**Individual contribution**

Index Number-

Name-

Responsibilities-

* Project preparation and Study the basic of microcontroller programming
* Make a study about ultrasonic sensor, LCD.
* Write the coding part for the above-mentioned sensors and modules.
* Interfacing ultrasonic sensor, lcd with Atmega32 AVR microcontroller

\* Programming ultrasonic sensor to track the level of food and water.

Ultrasonic Sensor

A close up of electronics

Description automatically generated

Maximum Voltage-5V

Maximum Current-4.4mA

Range -20cm- 16.5m

* **VCC** - +5 V supply
* **TRIG** – Trigger input of sensor.

Microcontroller applies 10 us trigger pulse to the HC-SR04 ultrasonic module.

* **ECHO**–Echo output of sensor.

Microcontroller reads/monitors this pin to detect the obstacle or to find

the distance.

* **GND** – Ground

This Ultrasonic Sensor Circuit consists of a set of ultrasonic receiver and transmitter which operate at the same frequency. When something moves in the area covered the circuit’s fine balance is distributed and the alarm is triggered. The ultrasonic circuit is very sensitive and can be adjusted to reset itself automatically or to stay triggered till it is reset manually after an alarm.

The ultrasonic transmitter is built around two NAND gates wired as inverters and they form a multivibrator the output of which drives the transducer. The trimmer P2 adjusts the output frequency of the transmitter and for greater efficiency it should be made the same as frequency of the transducers in use. The ultrasonic receiver uses a transducer to receive the signals that are reflected to it the output of which is amplified by the transistor TR3, and IC1 which is a 741 op-map. The output IC1 is taken to the non-inverting input of IC2 the amplification factor of which is adjust by means of P1.

How it works

The ultrasonic circuit is adjusted in such a way as to stay in balance as long the same as the output frequency of the transmitter. If there is some movement in the area covered by the ultrasonic emission the signal that is reflected to the receiver becomes distorted and the circuit is thrown out of balance. The circuit works from 0-12 VDC and can be used with batteries or a power supply.

Advantage of Ultrasonic Sensor

1.Not affected by colour or transparency of objects.

2.Can be used in dark environments.

3.Low -cost option

4.Not highly affected by dust, dirt, or high moisture environments.

Circuit Diagram of Ultrasonic Sensor

Diagram, schematic

Description automatically generated

Diagram with LCD and Atmega 32

Diagram, schematic

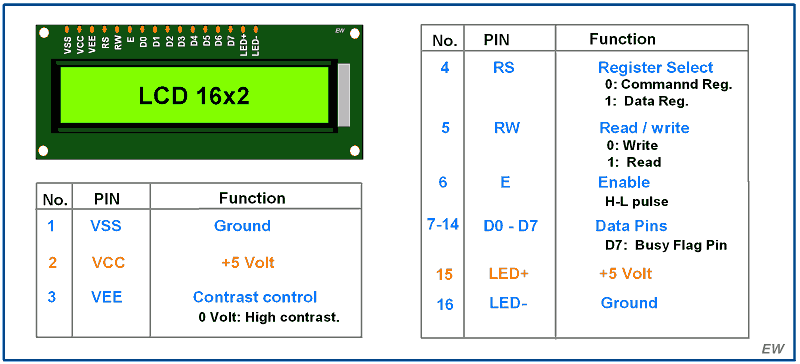
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Sketch Diagram that connected to the Atmega 32

