

# 04 Distance Sensor Radar

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Student Name: [REDACTED]

Student #: [REDACTED]

Student Email: [REDACTED]

Primary Github address: [https://github.com/DylanCaz/Submission\\_DA.git](https://github.com/DylanCaz/Submission_DA.git)

Directory:

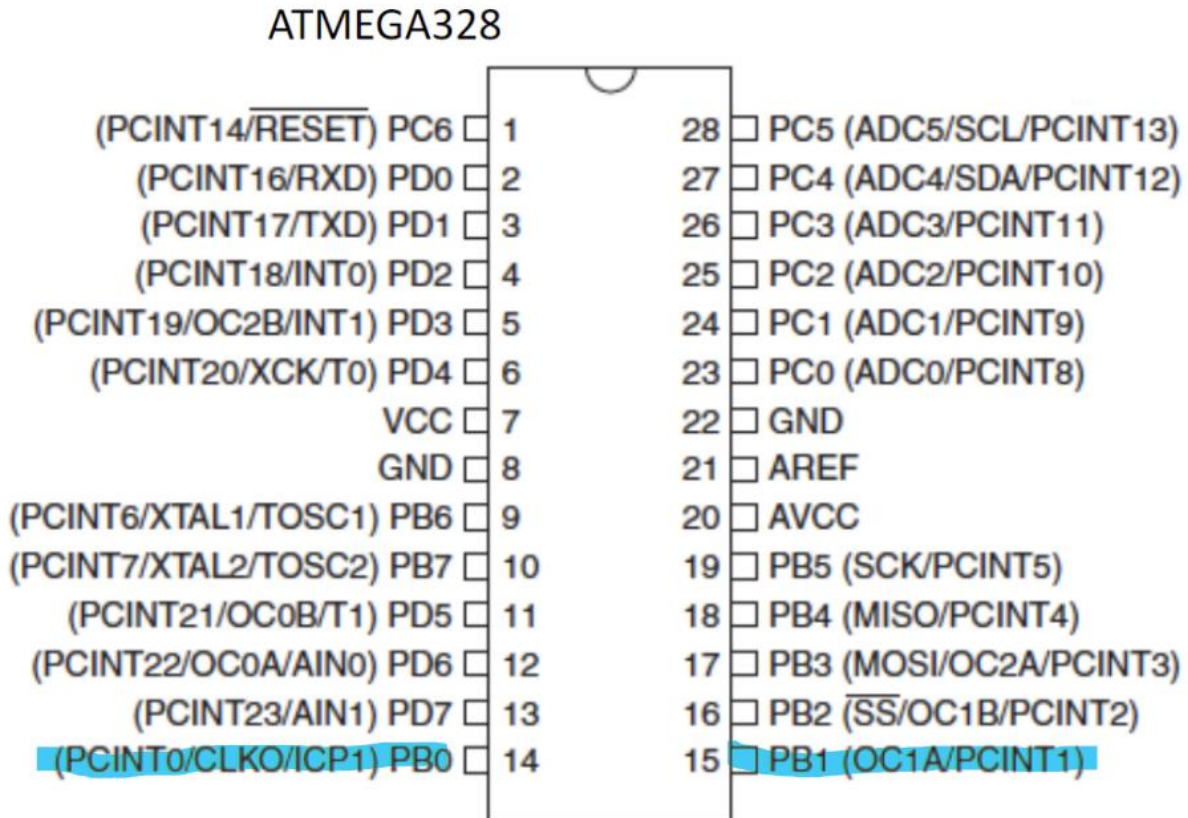
[https://github.com/DylanCaz/Submission\\_DA/tree/main/Design\\_Assignments\\_sub/DA\\_4\\_sub](https://github.com/DylanCaz/Submission_DA/tree/main/Design_Assignments_sub/DA_4_sub)

Submit the following for all Labs:

1. In the document, for each task submit the modified or included code (only) with highlights and justifications of the modifications. Also, include the comments.
2. Use the previously create a Github repository with a random name (no CPE/301, Lastname, Firstname). Place all labs under the root folder ESD301/DA, sub-folder named LABXX, with one document and one video link file for each lab, place modified asm/c files named as LabXX-TYY.asm/c.
3. If multiple asm/c files or other libraries are used, create a folder LabXX-TYY and place these files inside the folder.
4. The folder should have a) Word document (see template), b) source code file(s) and other include files, c) text file with youtube video links (see template).

