#define LCD\_Dir DDRB /\* Define LCD data port direction \*/

#define LCD\_Port PORTB /\* Define LCD data port \*/

#define RS PD3 /\* Define Register Select (data reg./command reg.) signal pin \*/

#define RW PD6

#define EN PB4 /\* Define Enable signal pin \*/

void LCD\_Command(unsigned char cmnd)

{

LCD\_Port = (LCD\_Port & 0xF0) | (cmnd >> 4); /\* sending upper nibble \*/

PORTD &= ~(1 << RS); /\* RS=0, command reg. \*/

PORTD &= ~(1 << RW);

LCD\_Port |= (1 << EN); /\* Enable pulse \*/

*\_delay\_us*(1);

LCD\_Port &= ~(1 << EN);

*\_delay\_us*(200);

LCD\_Port = (LCD\_Port & 0xF0) | (cmnd & 0x0F); /\* sending lower nibble \*/

LCD\_Port |= (1 << EN);

*\_delay\_us*(1);

LCD\_Port &= ~(1 << EN);

*\_delay\_ms*(2);

}

void LCD\_Char(unsigned char data)

{

LCD\_Port = (LCD\_Port & 0xF0) | (cmnd >> 4); /\* sending upper nibble \*/

PORTD |= (1 << RS); /\* RS=0, command reg. \*/

PORTD &= ~(1 << RW);

LCD\_Port |= (1 << EN); /\* Enable pulse \*/

*\_delay\_us*(1);

LCD\_Port &= ~(1 << EN);

*\_delay\_us*(200);

LCD\_Port = (LCD\_Port & 0xF0) | (cmnd & 0x0F); /\* sending lower nibble \*/

LCD\_Port |= (1 << EN);

*\_delay\_us*(1);

LCD\_Port &= ~(1 << EN);

*\_delay\_ms*(2);

}

void LCD\_Init(void) /\* LCD Initialize function \*/

{

LCD\_Dir |= 0x1F; /\* Make LCD command port direction as o/p \*/

DDRD |= (1 << RS) | (1 << RW);

*\_delay\_ms*(20); /\* LCD Power ON delay always >15ms \*/

LCD\_Command(0x33);

LCD\_Command(0x32); /\* send for 4 bit initialization of LCD \*/

LCD\_Command(0x28); /\* Use 2 line and initialize 5\*7 matrix in (4-bit mode)\*/

LCD\_Command(0x0c); /\* Display on cursor off\*/

LCD\_Command(0x06); /\* Increment cursor (shift cursor to right)\*/

LCD\_Command(0x01); /\* Clear display screen\*/

*\_delay\_ms*(2);

LCD\_Command(0x80); /\* Cursor 1st row 0th position \*/

}

void LCD\_String(char \*str) /\* Send string to LCD function \*/

{

int i;

for (i = 0; str[i] != 0; i++) /\* Send each char of string till the NULL \*/

{

LCD\_Char(str[i]);

}

}

void LCD\_String\_xy(char row, char pos, char \*str) /\* Send string to LCD with xy position \*/

{

if (row == 0 && pos < 16)

LCD\_Command((pos & 0x0F) | 0x80); /\* Command of first row and required position<16 \*/

else if (row == 1 && pos < 16)

LCD\_Command((pos & 0x0F) | 0xC0); /\* Command of first row and required position<16 \*/

LCD\_String(str); /\* Call LCD string function \*/

}

void LCD\_Clear()

{

LCD\_Command(0x01); /\* Clear display \*/

*\_delay\_ms*(2);

LCD\_Command(0x80); /\* Cursor 1st row 0th position \*/

}