

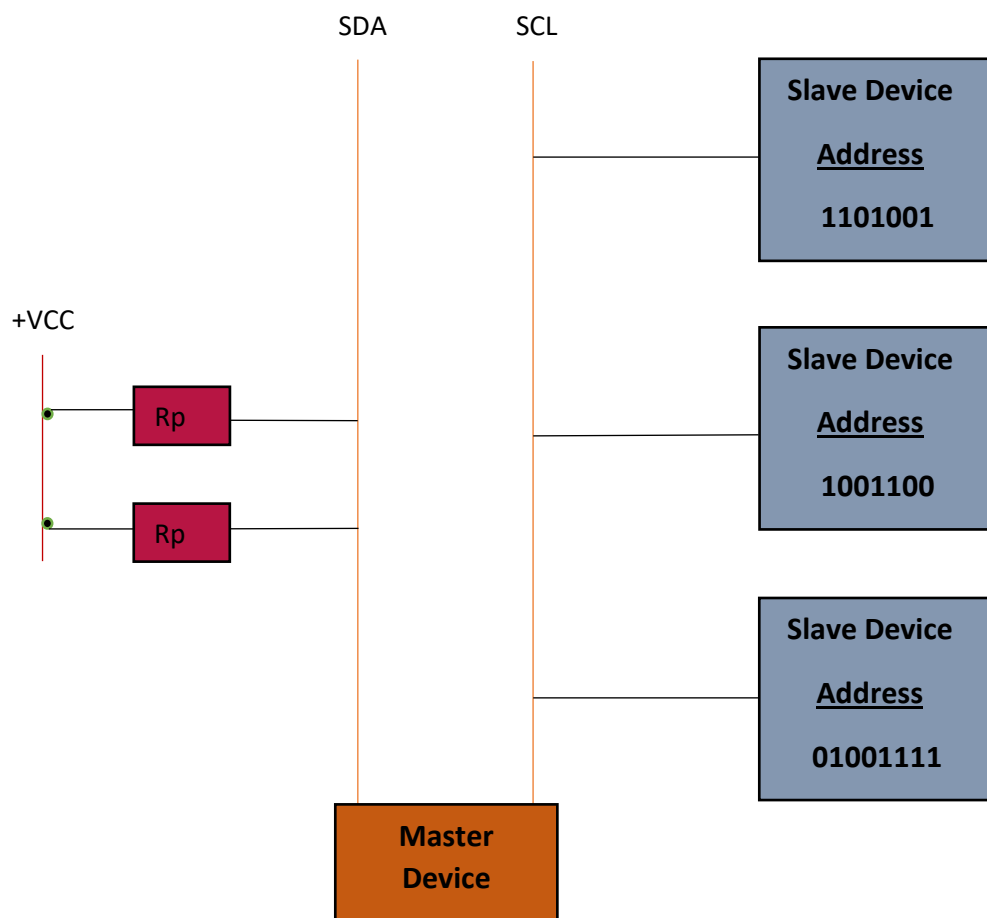


KARTHIK P S

Electrical and Electronics Engineer

1.WRITE A BRIEF SUMMARY ABOUT I2C PROTOCOL?

I2C-Inter Integrated Protocol is a bus interface connection protocol for serial Communication and it combine best features of UART and SPI. It is a Two Wired Interface because it only uses two wire to transmit data between devices and this allows communication between microcontroller and sensor array and displays. It is widely used for short distance communication. SDA-it is the line to sending and receiving data for master and slave. SCL-it is the line to carry the clock signal. Its maximum speed for standard mode is 100kbps, fast mode-400kbps. I2C have single master with multiple slaves and multiple master with multiple slaves. It has been done by connecting 4.7Kohm pull up resistor to SDA and SCL VCC. In this protocol maximum we use unlimited master and 1008 slave. It Transfer data bit one by one at regular time interval by reference of clock line. In working of I2C as following,



In this data can be transferred in message that message contain start bit, address bit, data frame, read/write bit ACK/NACK bit and stop bit

(1) START BIT:

it switches SDA line from high to low before SCL line switch from high to low. Once this condition is Send by master device and all slaves get active and wait for address block

(2) ADDRESS BLOCK:

I2C does not have select lines like SPI so we need address block. It has seven bits and it is filled with address of slave device. The slave Compare its own address with master address and if that address matches it send low voltage ACK bit back to master. If does not match SDA line will remain high.

(3) READ/WRITE BIT:

It specifies the direction of data transfer that is if master send the data to slave this bit set to '0' also receives bit set to '1'.

