I2C and EEPROM interfacing using 8051 microcontroller

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Aim: 8051 and EEPROM interfacing using I2C interface

Theory:

I²C

I²C is a serial computer bus, which is invented by NXP semiconductors previously it is named as Philips semiconductors. The I²C bus is used to attach low speed peripheral integrated circuits to microcontrollers and processors. I²C bus uses two bidirectional open-drain lines such as SDA (serial data line) and SCL (serial clock line) and these are pulled up with resistors. I²C bus permits a master device to start communication with a slave device. Data is interchanged between these two devices. Typical voltages used are +3.3V or +5V although systems with extra voltages are allowed. Nowadays new microcontrollers have inbuilt I²C Registers. But in 8051 there is no such registers. So it is required to achieve I²C in 8051.

Many devices support I²C. For example, EEPROM, ADC, LCD, etc.

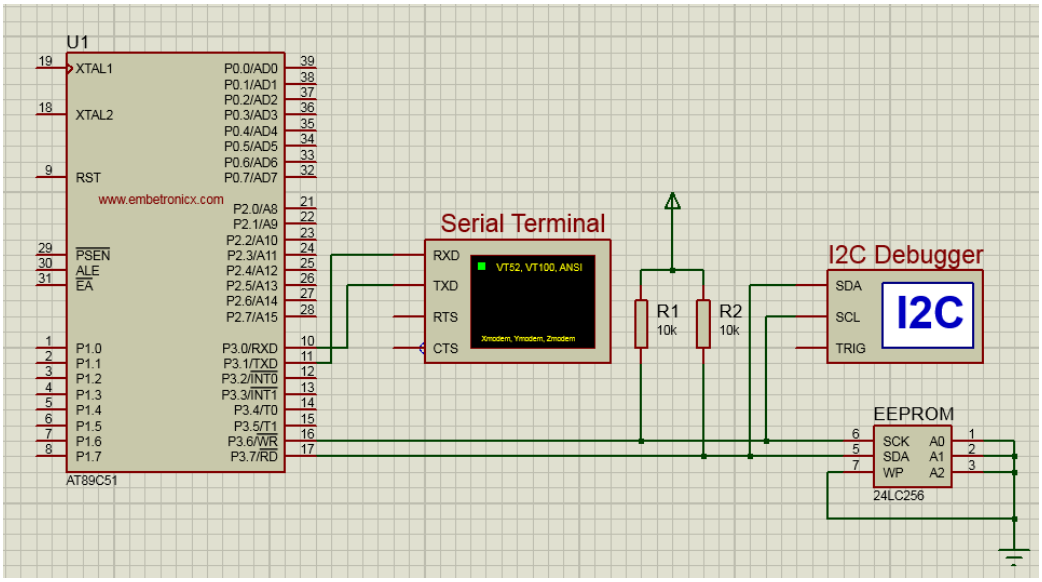
EEPROM

Electrically Erasable Programmable ROM (EEPROM) is a user-modifiable ROM which can be removed and reprogrammed frequently through the application of higher than the normal electrical voltage. An EEPROM is a kind of non-volatile memory used in electronic devices like computers to store small quantities of data that should be saved when power is detached.

Connection Diagram

SCK – P3.6

SDA – P3.7



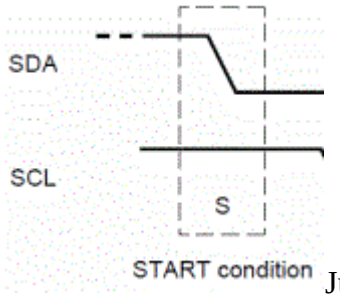
Write Mode

1. Send the START command from the Master.
2. Send Device (EEPROM) Address with write mode.
3. Send Register address in Device (EEPROM), Where we have to access.
4. Send the Data to the Device (EEPROM).
5. If you want to send more than one byte, keep sending that byte.
6. Finally, Send the STOP command.

Read Mode

1. Send the START command from the Master.
2. Send Device (EEPROM) Address with write mode.
3. Send Register address in Device (EEPROM), Where we have to access.
4. Send again START command or Repeated START command.
5. Send Device address with Read mode.
6. Read the data from Device (EEPROM).
7. Finally, Send STOP command.