![Diagram, schematic

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NAClcd6Zj3oYk0mR6mgBsa9s0rMTQwKtxRtNSA3dSrxSbTTqAEyKbJarcKySfdNFL5o6f0qgMXUfB9jqkqyXE+pZ/uQ380a/8AjriuR8UeE9P0vVvC8tq1+0v9poR52oTyDAGT8rORXpORXO+LdJvNSk02SyjhNzb3HmpNOfkiG3GcDk/hVxA6Bpo44zJJIscY6vIwVfzPFYE3imS/keHRLKTVJf4rh2aG1T6yY3N/wEGpU8Mx3WJNVlbU5R/C52xL/uxD5T+JrYRRtUHAVOiEfL+AHFXzActdeD316ON/Ed0NVjjGf7PiUx2a/wDAM/P/AMCNP8A6daw+FrPybaGNSHI2xjj5vqa6ebHkyBecjArI8IWv2Pw7ZxnIKqQQf97NTzCJNa8O6b4htDa39otxBuyEYDg+uRg1oKoRRtRUwMAKB0pce9GPesmaRlpYRc5zjn34/lWbGu7Xrp/l+SFV5zzWnj3rOhB/ti+PbYgpFrW+pobqF460u5fWjzRQZSDpT/mprc1JkUCE2mlyKWmHjrQSFB46UUu00FBuo2mjaaXcBQA5eKXHvScetLj3qgEXimtzT9vvTNwoAXaaUc9DS496ReKAHLxRu9qTGe9O2k9qkBygjrS7gaMinKuKBCbTUmRTP4tuead5ZqgJM0u4etJ8npTttAwV93UUu0UFQOlGM96AFXim8etOp2ygQVIMHoajoXcO1AEuPel2mkxnvTsigY0/L1pV4pFjLdaXacZxQBLSLxRuBpdpqQHUqyYo2ml25qgH7vlxRuBpApY4FPVcUEibT0qVM/jUe35s5qRUw2c0AObmlWMijaakyKAFoo680mRQBzMhDdBULMCcDrUoGaQoY2yFyKyiajce9R7T6VL5ZoLY7VZBEyg04cnFO2gU3HmNnpQAdaMAUqqV6ikZSaRYi7R3pvWpNtCrimA3y/enhQetJkeppNxoANp3ZpoUt0qTHvTScdKCRCcdKjII606lYE9KChoIZcCjcacVA6U0IzdBTAXZTNpqU8Um00yBKbxSZNSAA9KAE+am7TTtuO9Mcn+HmgY7IptFLtNAhMijA9aXijanpQA1uaXHvS7TTTx1NSA0c0tOVQKbVAJu9qP4s4p+0U3aaAG7TSSU+mhSeooAi3U7aad5ZooEKwBXFNGNm3jA6ACnYIo2igkZtNHlmpSoHWgfN0570iyHHvVCx+bVL8n/AGa0FUt0BP0GazrBl/tHUjuGA4B57VNzaMTQ2g03Ap4UqMkEY65FO2UzKQzaak2mnYFIPm6VRIzJpwUnrT9tJtNADdpp1G00u05xQAbTjNDLmn7TtxijafSgBhUr1FLj3qQKT1pfLz2oGQBiak2/7NSLEF60bTSAi2H3o2mp8CoypFMBiVMin0pqJUiJ70AN8vNP2n0qVE70m00Eke0Zz3p4YN0p4jLcikMe3oM0AG2nbTS7T6U4qRQURH5eppy8UqqCcGjaRxigkUNntTqFTFSbPagCEjFO3CnuvtSqij73H4UALGpo2n0pzRlelPZSvUUFCFSOlOCgrinbGGOOtOUAUARrER2p20+lS7TnG0/lSUAQ8+lTpHTlVG6EfnTl4k/2fXNADCpDZFKFJ7VKAG6GnKoXrQSQhSe1SbTU6qtO2L7/AJUFEGPel2n0qby19afxQSRrgLjvUfln0qcR5pfLHrTA5VVAprMD0p1V6xiak1NkULjNOpJv4asgY6mnKQOoprUtABJTKfJTKgAx70bTRT6sBMj0o202n0AMpdlJT6CyPy6Tad2O9Opf46AE2ikPHSlooIBlBpu006iqAg2n0p6qR1FOp1ADWUmm7RUlFBZBtPpTvan0z+KggTJ9Kb70+m/wUAOPHWo256VJJTKADHvRz6UVNQBDtIpcEDNOenv9ygCvtNOCk9KKfHQBHx60baWigkY3NGeM/wBKWlm/1dBAsikVFND9qtnh3tHuXG9DhhSt/qanSpNInnmuaDqWh2N7Mmo3+qIqZWXUtWeNc/7qIq/rWN4LutR17UJI1jsUXbvDLey3G78pK9XuP+QXL/u1evvu/wDbKp5T1IVf3T0MbS9MFjCMrH5h++YwRn8zWgEJwMH8qKbH90VcTzZB5Q9aRlC9KbTKZBIuGGQePrShSWxhs/Slh/1dQp/rKAJ2Ur1FJ1bPapZKF+5QAn+elG4Gl/iWoloAl9OD69KRZMZpsnb/AHarx96Ci0703zBz7VSfpUcX3mp2A1Yfm60rj9TiqUNQzfwf71IDRRh6j86lXCjJIx9axEp0n3RQBvp/q89ulNLqP4l/OuJs/wDVN/vVrPQB0Znj2gLImSMj5hTBcRkZ8xfzri/+XyL6VbT7lAHUm9t1zmeMYGTlxStfW7LkSqQea4jVv+PaT/dq7Y/6lP8AdoA6b7dBuz5g/Wk/tW0kkcLMCUOG4PFc5VPTv+Pq8/3qAO0/tS3/AL/6H/CmT69ZxSIhdgznCjB5/SsWs+//AOPyz/3qAOqbVoG6bqDrFvFGXKsVAyTWQnSm3H/HnL/u0AbtvrEE9urhWO4ZHNO/tRO0bN+NYGlf8eMH+7V9KALa+Io5riaEQshTnOasf2t/0zrnYv8AkKXX+6taVAFi58SNYtH+4DeY+D8x4FWBrDsAQi1zesf8sv8AerSg+4lAF6fVp44yQsefpTbPW7q6twxEYJ6cVTuv9S9RaV/x5pQBrHUrgdCtVotcvGvpozL8o6cCo6zR/wAhh6CTpUvJ5PvSbak+2OTjzG/Os5OlTR/eNBRoRSStgF+anjZl/izVeH761MlAFhZMd6PN/wBqkqFelK4H/9k=)