(3) ACK/NACK BIT:

ACK/NACK-acknowledge/no-acknowledge. This bit set '0' if physical address of slave coincides with address broadcast by master device otherwise set '1' that is data frame is received successfully ACK bit sent to the sender

(4) DATA FRAME:

After master detect ACK bit the first data frame is ready to be send that's data frame and It comprises 8bit. It Send MSB first. each data frame followed by ACK/NACH to verify that frame has been received successfully. ACK bit received by either master or slave before next frame can sent. After all data frame can be send master through SDA line. So that master comes to stop bit that is the SDA line from low to high before SCL line switches from high to low.

(5) STOP BIT:

The SDA line switches from a low voltage level to a high voltage level *after* the SCL line switches from low to high.

STEPS OF I2C DATA TRANSMISSION:

- ❖ first master sends start condition to every connected slave by switching SDA line.
- ❖ Then master send 7bit address of the slave It want to communicate with read or write bit.
- ❖ And each slave compares its own address with address send from master device. If it matches slave return ACK bit by pulling the SDA line from low for one bit otherwise it remains high.
- ❖ After all data can be transferred the receiving device return another ACK bit to sender. then to stop the transmission master send stop condition by switching the SDA line from low to high with SCL line is high.

SPECIAL FEATURES:

- ✓ It has half duplex protocol that is bidirectional communication is possible but not simultaneously
- ✓ synchronous serial communication that means data can be transferred frame of frame
- ✓ Arbitration-In I2C support multi master bus system but more than one bus cannot be used simultaneously. So that SDA and SCL line can be monitored. If SDA line found high when it Support low it stops the transfer of data. It is used for Low-speed communication.

ADVANTAGES:

- ✓ First one is that it can be configured in multi master mode.
- ✓ complexity is reduced because it only uses two bi-directional lines.
- ✓ It is cost efficient and it uses ACK/NACK features due to this it has improved error correction.

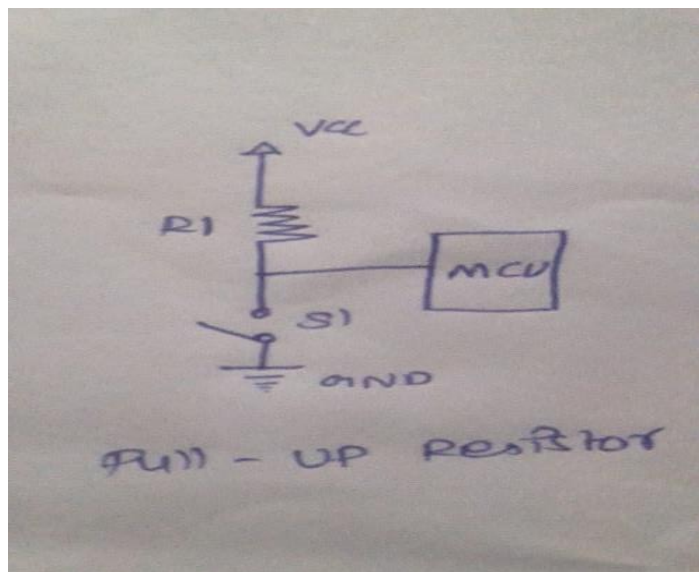
LIMITATION:

- ✓ It has low speed
- ✓ size of data frame is limited to 8bit and half duplex communication protocol.

2.WRITE SHORT TEXT ABOUT PULL UP RESISTOR, PULL DOWN RESISTOR, OPEN DRAIN, ACTIVE LOW AND ACTIVE HIGH?

(1) PULL-UP RESISTOR:

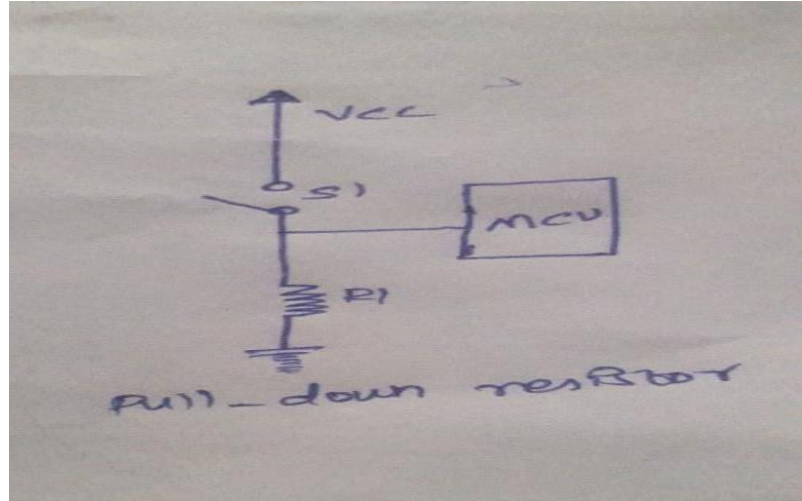
- It is a type of resistor which used to ensure that wire is pulled to high logic level in absence of an input signal. The high impedance state occurs when the pin not pulled to low or high logic level but it left floating instead. Example of this is an unconnected input pin of microcontroller. In this resistor are solve dilemma for mc by pulling value to high as seen in figure,
- If there were not pull up resistor the MCU'S input is floating when switch is open. It is not a special resistor. It is fixed value between voltage supply and appropriate pin which result in defining of input and output voltage in absence of driving signal. A typical value of this resistor is 4.6kohm but it can vary depending upon application.



