

# Distance measurer on Atmega 8535

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## Аннотация

In this work we present measuring devices, based on AVR Atmega 8535 microcontroller. It uses 2 HC-SR04 ultrasonic modules, which allow to calculate and compare distance.

## 1 Introduction

It's an educational project referred to Microcontroller courses in MIPT at 2nd grade.  
Research supervisor: candidate of technical sciences Donovan Gennady Innokentievich.

## 2 Project scheme

The scheme of the Measuring device (MD) is as follows:

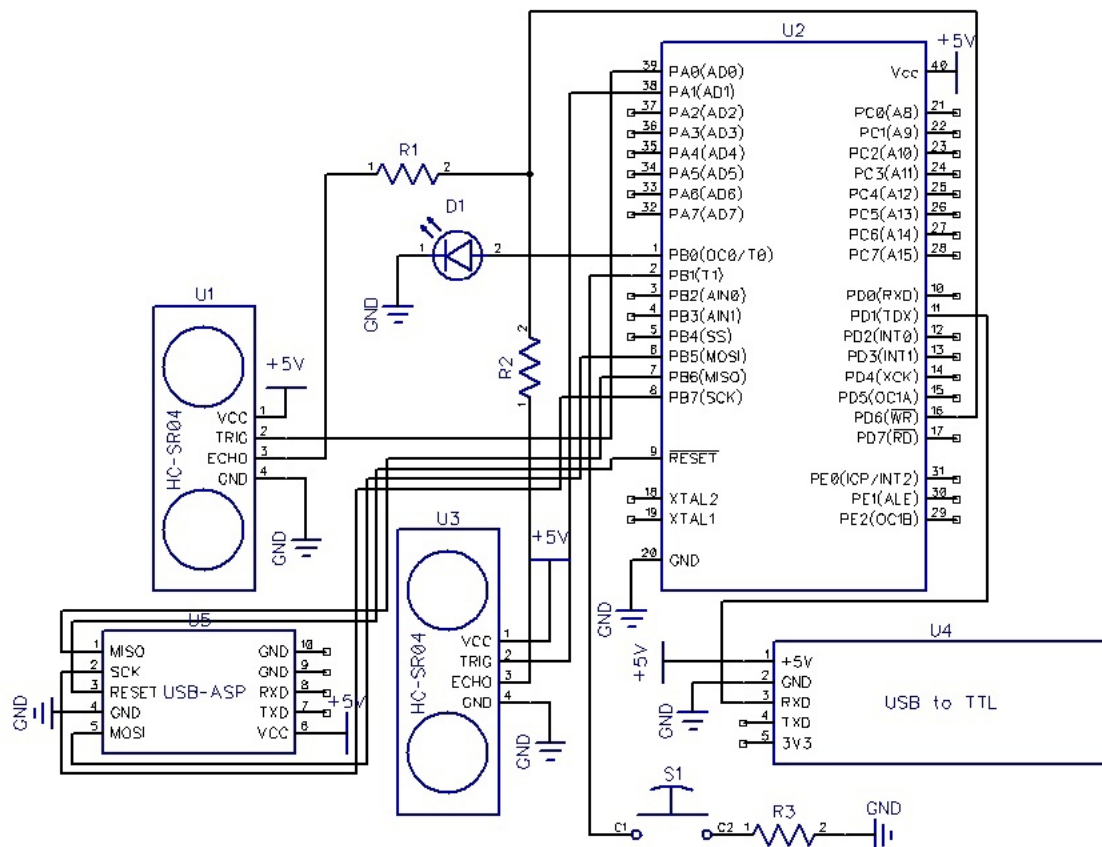


Рис. 1: MD Scheme

It consists of 3 main parts:

1. Atmega 8535 - Microcontroller unit - will be called MC

2. Two HC-SR04 modules - ultrasonic waves detector - UWD
3. USB-ASP - flash driver - allows to program MU - ASP
4. USB TO TTL - flash driver - was used to transmit information from MC to PC - TTL

### 3 HC-SR04 description

The transmitter emits a 8 bursts of an directional  $40KHz$  ultrasonic wave when triggered and starts a timer. Ultrasonic pulses travel outward until they encounter an object, The object causes the the wave to be reflected back towards the unit. The ultrasonic receiver would detect the reflected wave and stop the stop timer. The velocity of the ultrasonic burst is  $340m/sec.$  in air. Based on the number of counts by the timer, the distance can be calculated between the object and transmitter.