**LCD16x2 display module**

 Maximum voltage-5V Maximum current-20mA-50mA.

Source Code

Main.c

#define F\_CPU 8000000UL

#include <avr/io.h>

#include <avr/interrupt.h>

#include <util/delay.h>

#include <string.h>

#include <stdlib.h>

//#include "LCD\_16x2\_H\_file.h" /\* Include LCD header file \*/

#include "LCD\_16x2\_C\_file.c "

#define Trigger\_pin PA0 /\* Trigger pin \*/

int TimerOverflow = 0;

ISR(TIMER1\_OVF\_vect)

{

TimerOverflow++; /\* Increment Timer Overflow count \*/

}

int main(void)

{

char string[10];

long count;

double distance;

DDRA = 0x01; /\* Make trigger pin as output \*/

PORTD = 0xFF; /\* Turn on Pull-up \*/

LCD\_Init();

LCD\_String\_xy(1, 0, "Ultrasonic");

sei(); /\* Enable global interrupt \*/

TIMSK = (1 << TOIE1); /\* Enable Timer1 overflow interrupts \*/

TCCR1A = 0; /\* Set all bit to zero Normal operation \*/

while (1)

{

/\* Give 10us trigger pulse on trig. pin to HC-SR04 \*/

PORTA |= (1 << Trigger\_pin);

*\_delay\_us*(10);

PORTA &= (~(1 << Trigger\_pin));

