COLEGIO TECNOLOGICO DEL SUR
GRUPAL PROJECT WEATHER STATION "ESTEM"

SPECIFIC REPORT OF MATIAS SERINO MARIN: INFORMATICS PART, ETHERNET CONNECTION.

1.Introduction to general project:

'Estem' is a weather station made by the last-year of the secondary school "Colegio Tecnológico del Sur" with the supervision of the Engineer Horacio Arnaldi.

It can measure weather variables: Air Quality, Wind Speed, Humidity, Temperature, Atmospheric Pressure, millimeters of rain, and Ultraviolet Radiation.

The objective is to show actual and historical weather data, into a web page designed by graphics.

Complete project can be found at: https://github.com/sxtoE/estem and the server part at: https://github.com/sxtoE/climacts .

2.Specific Informatics & Ethernet connection:

As the objective is to show data into a web page, is necessary send that data from Arduino Microcontroller and receive it at the web-server.

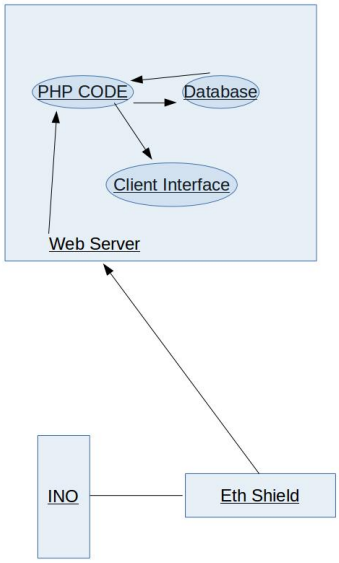
That is not all, because it's also needed to have the measures that has been taken before. Allowing that, a database is running at the web server, saving all measures taken at the past.

There is an ethernet shield, enabling the data to flow to the server, using GET method, inserting variables into the URL and making requests. The next code is used to do that:

```
        /*
 * Conexión hardware:
 * Arduino mega | Ethernet shield
 * pin 50  | so
 * pin 51  | st
 * pin 52  | sck
 * pin 53  | cs
 *
 *
 */
#include <UIPEthernet.h> // Used for Ethernet
byte mac[] = { 0x54, 0x34, 0x41, 0x30, 0x30, 0x31 };  //Mac address del ethernet shield
EthernetClient client;      //Iniciamos como cliente
char server[] = "192.168.40.2"; // Ip address del servidor
int t_espera = 1000;      //Tiempo de espera entre envio de datos
float v_temperatura = 0, v_humedad = 0, v_presion = 0, v_uv = 0, v_viento = 0, v_lluvia = 0, v_dioxido = 0, v_monoxido = 0,
v_amoniaco = 0;
void setup() {
  Serial.begin(9600); //iniciar si o si arriba de inicializarEthernetShield();
  inicializarEthernetShield(); //Función que inicializa la placa.
}
void loop() {
  enviarDatos(v_temperatura, v_humedad, v_presion, v_uv, v_viento, v_lluvia, v_dioxido, v_monoxido, v_amoniaco); //Función que envía
los datos al servidor
  delay(t_espera); //Tiempo que esperaremos entre cada send de data al server
}
void enviarDatos(float vi_temperatura, float vi_humedad, float vi_presion, float vi_uv, float vi_viento, float vi_lluvia, float
vi_dioxido, float vi_monoxido, float vi_amoniaco) {
  // if you get a connection, report back via serial:
  if (client.connect(server, 80)) {//Fixme: Cambiar este puerto por el usado.
    Serial.println("-> Connected");
    // Make a HTTP request:
    client.print( "GET /eth/index.php?");
    client.print("temperatura=");
    client.print(vi_temperatura);
    client.print("&&");
    client.print("humedad=");
    client.print(vi_humedad);
    client.print("&&");
    client.print("presion=");
    client.print(vi_presion);
    client.print("&&");
    client.print("uv=");
    client.print(vi_uv);
```

```
    client.print("&&");
    client.print("viento=");
    client.print(vi_viento);
    client.print("&&");
    client.print("lluvia=");
    client.print(vi_lluvia);
    client.print("&&");
    client.print("dioxido=");
    client.print(vi_dioxido);
    client.print("&&");
    client.print("monoxido=");
    client.print(vi_monoxido);
    client.print("&&");
    client.print("amoniaco=");
    client.print(vi_amoniaco);
    client.println( " HTTP/1.1");
    client.print( "Host: " );
    client.println(server);
    client.println( "Connection: close" );
    client.println();
    client.println();
    client.stop();
    t_espera = 1000;
  }
  else {
    // you didn't get a connection to the server:
    Serial.println("--> connection failed/n");
    t_espera = 1;
  }
}
void inicializarEthernetShield() {
  Ethernet.begin(mac);
  Serial.println("Estacion Meteorologica");
  Serial.println("-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-\n");
  Serial.print("IP Address        : ");
  Serial.println(Ethernet.localIP());
  Serial.print("Subnet Mask       : ");
  Serial.println(Ethernet.subnetMask());
  Serial.print("Default Gateway IP: ");
  Serial.println(Ethernet.gatewayIP());
  Serial.print("DNS Server IP     : ");
  Serial.println(Ethernet.dnsServerIP());
}
```

The infrastructure used is represented by the diagram below:



2.1Details of technical parameters:

2.1.1: Arduino-Ethernet Shield Communication:

→ Interface SPI (SERIAL PERIPHERIAL INTERFACE) using following connections:

Arduino Digital Input Output	Ethernet Card
DP 50	SO (miso)
DP 51	ST (mosi)
DP 52	SCK (clock)
DP 53	CS (slave select)

→ Ethernet shield powering wired VCC (5v) and GND from Arduino outputs to VCC and GND of Ethernet Shield.

