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## The Ultrasound Applications Based on Microcontroller Board

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**Abstract** The ultrasound sensor has ability to get accurate data of distance for target. Its applications are covered very widely such as in vehicle electronics, consumer electronics, etc. due to the robust sense abilities of measurement of distance. In this paper, it is used to get data from target and these data are shown in window and screen. The experiment results show that it possesses good performance.

**Keywords** Microcontroller, ultrasound, sensor

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### Introduction

Many ultrasound sensors can let us to monitor the distance between our position and target based on the Android operation system (OS) [1-3]. Recently, the Android OS has become a popular platform for mobile phone. Motion sensor such as ultrasound is useful for monitoring distance data. The development of MEMS (micro-electromechanical system) ultrasound is by using the concept of sound reflections. The distance can be calculated by the velocity of sound and reflection time. Analog Devices ultrasound has ability to sense and measure the distance of an object under complex and severe operating conditions. The Microcontroller introduced in 2005 is a free used software and hardware tool such that all designers can develop their products. It is very easy to learn and connect to other devices and sensors. Now it has also become a popular test platform to learn, design and develop any applications [4, 5].

In this paper, the ultrasound based Microcontroller Test Platform is used to get data then show them in window and LCD screen by means of Microcontroller based on Arduino 2560 board manufactured by *DMATEK Ltd, Taiwan* [6]. The experimental results show the good performances are possessed.

### The Microcontroller and Ultrasound Concept

The microcontroller environment is a free software of integrated development environment (IDE). The free microcontroller software IDE is an easy use software such as that it can be wrote with machine code and upload to the mother board easily. The programs are written by C and Java language and it is based on other processing software. This software can be combined with any microcontroller board. After the software is installed in personal computer successfully, then any applications can be developed by connecting any sensors. In this paper, the microcontroller ADK is used by combining ultrasound sensor. The microcontroller board is based on the ATmega2560. It is based on the MAX3421e IC to has a USB host interface to connect with Android type phones and has 54 DIO(digital input/output) pins, 4 hardware serial ports, one 16 MHz crystal oscillator, one USB connection, power jack, an ICSP header, and a reset button. The ADK flash memory has 256 KB for storing code of which 8 KB is used for the bootloader, 8 KB of SRAM and 4 KB of EEPROM [6].

The programming for ultrasound can be used by the libraries supported by Microcontroller. At first, the ultrasound board should be connected with ADK, then select board type and COM port number. There are three steps should be done. First is compiling, 2<sup>nd</sup> is to upload the machine code to ADK, finally is to open serial window to monitor data of distance. For program diagram is shown in Fig. 1. The data of ultrasound can be shown in window and LCD. The ultrasound diagram is shown in Fig. 2.



```
    ult.init();  
    Serial.begin(9600);  
    Serial.println("Starting up");  
}  
|  
|  
void loop()  
{  
    distance = ult.getDistance();  
    if((distance < 1000) && (distance > 2))  
    {  
        Serial.print("Distance:");  
        Serial.print(distance);  
        Serial.println("cm");  
    }  
}
```