START Command

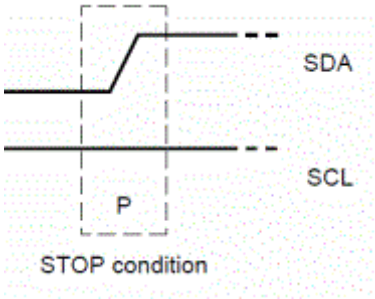


Just go through the above diagram. In this

1. Initially, SDA and SCL are High.
2. SDA first goes to Zero.
3. Then SCL goes to Zero.

```
void i2c_start(void)
{
SDA=1;
SCL=1;
SDA=0;
SCL=0;
}
```

STOP Command



When SCL is High, We have to toggle the SDA Low to High.

```
void i2c_stop(void)
{
SDA=0;
SCL=1;
SDA=1;
SCL=0;
}
```

Code:

```
#include <reg51.h>
unsigned char bdata EP_DATA;
sbit lsb=EP_DATA^0;
```

```
sbit msb=EP_DATA^7;
sbit SDA = P3^7;
sbit SCL = P3^6;
unsigned char rec[12];
void i2c_start(void);
void i2c_stop(void);
void i2c_send (unsigned char);
void i2c_send_byte(unsigned char addr,unsigned char dataa);
void i2c_send_string(unsigned char addr,unsigned char *s);
unsigned char i2c_read(void);
unsigned char i2c_read_byte(unsigned char addr);
unsigned char i2c_read_string(unsigned char addr);
void ser_init();
void tx(unsigned char send);
void tx_str(unsigned char *s);
void i2c_start(void)
{
SDA=1;
SCL=1;
SDA=0;
SCL=0;
}
void i2c_send (unsigned char send)
{
unsigned char i;
EP_DATA=send;
for(i=0;i<=7;i++) {
SDA=msb;
SCL=1;
SCL=0;
EP_DATA=EP_DATA<<1;
}
while(SDA!=0);
SCL=1;
SCL=0;
}
unsigned char i2c_read(void)
{
unsigned char i;
lsb=SDA;
for(i=0;i<=7;i++) {
EP_DATA=EP_DATA<<1;
lsb=SDA;
SCL=1;
SCL=0;
}

if(EP_DATA==13) {
SDA=1;
SCL=1;
```

```
SCL=0;
SDA=0;
i2c_stop();
return(EP_DATA);
}
SDA=0;
SCL=1;
SCL=0;
SDA=1;
return(EP_DATA);
}
void i2c_stop(void)
{
SDA=0;
SCL=1;
SDA=1;
SCL=0;
}
void i2c_send_byte(unsigned char addr,unsigned char dataa)
{
i2c_start();
i2c_send(0xa0);
i2c_send(addr);
i2c_send(dataa);
i2c_stop();
}
unsigned char i2c_read_byte(unsigned char addr)
{
unsigned char rec;
i2c_start();
i2c_send(0xa0);
i2c_send(addr);
i2c_start();
i2c_send(0xa1);
rec=i2c_read();
i2c_stop();
return rec;
}
void i2c_send_string(unsigned char addr,unsigned char *s)
{
i2c_start();
i2c_send(0xa0);
i2c_send(addr);
while(*s) {
i2c_send(*s++);
}
i2c_stop();
}
unsigned char i2c_read_string(unsigned char addr)
{
```

```
unsigned char i;
i2c_start();
i2c_send(0xa0);
i2c_send(addr);
i2c_start();
i2c_send(0xa1);
for(i=0;i<10;i++) {
rec[i]=i2c_read(); }
i2c_stop();
return rec;
}
void ser_init()
{
SCON=0x50;
TMOD|=0x20;
TH1=0xFD;
TL1=0xFD;
TR1=1;
}
void tx(unsigned char send)
{
SBUF=send;
while(TI==0);
TI=0;
}
void tx_str(unsigned char *s)
{
while(*s)
tx(*s++);
}

int main()
{
#unsigned char data[12];
ser_init();
i2c_send_string(0x00,"EmbeTronicX");
i2c_read_string(0x00);
tx_str(rec);
while(1);
}
```

Conclusion:

In this experiment I interfaced 8051 and EEPROM interfacing using I2C. 8051 doesn't have built in I2C therefore externally it is achieved. EEPROM also supports I2C and I read and also written on using the I2C using 8051. Data was successfully read and written on the EEPROM.