Position measurement and control of a Piezoresistive Contactless position sensor through Ethernet

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Abstract

A position control mechanism for contactless position measurement has been proposed through Ethernet. The distance values are displayed on the controlling end and based on the position the object can be made to move towards or away from the sensor by issuing a command. A servomotor assembly is used for the controlling action at the host end. The servomotor is controlled by a microcontroller based arduino uno board. The motor in turn controls the position of the object whose position is to be detected.

Index Terms—Piezoresistance, servomotor, arduino uno, microcontroller, Ethernet.

1. Introduction

A contactless position measurement system was proposed based on piezoresistance in [1].A control mechanism for the same has also been proposed in [2]. This paper presents a mechanism to read the sensor remotely through Ethernet and also to control the position of the object. An arduino Ethernet shield has been used along with the arduino board for connecting the sensor to Ethernet.

The research was carried out in KLESSCET, Belgaum during February – June 2013.

2. Design and implementation

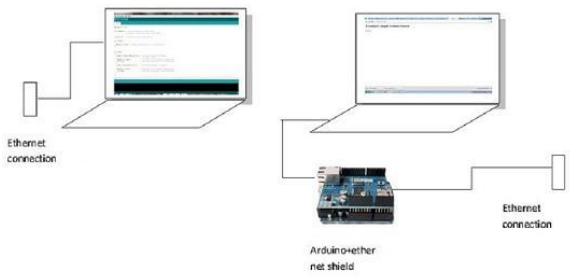

Fig1. Block diagram to read the sensor remotely.

The general block diagram to read the sensor remotely is shown in fig 1. The sensor along with the external hardware setup(not shown in the diagram) is connected to arduino uno. Arduino uno is meshed with an Ethernet shield which connects the board to Ethernet thereby connecting the sensor to Ethernet. Another system which is connected to the same router as that of the Ethernet shield is used to read the sensor. If the latter ystem is connected to different router than the shield then port forwarding is necessary.

2. To read the IP address

In order that the remote computer must be able to read the sensor through Ethernet , it is necessary to get the IP and MAC addresses for the arduino uno and Ethernet shield assembly. These addresses are unique for a given shield. The MAC address will be provided by the manufacturer along with the device during purchase. In IP address can be obtained through DHCP by executing the program through arduino IDE. This sketch uses the DHCP extensions to the Ethernet library to get an IP address via DHCP and print the address obtained using an Arduino Wiznet Ethernet shield.the IP address displayed on the command window is shown in fig 2.

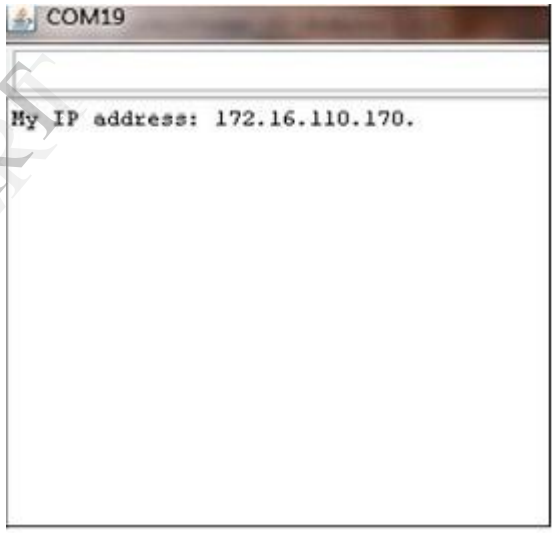

Fig 2: The Ip displayed on the command window.

The IP and MAC addresses for our board combinations are:
MAC id : 0x90,0xA2,0xDA,0x0E,0x03,0x76
IP address: 172,16,110,170.

Thus by using this IP address the sensor can be read anywhere through a remote computer through the arduino Ethernet shield.

3. Experimental Setup

The experimental setup to read the sensor remotely through another computer connect the Ethernet through same router is shown in fig 3. Once the IP address has been obtained, Arduino uno is then configured as a web server. In order to access the sensor through a latter system the link containing the IP address and the output port of the arduino should be given as
"http:\\ 172.16.110.170: 8081"

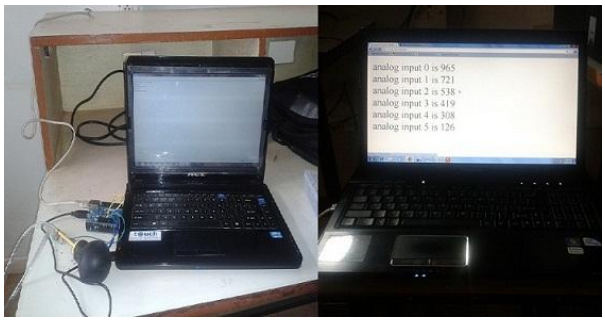

Fig 3 : the experimental setup to read the sensor remotely.