TCNT1 = 0; /\* Clear Timer counter \*/

TCCR1B = 0x41; /\* Capture on rising edge, No prescaler\*/

TIFR = 1<<ICF1; /\* Clear ICP flag (Input Capture flag) \*/

TIFR = 1<<TOV1; /\* Clear Timer Overflow flag \*/

/\*Calculate width of Echo by Input Capture (ICP) \*/

while ((TIFR & (1 << ICF1)) == 0);/\* Wait for rising edge \*/

TCNT1 = 0; /\* Clear Timer counter \*/

TCCR1B = 0x01; /\* Capture on falling edge, No prescaler \*/

TIFR = 1<<ICF1; /\* Clear ICP flag (Input Capture flag) \*/

TIFR = 1<<TOV1; /\* Clear Timer Overflow flag \*/

TimerOverflow = 0;/\* Clear Timer overflow count \*/

while ((TIFR & (1 << ICF1)) == 0);/\* Wait for falling edge \*/

count = ICR1 + (65535 \* TimerOverflow); /\* Take count \*/

/\* 8MHz Timer freq, sound speed =343 m/s \*/

distance = (double)count / 466.47;

*dtostrf*(distance, 2, 2, string);/\* distance to string \*/

*strcat*(string, " cm "); /\* Concat unit i.e.cm \*/

LCD\_String\_xy(2, 0, "Dist = ");

LCD\_String\_xy(2, 7, string); /\* Print distance \*/

if (distance <100)

{

PORTA|=(1<< PINA5);// For led on

PORTD |=(1<< PIND3);//for buzzer

}

*\_delay\_ms*(200);

}

}

LCD\_16\*2\_Cfile.c

/\*

\* LCD\_16x2\_C\_file.c

\*

\*

\*/

#define F\_CPU 8000000UL /\* Define CPU Frequency e.g. here its 8MHz \*/

#include <avr/io.h> /\* Include AVR std. library file \*/

#include <util/delay.h> /\* Include inbuilt defined Delay header file \*/

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

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

#define RS PB0 /\* Define Register Select (data reg./command reg.) signal pin \*/

#define EN PB1 /\* Define Enable signal pin \*/

void LCD\_Command( unsigned char cmnd )

{

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

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

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

*\_delay\_us*(1);

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

*\_delay\_us*(200);

LCD\_Port = (LCD\_Port & 0x0F) | (cmnd << 4); /\* 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 & 0x0F) | (data & 0xF0); /\* sending upper nibble \*/

LCD\_Port |= (1<<RS); /\* RS=1, data reg. \*/

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

*\_delay\_us*(1);

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

*\_delay\_us*(200);

LCD\_Port = (LCD\_Port & 0x0F) | (data << 4); /\* 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 = 0xFF; /\* Make LCD command port direction as o/p \*/

*\_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 \*/

}

int main()

{

LCD\_Init(); /\* Initialization of LCD\*/

LCD\_String("Hen Cage"); /\* Write string on 1st line of LCD\*/

LCD\_Command(0xc0); /\* Go to 2nd line\*/

LCD\_String("Hello"); /\* Write string on 2nd line\*/

while(1);

}

LCD\_16\*2\_Cfile.h

/\*

\* LCD\_16x2\_H\_file.h

\* http://www.electronicwings.com

\*

#ifndef LCD\_16x2\_H\_H\_ /\* Define library H file if not defined \*/

#define LCD\_16x2\_H\_H\_

#define F\_CPU 8000000UL /\* Define CPU Frequency e.g. here its 8MHz \*/

#include <avr/io.h> /\* Include AVR std. library file \*/

#include <util/delay.h> /\* Include Delay header file \*/

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

#define LCD\_Command\_Dir DDRC /\* Define LCD command port direction register \*/

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

#define LCD\_Command\_Port PORTC /\* Define LCD data port \*/

#define RS PC0 /\* Define Register Select (data reg./command reg.) signal pin \*/

#define RW PC1 /\* Define Read/Write signal pin \*/

#define EN PC2 /\* Define Enable signal pin \*/

void LCD\_Command (char); /\* LCD command write function \*/

void LCD\_Char (char); /\* LCD data write function \*/

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

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

void LCD\_String\_xy (char,char,char\*); /\* Send row, position and string to LCD function \*/

void LCD\_Clear (void); /\* LCD clear function \*/