## 1. COMPONENTS LIST AND CONNECTION BLOCK DIAGRAM w/ PINS

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## 2. DEVELOPED MODIFIED CODE OF TASK 1/2/3

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```
#define F_CPU 16000000UL
#include <stdio.h>
#include <stdlib.h>
#include <avr/io.h>
#include <util/delay.h>
#include <avr/interrupt.h>
#include <string.h>

#define BAUDRATE 9600
#define UBBR_9600 103 // 16Mhz with .2% error
#define Trigger_pin PB1 // Trigger Pin
int TimerOverflow = 0;

void USART_init(unsigned int ubrr); //Function to initialize and configure USART
void USART_send(unsigned char data); // Function to send char to serial port
void USART_tx_string( char *stringPtr ); // Function to send string to serial port

int main()
{
    char string[10];
    long cnt;
```

```

double distance;

DDRB = (1 << 0) | (1 << 1); // PB0 and PB1 as an output
USART_init(UBRR_9600);

sei(); // Global Interrupt
TIMSK1 = (1 << TOIE1); // Enable Timer1 overflow interrupt
TCCR1A = 0; // Setting bits to zero for Normal operation
while(1)
{
    PORTB |= (1 << Trigger_pin); // setting PB1 to trigger pin on HC-SR04
    _delay_us(340);
    PORTB &= ~(1 << Trigger_pin); // Toggle pin off

    TCNT1 = 0;
    TCCR1B = (1 << ICES1) | (1 < CS10); // No prescaler, Input Capture Noise
Canceler High
    TIFR1 = (1 << ICF1); // Clear Input Capture flag,
    TIFR1 = (1 << TOV1); // Clear Timer Overflow flag

    while((TIFR1 & (1 << ICF1)) == 0); // Waiting for falling edge
    TCNT1 = 0; // Clear timer counter
    TCCR1B = (1 << CS10); // No prescaler, Input Capture Noise Canceler High
    TIFR1 = (1 << ICF1); // Clear Input Capture flag,
    TIFR1 = (1 << TOV1); // Clear Timer Overflow flag
    TimerOverflow = 0; // Clear Timer overflow count

    while((TIFR1 & (1 << ICF1)) == 0); // Waiting for falling edge
    cnt = ICR1 + (65535 * TimerOverflow); // take count

    distance = (double)cnt/933; // 16Mhz Timer Frequency, sound speed = 343ms

    dtostrf(distance, 2, 2, string); // Convert distance into string
    strcat(string, " cm ");
    USART_tx_string("Distance = ");
    USART_tx_string(string);
    USART_tx_string("\r\n");
    _delay_ms(1000); // Task 3 waiting for 1 second after each output read
}