The formula is expressed as:  $D = C \cdot T$  which is know as the time/rate/distance measurement formula where  $D$  is the measured distance, and  $R$  is the propagation velocity (Rate) in air (speed of sound) and  $T$  represents time. In this application  $T$  is devided by 2 as  $T$  is double the time value from transmitter to object back to receiver.



Рис. 2: HC-SR04 views

	Pin Symbol	Pin Function Description
1	VCC	5V power supply
2	Trig	Trigger Input pin
3	Echo	Receiver Output pin
4	GND	Power ground

### 4 Using of HC-SR04

Our aim was to create enough pulse in the (UWD).

Then we had to measure time using inner TIMER 1 (PD6).

In our experiment we connected 2 devices in order to compare distances. Conflict of Echo was solved using diodes (or resistances). Therefore we used 2 devices at the same time.

We translate information from MC to PC using TTL. Our Information transfer protocol was UART.

### 5 How to use?

1. Get main parts, such as AtMega 8535, USBASP, USB TO TTL, indicators HC-SR04.
2. **Assemble the installation** according to scheme above.

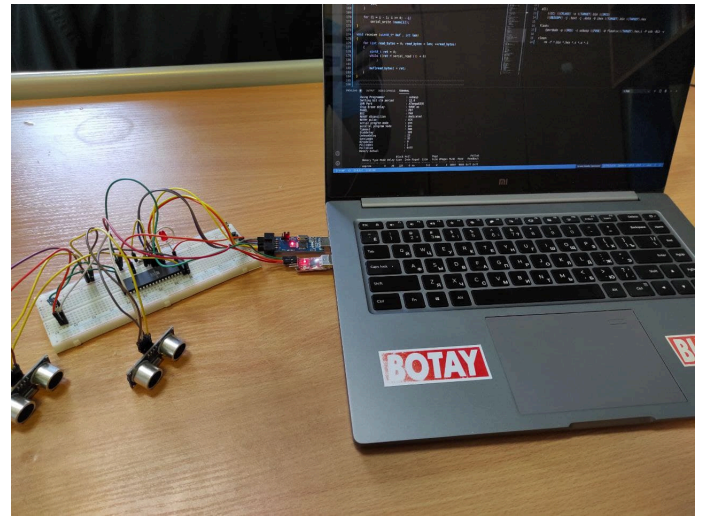
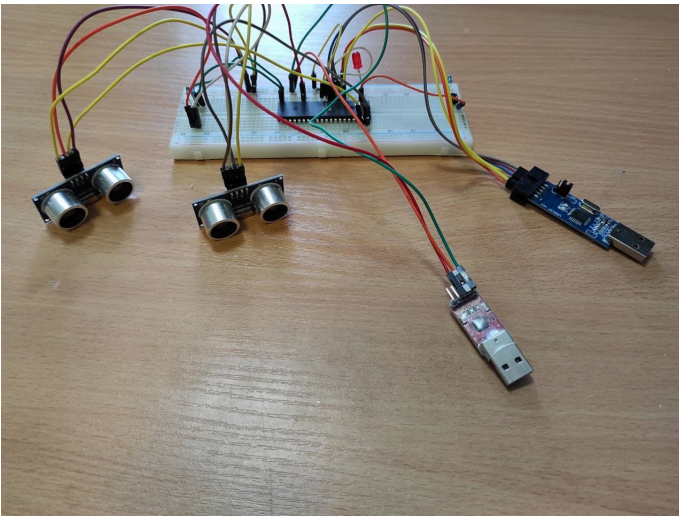


Рис. 3: Our layout board

3. **Clone** this repository: <https://github.com/MarkGoncharovAI/MicroController.com>
4. Open the terminal inside downloaded folder
5. Install **AVR-instruments**.
6. **Compile** file: "make"
7. **Program your MC**: "make flash"
8. Check results in mm using graphical serial terminal. For example, we used cutecom: "sudo apt install cutecom".