A webpage displaying the analog values of the analog ports of the microcontroller ATmega will be displayed. Since we have connected the sensor to analog port 2 only the values on that port are significant. Other values will be random and are not considered.

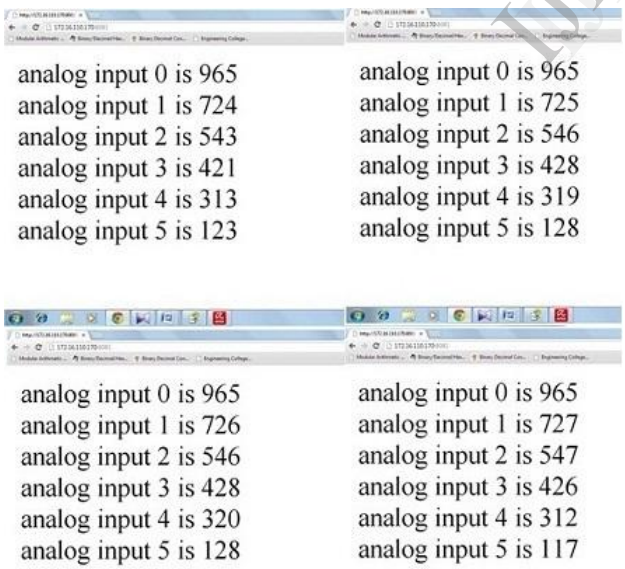

Fig 4: Web page displaying the sensor values read on a remote computer

Fig 5: The report on the command window indicating the connection of the Ethernet shield to the server

Fig 5 shows the status that client is connected/disconnected and remaining details pertaining to the connection.

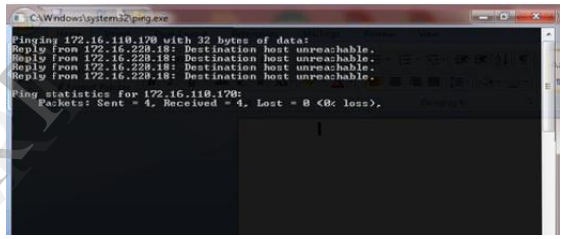

Fig 6: Snapshot of terminal window displaying number of data packets sent and received

Fig 6 shows the data transferred and received status for a network connection on the command prompt terminal. It can be seen the communication is successful and the loss is 0%.

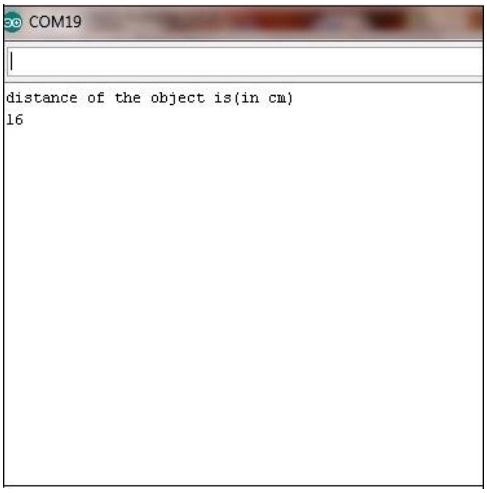

Fig 7: Display of the position of the object

Finally the position value is displayed as shown in fig 7.

Now that the sensor is successfully read through a remote computer, the position of the object can be controlled by issuing a command to the servomotor through Ethernet.

Fig 8: Webpage for the servomotor control.

The webpage for the control of servomotor appears as shown in fig 8. Two options are provided as ON and OFF. Upon asserting the on command, the servomotor starts to rotate in and the object will be moved away from the sensor. Similarly on asserting the off command the servomotor stops thus positioning the object to a new desired position. The sensor values will be read again periodically with a certain delay. The procedure can be repeated until the desired position is obtained.

Conclusion and future work

A procedure for reading the position of a magnet remotely through Ethernet is provided along with a control mechanism using servomotor assembly. The positioning can be achieved with suitable accuracy.

Work can be further carried out to increase the positioning range of the object ant to control the servomotor precisely

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10. References

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