, the infrared obstacle sensor has a built in IR transmitter and IR receiver.

An Infra-red Transmitter is a light emitting diod, that emits infra-red radiations. Here they are called IR LED. Even though an IR LED looks like normal LED, the radiation emitted by it is invisible to the human eye.