→ Library to controle ethernet shield: UIPEthernet.h https://github.com/UIPEthernet/UIPEthernet

2.1.2: Ethernet-WebServer Communication:

→ Using TCP/IP protocol. Sending GET variables. Ethernet shield as a client of a web server running on open port 555.

→ URL format example:

```
serverIp/eth/index.php?
temperatura=4&&humedad=55&&presion=780&&uv=30&&lluvia=0&&dioxido=2&&monoxido=0.02&&amoniaco=0
```

→ Data packet one time each 5 minutes.

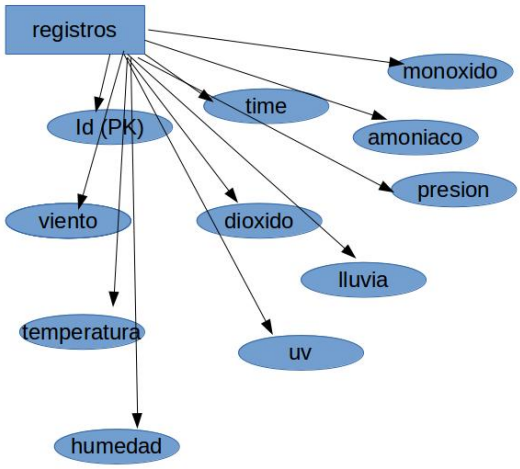
2.1.2.1: Server Receiving:

→ Using the next PHP code, to receive GET variables, make an insert into database:

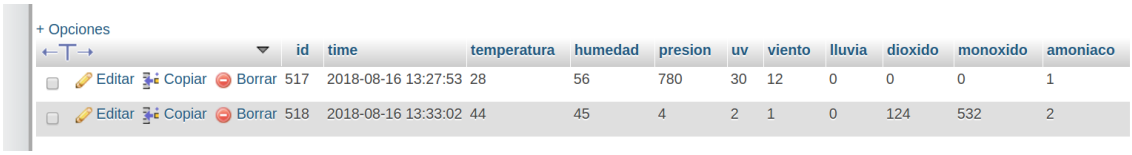
```
<?php
        $link = mysqli_connect("localhost","root","","estem");
        if((isset($_GET['temperatura'])) && (isset($_GET['humedad'])) && (isset($_GET['presion'])) && (isset($_GET['uv'])) && (isset($_GET['viento'])) && (isset($_GET['lluvia'])) && (isset($_GET['dioxido'])) && (isset($_GET['monoxido'])) && (isset($_GET['amoniaco'])) ){
                $temperatura = $_GET['temperatura'];
                $humedad = $_GET['humedad'];
                $presion = $_GET['presion'];
                $uv = $_GET['uv'];
                $viento = $_GET['viento'];
                $lluvia = $_GET['lluvia'];
                $dioxido = $_GET['dioxido'];
                $monoxido = $_GET['monoxido'];
                $amoniaco = $_GET['amoniaco'];
                $sql1 = "INSERT INTO registros (`temperatura`,`humedad`,`presion`,`uv`,`viento`,`lluvia`,`dioxido`,`monoxido`,`amoniaco`) VALUES ('$temperatura','$humedad','$presion','$uv','$viento','$lluvia','$dioxido','$monoxido','$amoniaco')";
                mysqli_query($link, $sql1);
        }
?>
```

2.1.3: Database:

→ Entity Atribute Relation DIAGRAM OF DATABASE:



→ Entity registries examples:



+ Opciones

	id	time	temperatura	humedad	presion	uv	viento	lluvia	dioxido	monoxido	amoniaco
Editar Copiar Borrar	517	2018-08-16 13:27:53	28	56	780	30	12	0	0	0	1
Editar Copiar Borrar	518	2018-08-16 13:33:02	44	45	4	2	1	0	124	532	2

→ Mysql database server configuration: Port 3306, only accessible at 127.0.0.1 ip at Apache server. (Only accessible by the server, not even at another computer at the same Local Area Network)

2.1.4: Client Interface:

→ Showing the actual variables refreshed one time each 5 minutes.

→ Showing historical data measures into dual-axis graphics.

2.1.5: Server hardware and software:

→ Windows 7 Ultimate 32 bits.
→ Xampp package (Apache-filezilla,mysql etc).
→ 50 GB HDD storage.
→ 2 GB RAM.
→ Dual-core intel processor 2 Ghz.
→ Ethernet connection at 100Mb/s.

2.1.6: Ip Configuration Functional Example:

- ROUTER AS GATEWAY AND DHCP SERVER: ip: 10.0.0.1 mask: 255.0.0.0
- ETHERNET SHIELD: ip: 10.0.6.4 mask: 255.0.0.0 gw: 10.0.0.1
- SERVER: ip: 10.0.6.5 mask: 255.0.0.0 gw: 10.0.0.1
- CLIENT: ip: 10.0.6.170 mask: 255.0.0.0 gw: 10.0.0.1

3. To conclude:

A weather station, managed by the School, is enabling people that goes to that school, to know how it's the weather over there. That is not the only advantage, applying some prediction-algorithms, the station could say how will be the weather tomorrow, and, based on that, send recommendations to the clients.

Colegio Tecnologico del Sur is located over an area where may will snow, causing class-cancellation. Preventing bad information, knowing real weather data, day-to-day life will increase the time well spent.

Total Project Credits:

Colegio Tecnologico del Sur,
Ing. Horacio Arnaldi,
Tobias Guevara,
Facundo Sagaria,
Selena Sacco,
Luciano Miranda,
Eluney Andrade,
Joaquin Ferrada,
Matias Serino Marin,
Jose Argañaraz,
Facundo Silvera;

This report was made by Matias Serino Marin, ethernet connection, data transmit to server responsible.

Matias Serino Marin August 2018.