}

//Function to initialize and configure USART
void USART_init(unsigned int ubrr)
{
    UBRR0H = (unsigned char)(ubrr>>8);
    UBRR0L = (unsigned char)ubrr;
    UCSR0B |= (1 << TXEN0) | (1 << RXEN0); // enable transmission and reception
    UCSR0B |= (1 << RXCIE0); // enable RX interrupt
    UCSR0C |= (1 << UCSZ01) | (1 << UCSZ00); // set frame formate to 8bits, no parity,
1
}
// Function to send char to serial port
void USART_send(unsigned char data)
{
    while (!(UCSR0A & (1 <<UDRE0)));
    UDR0 = data;
}

```

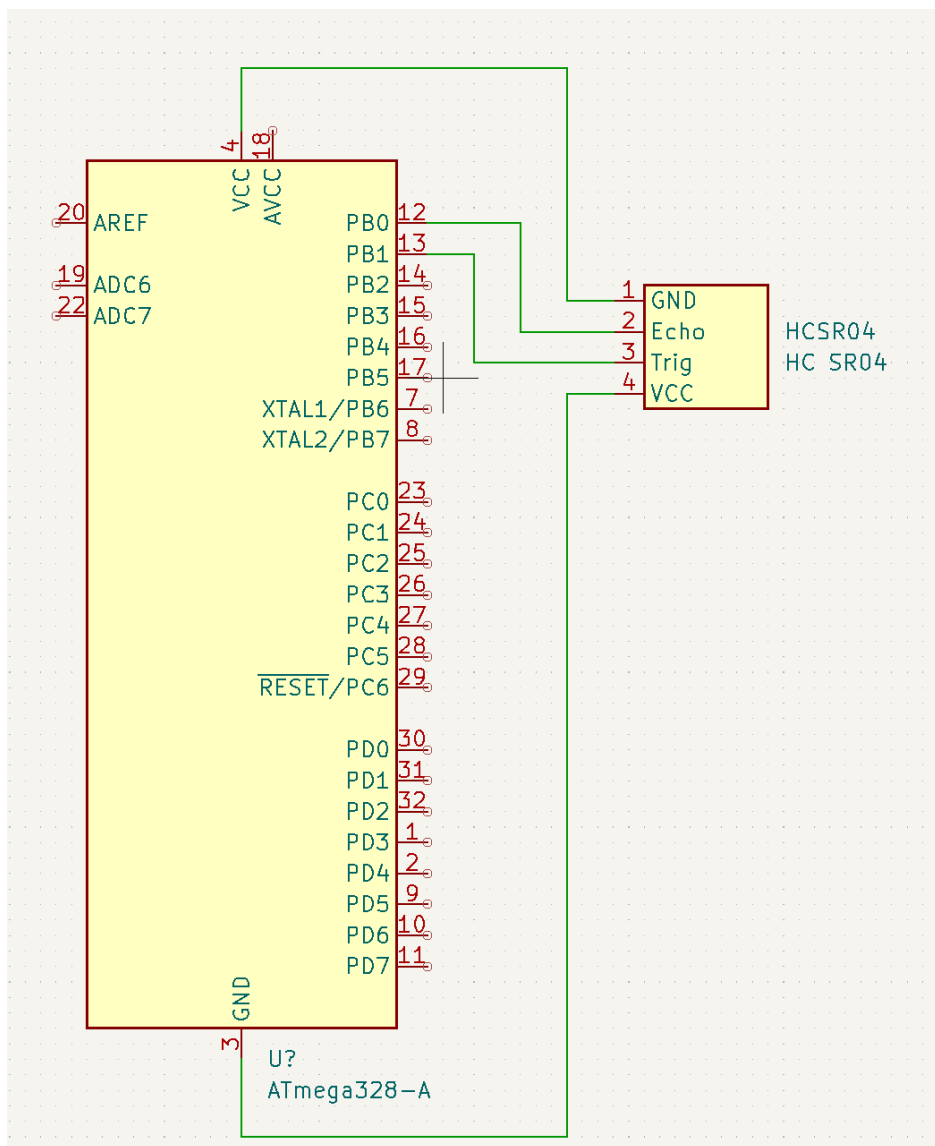
```

// Function to send string to serial port
void USART_tx_string(char* stringPtr)
{
    while ((*stringPtr != 0x00))
    {
        USART_send(*stringPtr);
        stringPtr++;
    }
}

ISR(TIMER1_OVF_vect)
{
    TimerOverflow++; // Increment timer overflow count
}

```

### 3. SCHEMATICS



#### 4. SCREENSHOTS OF EACH TASK OUTPUT (ATMEL STUDIO OUTPUT)

##### Successful Build

```
----- Build started: Project: Design_Assignment_4, Configuration: Debug AVR -----
Build started.
Project "Design_Assignment_4.cproj" (default targets):
Target "PreBuildEvent" skipped, due to false condition; ('$(PreBuildEvent)' != '') was evaluated as ('' != '').
Target "CoreBuild" in file "C:\Program Files (x86)\Atmel\Studio\7.0\Vs\compiler.targets" from project "C:\Users\cazar\OneDrive\Documents\UMLV\UMLV 2021-2022\Spring 2022\CPE 301\Lecture\Design Assignments\DA4\Design_Assignment_4\Design_Assignment_4\De
Task "RunCompilerTask"
    Shell Utils Path C:\Program Files (x86)\Atmel\Studio\7.0\shellutils
    C:\Program Files (x86)\Atmel\Studio\7.0\shellutils\make.exe all --jobs 20 --output-sync
    make: Nothing to be done for 'all'.
    Done executing task "RunCompilerTask".
Task "RunOutputFileVerifyTask"
    Program Memory Usage : 2686 bytes 0.2 % Full
    Data Memory Usage : 22 bytes 1.1 % Full
    warning: Memory Usage estimation may not be accurate if there are sections other than .text sections in ELF file
    Done executing task "RunOutputFileVerifyTask".
Done building target "CoreBuild" in project "Design_Assignment_4.cproj".
Target "PostBuildEvent" skipped, due to false condition; ('$(PostBuildEvent)' != '') was evaluated as ('' != '').
Target "Build" in file "C:\Program Files (x86)\Atmel\Studio\7.0\Vs\avr.common.targets" from project "C:\Users\cazar\OneDrive\Documents\UMLV\UMLV 2021-2022\Spring 2022\CPE 301\Lecture\Design Assignments\DA4\Design_Assignment_4\Design_Assignment_4\Des
Done building target "Build" in project "Design_Assignment_4.cproj".
Done building project "Design_Assignment_4.cproj".

