

# PRINCIPLES AND APPLICATION OF MICROCONTROLLERS

## AVR C Lab7: DMS Distance Meter

### Introduction

In this lab, you are required to design and build a distance meter using an AVR ATmega328P microcontroller. The meter you are required to build will acquire distance using a DMS sensor. It will display the distance in centimeters of 2 decimals on two 7-segment LEDs continuously. The meter will also send the distance readings back to a personal computer. After completing this lab you should be able to:

- Master in AVR ADC programming
- Master in AVR serial programming
- Perform sensor calibration

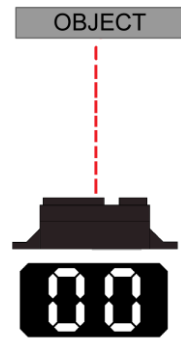


Figure 1: Distance meter

### Parts List

- A breadboard
- An AVR ATmega328P MCU
- Resistors
- Two 7-segment LEDs
- A GP2Y0A21YK DMS sensor
- A capacitor

### Distance Meter

A distance meter is used for accurately determining the distance of an object without contact the object. The distance measurement can be achieved using various approaches, including ultrasonic ranging module, laser rangefinder, radar distance measurement, and etc. In this lab, the distance measurement will be achieved using a Sharp GP2Y0A21YK DMS sensor.

### Procedure

Use the pins of Port C to read the DMS signals. Use PD1 as the TX to send the readings to a computer (Fig. 2). Use the rest of the pins of Port D as the output to a 7-segment LED. Use Port B as the output to the other 7-segment LED. Remember to calibrate the meter you build so that it gives the actual distances rather than the voltages of the DMS sensor.

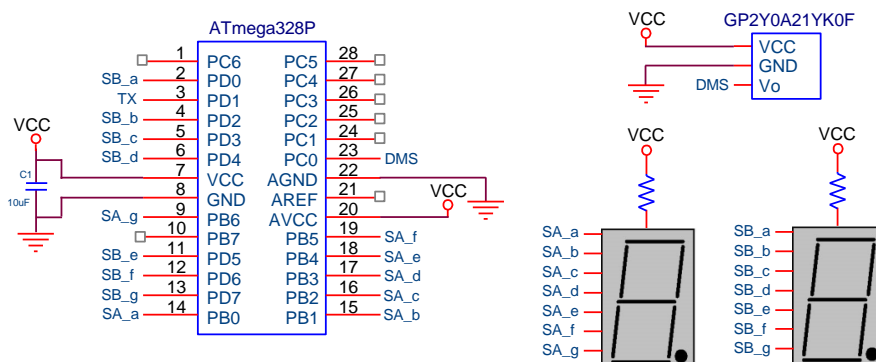


Figure 2: Circuit diagram of DMS distance meter

**Deliverables**Basic points (80%):

Complete the meter without the serial function.

Basic + advanced points (20%):

Complete the meter with the serial function.

Demo the result to the TAs, or record it in a video. Upload the followings to ceiba: 1) your C program source code, 2) a photo of your physical circuit, and 3) contributions from each teammate to the lab. The contributions must include the information of the tasks each teammate has done and the contributions in percentage. The total percentage should be 100%. All the teammates have to agree with the contributions before they are uploaded.

**Bonus**

You will obtain a 20% bonus if you equip the distance meter on a wheel robot. The robot displays the distance in head of it on the 7-segment while it is moving.