### CSE423: Embedded System Summer-2020 Access data remotely

DIUCSE



# **Today's Lecture**



- What is Ethernet Shield
- How Ethernet works?
- How to setup local server
- How to access data remotely via internet



We will introduce and examine the use of Ethernet networking with Arduino over local networks and the greater Internet.

Pre-requisite:

- Basic understanding of computer networking
- Basic knowledge on IP and MAC address



Required hardware:

- □ Arduino UNO
- □ Ethernet Shield (W5100 Ethernet controller IC)
- External 9V 1.5A adapter
- Ethernet Cable with RJ45 connector





### Steps to be followed:

- Open the Arduino IDE and select File > Examples > Ethernet > Webserver. This loads a simple sketch which will display data gathered from the analogue inputs on a web browser. However don't upload it yet, it needs a slight modification.
- You need to specify the IP address of the Ethernet shield which is done inside the sketch. This is simple, go to the line:

```
IPAddress ip(192,168,1, 177);
```

And alter it to match your own setup based on your router's IP assign range.



If you are running more than one Ethernet shield on your network, ensure they have different MAC addresses by altering the hexadecimal values in the line:

byte mac[] = { 0xDE, 0xAD, 0xBE, 0xEF, 0xFE, 0xED };

Once you have made your alterations, save and upload the sketch. Now open a web browser and navigate to the IP address you entered in the sketch, and you should be presented with something similar to the following:





# If some value appears in your web browser which means it is working!

# Working with Ethernet Shield



### Let's examine few things again:

<b></b>	WebServer	Arduino 1.8.5			—	ш	×
File	Edit Sketch	Tools Help					
	New Open Open Recent Sketchbook	Ctrl+N Ctrl+O					
	Examples	>					
	Close Save Save As	Ctrl+W Ctrl+S Ctrl+Shift+S	Built-in Examples 01.Basics 02.Digital 03.Analog	>	le of the analog input pins.		
	Page Setup Print	Ctrl+Shift+P Ctrl+P	04.Communication 05.Control	>	d.		
	Preferences	Ctrl+Comma	06.Sensors	>			
	Quit	Ctrl+Q	08.Strings	>	11, 12, 13		
* Analog inputs			09.USB 10.StarterKit_BasicKit 11.ArduinoISP	> > >	rough A5 (optional)		
k n k	oy David Nodified Dy Tom I	d A. Mell d 9 Apr 2 Igoe	Examples for any board Adafruit Circuit Playground Bridge Esplora	> > >			
n	nodified	l 02 Sept	Ethernet	>	AdvancedChatServer		
k	y Artur	co Guadal	Firmata GSM LiquidCrystal	~ ~ ~	BarometricPressureWebServer ChatServer DhcpAddressPrinter		~
			Robot Motor	>	TelnetClient	_	-
			SD	>	UdpNtpClient		
			Servo SpacebrewYun Stepper Temboo	>	udpntpclient_pedantic UDPSendReceiveString WebClient WebClientRepeating		
			RETIRED	>	WebServer		



If we scroll though the code we will be finding the following sections:

for (int analogChannel = 0; analogChannel < 6; analogChannel++)</pre>

```
{ int sensorReading = analogRead(analogChannel);
client.print("analog input ");
client.print(analogChannel);
client.print(" is ");
client.print(sensorReading);
client.println("<br />");
}
client.println("</html>");
break;
```



### □ client.print ();

Allows us to send text or data back to the web page. It works in the same way as serial.print(), so nothing new there.

### client.println("<br />");

It sends the HTML code back to the web browser telling it to start a new line. The part that actually causes the carriage return/new line is the <br /> which is an HTML code (or "tag") for a new line.

Working with Ethernet Shield



# How to access data remotely ?

## Accessing remotely via Ethernet Shield



### **Requirements:**

# □ You will need a static IP address provided by your ISP. $\leftarrow \rightarrow \circlearrowright$ ⓐ 192.168.1.254/index.html#/gui/wan/home

<b>II\€O FiberGateway</b> GR241AG	A Home	Security	📽 Services	🗙 Tools 🛛 🛔 My	account
🛋 FGW Fiber Gateway	🚳 WAN	V Wide Area Netwo	ork		
Software version 3RGW040800r Serial Number 5054494E9133	02A Characte	ristics Statistics			
MAC address     00:06:91:33:7c       Uptime     6d 2h 5m 30s	:5f	eral info			
LAN Local Area Network				Interfa	ce veip0.1
Port status 🛛 🔍 🔍 🔍				Service nan	ne internet.12
Default gateway 192.168.1.254 DHCP on				Internet connectio	on 🔍 on
🚱 WAN Wide Area Network	1			Service typ	e IPoE
Port status:				Firewa	all 🔍 on
RX CATV power -1.820 dBm RX optical power -22.518 dBm				IP addre	ss 85.240.52.177
TX optical power 2.432 dBm				Default gatewa	ay 85.240.52.1



□ The next thing to do is **turn on** port-forwarding. This tells the router where to redirect incoming requests from the outside world. When the modem receives such a request, we want to send that request to the port number of our Ethernet shield using the following command:

EthernetServer server(125); where "125" is port number

# Working with Ethernet Shield



### □ Port-forwarding:

#### Port Forwarding

You can configure the router as a virtual server so that remote users accessing services such as the Web or FTP at your local site via public IP addresses can be automatically redirected to local servers configured with private IP addresses. In other words, depending on the requested service (TCP/UDP port number), the VoIP Router redirects the external service request to the appropriate server (located at another internal IP address). This tool can support both port ranges, multiple ports, and combinations of the two.

For example:

- Port Ranges: ex. 100-150
- Multiple Ports: ex. 25,110,80
- Combination: ex. 25-100,80

No.	LAN IP Address	Protocol Type	LAN Port	Public Port	Enable		
1	10.1.1. 77	TCP&UDP 💌	125	125		Add	Clean



Once we are done port forwarding, we can access the remotely by adding the Port Number with the Static IP to access our data remotely.





### What about sending a message to Twitter???