Build succeeded.
===== Build: 1 succeeded or up-to-date, 0 failed, 0 skipped =====
```

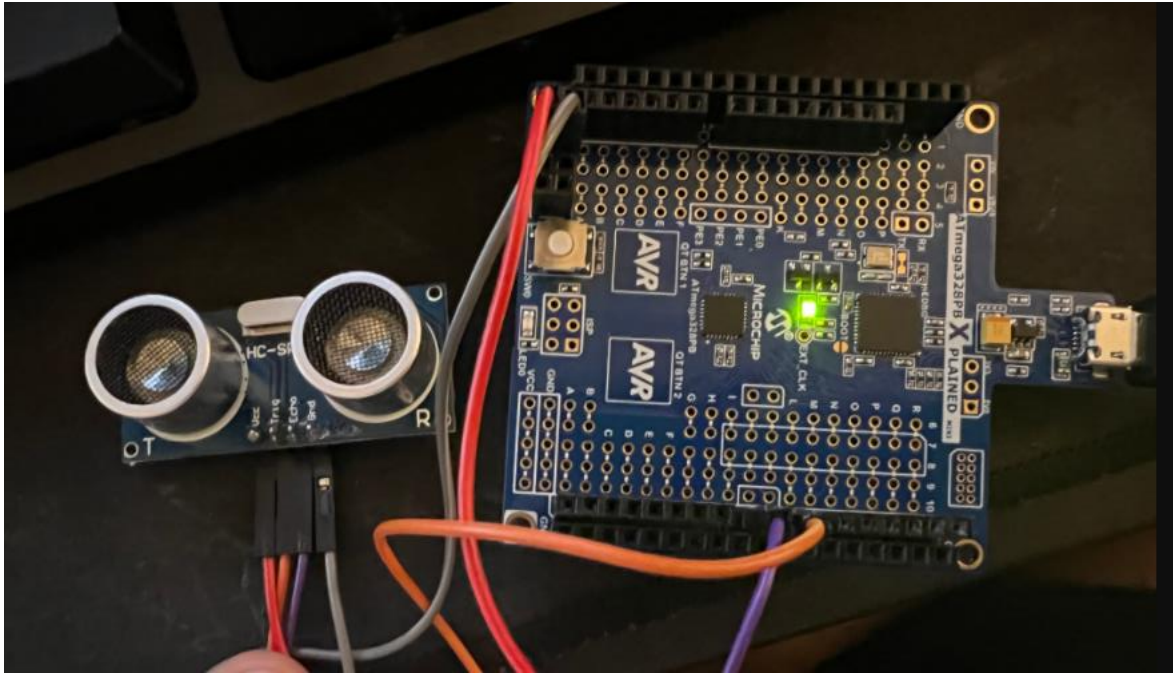
##### Terminal Window Output

```
Terminal 0
Distance = 69.72 cm
Distance = 59.54 cm
Distance = 10.08 cm
Distance = 12.46 cm
Distance = 55.65 cm
Distance = 36.76 cm
Distance = 20.24 cm
Distance = 20.65 cm
Distance = 20.48 cm
Distance = 20.01 cm
Distance = 20.83 cm
Distance = 21.18 cm
Distance = 19.84 cm
Distance = 20.76 cm
Distance = 21.05 cm
Distance = 21.07 cm
```

##### Logic Analyzer Output



**5. SCREENSHOT OF EACH DEMO (BOARD SETUP)**



**6. VIDEO LINKS OF EACH DEMO**

<https://youtu.be/6MvhiiGuJyE>

**7. GITHUB LINK OF THIS DA**

[https://github.com/DylanCaz/Submission\\_DA/tree/main/Design\\_Assignments\\_sub/DA\\_4\\_sub](https://github.com/DylanCaz/Submission_DA/tree/main/Design_Assignments_sub/DA_4_sub)

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*"This assignment submission is my own, original work".*

Dylan Cazares