(2) PULL-DOWN RESISTOR:

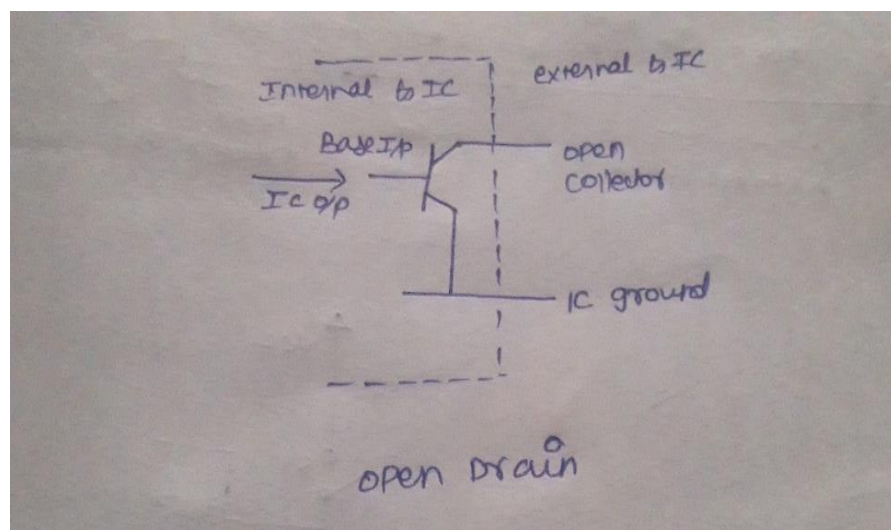
- Its working is same as pull-up resistor expect that they pull the pin to logical low. In this resistor connected between ground and appropriate pin on a device. The detailed figure as follows,

- A pushbutton switch is connected between supply voltage and mc pin. In this circuit when switch is closed the mc input is high logical level but when it is open, the pull-down resistor pulls down the input voltage to the ground for preventing undefined state at the input.
- It has high larger resistance than logic circuits. That means it pulls down the voltage too much and the input remains constant logic low



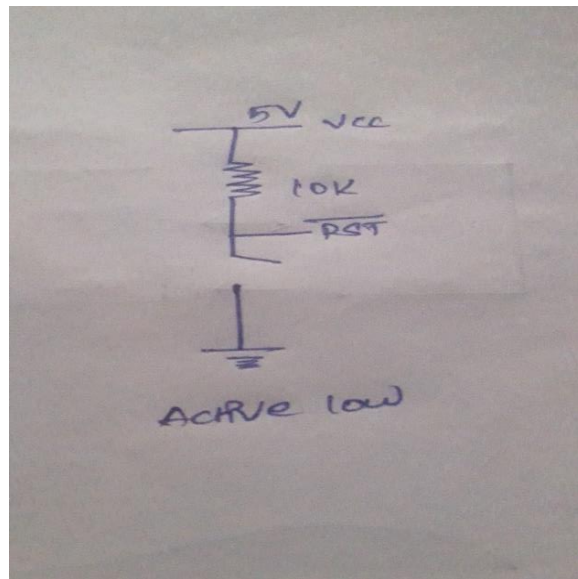
(3) OPEN-DRAIN:

- An open drain output is simply a transistor that connected to ground. Based on input open drain is like a switch that will connected or disconnected. An open drain commonly used in IC's. this helps multiple Device connected with single wire which is in mode of pull-down operation. This single wire is bidirectional one so its bidirectional nature will gain so much important to circuit due to many device interconnection. It has programmable output configuration with push-pull.
- In push-pull mode 0 connect output pin to ground, 1 will connect to V_{iO} . In open drain mode 0 continues connect to ground, and outputting 1 will disconnect pin to V_{iO} and remains floating. PMOS does not exist in open drain mode. So the output will be high or floating.