Figure 1: The diagram of Microcontroller program for ultrasound window

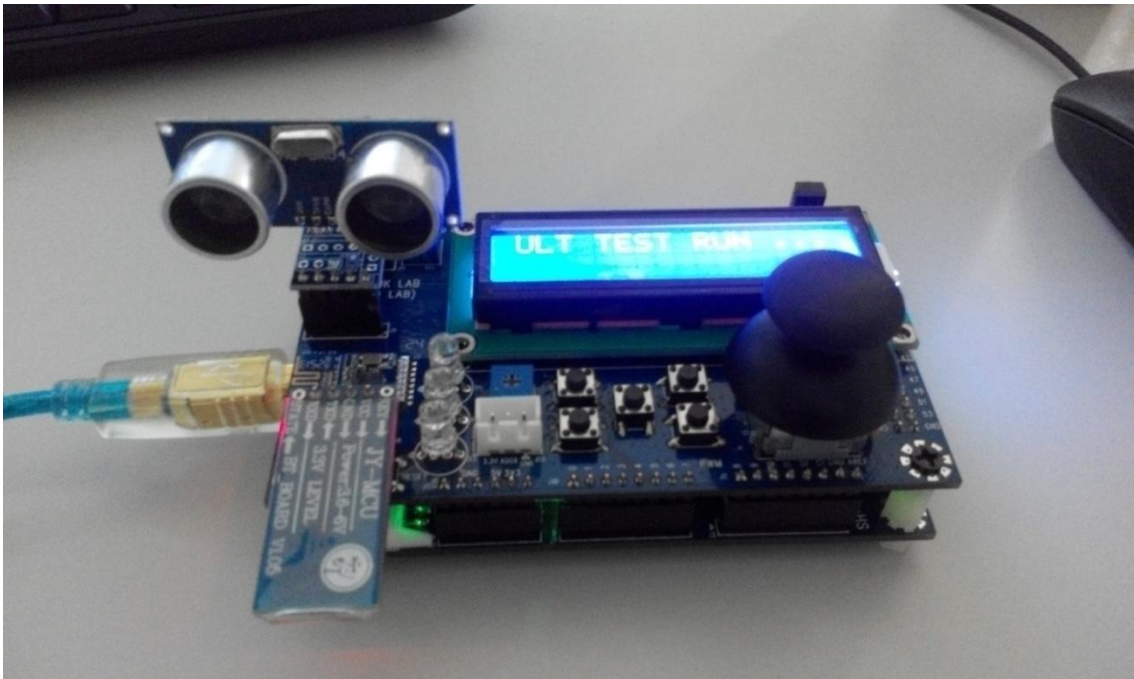


Figure 2: The diagram of ultrasound test platform

### Experimental Results

In this section, the ultrasound board must be connected with motherboard at first. After connection is successful, the Microcontroller ADK will run the program. The initial setup ultrasound is successful if the red light of ultrasound board is on such as the diagram shown in Fig. 2. Then the data which unit is cm of ultrasound will be transferred to PC's window by using serial port such as in Fig. 3. Meanwhile, the data will be shown in LCD of motherboard which is shown in Fig. 4. In Fig. 3, The value is implied the distance. The same conditions are also shown in Fig. 4.

In this paper, the Microcontroller, ultrasound module is used to test and teach students to learn basic theoretical and implemental applications of ultrasound. From this topic of course of ultrasound control for Microcontroller board, good experimental results are got in this paper.



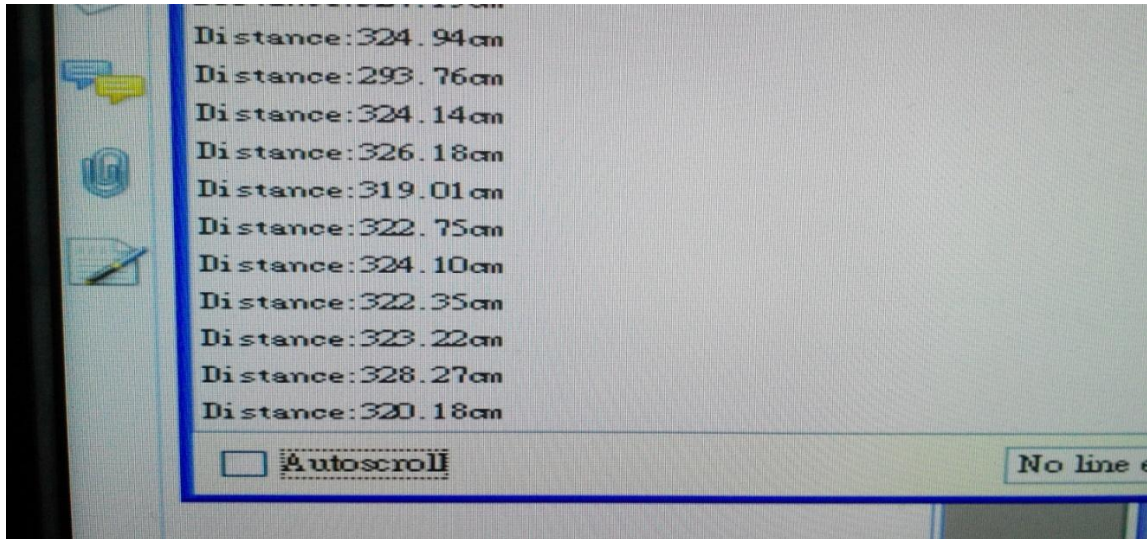


Figure 3: The PC's window shows the data transferred from ultrasound



Figure 4: The ultrasound data are shown in mobile phone

**Conclusion**

In this paper, the ultrasound control for Microcontroller board has been developed successfully. This is verified by the motherboard and ultrasound module. The development of ultrasound control application can be used to develop other different useful applications such as robotic, consumer electronics and vehicle electronics, etc. The experimental results demonstrate that good performances are achieved.

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