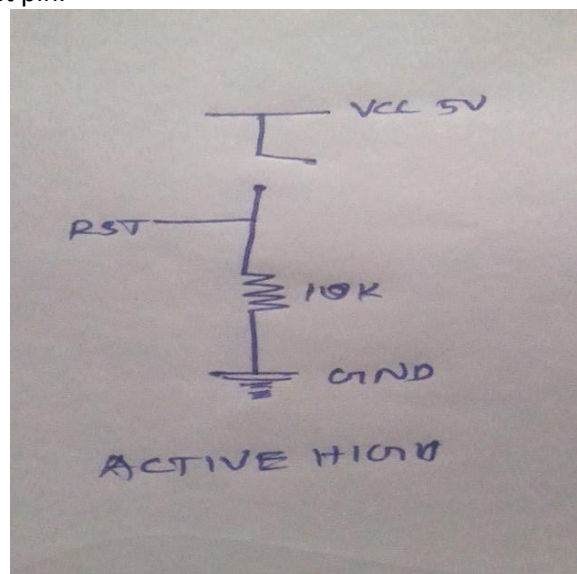
(4) ACTIVE LOW:

- Active low means the function get done when input is low state. if there is a chip which enable the output then there will be pin CE called chip enable. Active low always helps to eliminate intermediate state due to improper supply voltage.
- It is easier to pull down a signal than pull it up. In such condition we use active low. And these term uses to describe the required logic state of an integrated circuit pin that will enable its internal function. The physical pin provide access to the IC and changing its state to low activates this function. The figure describes how Active low can be done.



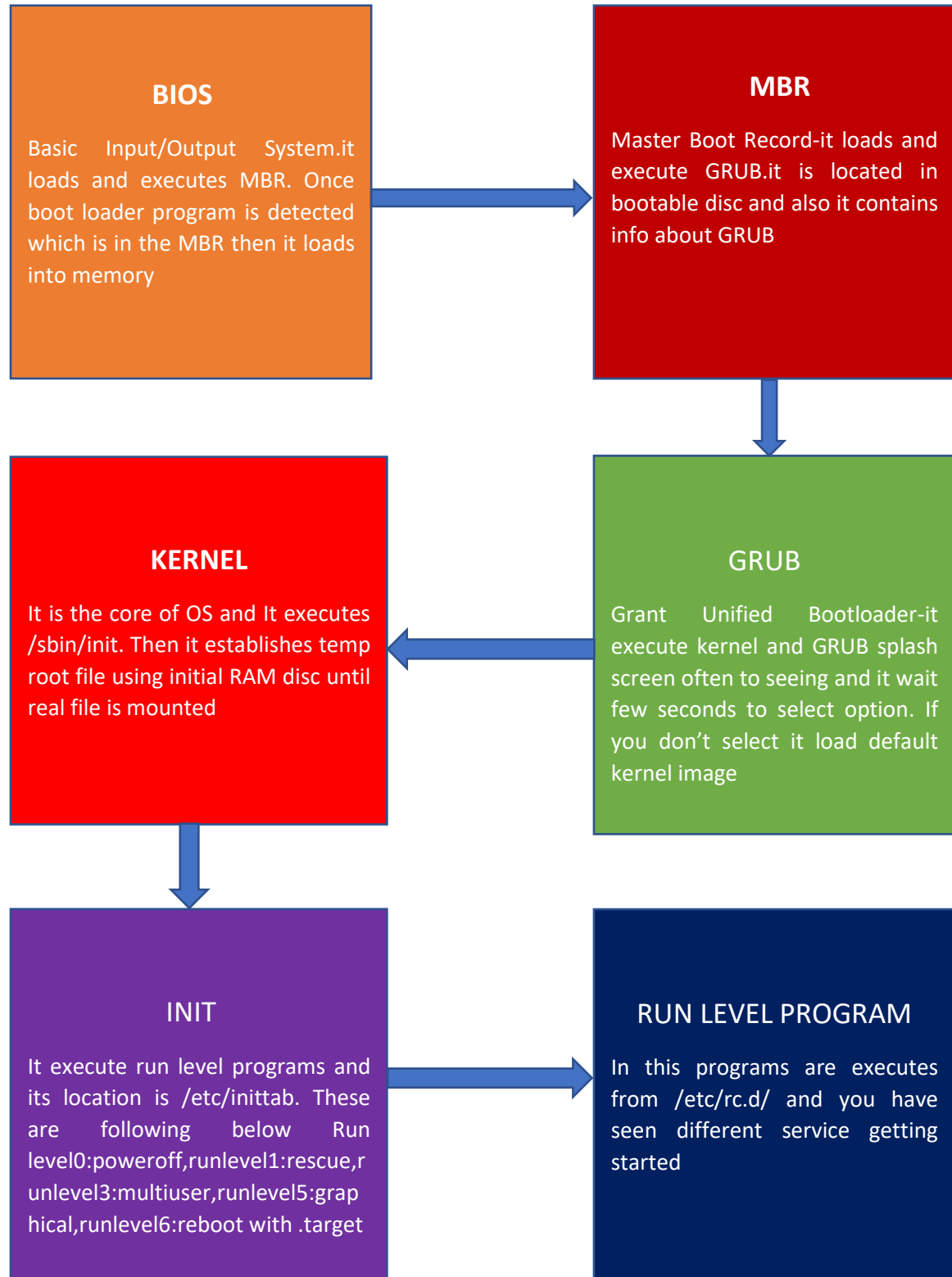
(5) ACTIVE HIGH:

- Active high means the function get done when inputs is high state. This would represent a value equal to or close to positive power supply of the circuit. Used active high pin usually pull-down resistors.
- Which keeps the electrical pull of the pin low so that any electrical noise does not activate in this function. In active high describes that figure says that when switch is pressed high signal is send to reset pin.



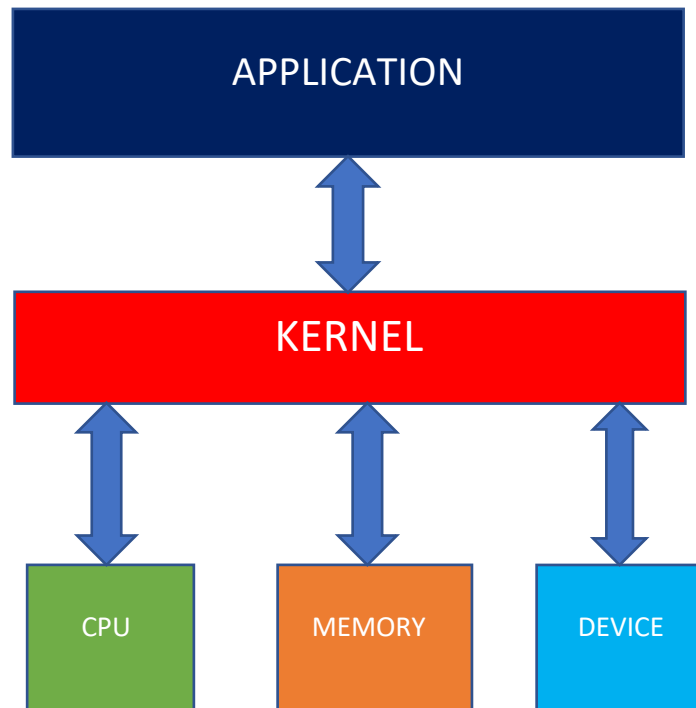
3.WRITE SHORT TEXT ABOUT LINUX BOOTING PROCESS AND ROLE IN KERNEL?

LINUX BOOTING PROCESS



KERNEL ROLE:

- Kernel is the core of operating system and it has complete control everything in that system. In this stage of the boot process, the kernel that was selected by GRUB file.
- Then it executes the `/sbin/init` program, which is always the first program to be executed. You can confirm this with its process id (PID), which should always be 1.
- Then it establishes a temporary root file system using Initial RAM Disk until the real file system is mounted



- The kernel performs its tasks, such as running processes, managing hardware devices, facilitates interactions between hardware and software components and handling interrupts, in this protected kernel space.
- This separation prevents user data and kernel data from interfering with each other and causing instability and slowness, as well as preventing malfunctioning applications from affecting other applications or crashing the entire operating system.
- The kernel is one of the first programs loaded on start up. It handles the rest of start up as well as memory, peripherals and I/O requests from software, translating them into translating data instructions for the CPU.
- It is used to concurrent access and use of hardware for different application. Kernel are self-extracted to save a space. It is located in `/boot` directory along with RAM and disc map of hard drive.
- Then it establishes a temporary root file system using Initial RAM Disk until the real file system is mounted.
- After selected kernel is loaded into the memory then it first extracted from its compressed location before it can perform any work. After kernel is extracted it loads system d and turns control over it.

4. WRITE ABOUT FIRST IMPRESSION ON ZEPHYR RTOS?

Some of the genuine first impression about Zephyr RTO is are enlisted below,

- (1) Open source real time operating system
- (2) Vibrant community participation
- (3) It Build with safety and security in mind
- (4) Cross-architecture with broad SoC and development board
- (5) Vendor neutral governance
- (6) Complete, fully integrated, highly configurable, modular for flexibility
- (7) Product development ready using LTS include security updates
- (8) Certification ready with auditable

