OBJECTIVE:

- To introduce students with IOT technology.
- To get familiar with the basics of frontend and Backend technologies.
- To design simple UI and a web server using web sockets.

EQUIPMENTS:

- Computer with Nodejs installed
- 5cm x 5cm single layer PCB board

INTRODUCTION:

The Internet of Things has become a very widely spread concept in the last few years. The reason for this is mainly the need to computerize and control most of the surrounding objects and have access to data in real time. Think about parking sensors, about phones which can check the weather and so on.

The Internet of Things represents the whole way from collecting data, processing it, taking an action corresponding to the signification of this data to storing everything in the cloud. All this is made possible by the internet.

The IoT is involved in medicine, agriculture or transportation due to sensors and cloud storage.

BASIC CONCEPTS:

IoT Stack

A basic Internet of Things system consists of the following components:
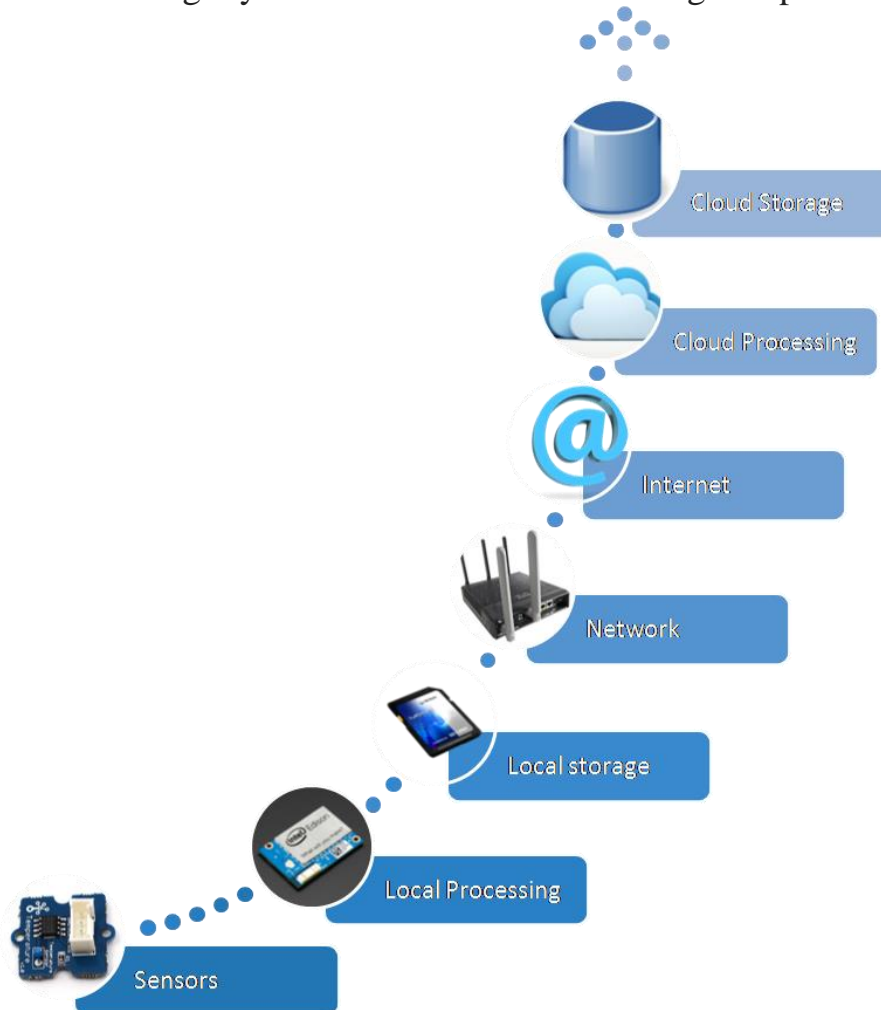
Sensors

They transform analog data given from scanning the environment to digital data, but they merely do any processing. On the bright side, they don't consume much power and can live on batteries for a long time. Sensors are present in everyday life more than you would expect. They improve industry, agriculture, homes, transportation or smart phones for example. They are tools which help monitoring the environment, collecting data about it and, with the help of computers, acting accordingly.

Local processing and storage devices

Local processing devices are the second level and third in IoT. At this point, data is locally stored and processed, ideally not sent forwards unless relevant. This part is explained in detail in the hardware section, as said devices are nothing more than microcontrollers and embeded boards, which handle the data they receive from the sensors.

Network and Internet

There is hardware which connects to the previously described devices, pulls out data and sends it to the cloud to be stored. There are 4 protocols used at this level: CoAP, MQTT (less secure and designed for machine to machine communication), HTTP (web protocol) and XMPP which functions as a chat.

Cloud

In the cloud, which comes next, data is collected and the main goal is for it to reach the point of making predictions based on the stored information. The cloud however, even though it represents one of the most useful features of the internet, is not used properly. Data sent to the cloud didn't reach the level of being formerly processed. Which means there is no preselected data. The cloud is constantly loaded with irrelevant information and thus losing it's property of being practical.

Web Design:
Front End Vs. Back End

The Front End is the stuff that you see and interact with: HTML, CSS , and JS
The Back End is everything else: so many choices!
Restaurant Analogy: The backend is everything that happens in the kitchen; the front end is what is plated and sent to your table

Front End [HTML, ~~CSS~~ , and JS]:
HTML Basics:

What is HTML?

HTML is the standard markup language for creating Web pages.

- HTML stands for Hyper Text Markup Language
- HTML describes the structure of Web pages using markup
- HTML elements are the building blocks of HTML pages
- HTML elements are represented by tags
- HTML tags label pieces of content such as "heading", "paragraph", "table", and so on
- Browsers do not display the HTML tags, but use them to render the content of the page

A Simple HTML Document

Example

```
<!DOCTYPE html>
<html>
<head>
<title>Page Title</title>
</head>
<body>

<h1>My First Heading</h1>
<p>My first paragraph.</p>

</body>
</html>
```

Example Explained

- The `<!DOCTYPE html>` declaration defines this document to be HTML5
- The `<html>` element is the root element of an HTML page
- The `<head>` element contains meta information about the document
- The `<title>` element specifies a title for the document
- The `<body>` element contains the visible page content
- The `<h1>` element defines a large heading
- The `<p>` element defines a paragraph

HTML Tags

HTML tags are element names surrounded by angle brackets:

<tagname>content goes here...</tagname>

- HTML tags normally come **in pairs** like `<p>` and `</p>`
- The first tag in a pair is the **start tag,** the second tag is the **end tag**
- The end tag is written like the start tag, but with a **forward slash** inserted before the tag name

Tip: The start tag is also called the **opening tag**, and the end tag the **closing tag**.

HTML tags are not case sensitive: <P> means the same as <p>.The HTML5 standard does not require lowercase tags, but W3C **recommends** lowercase in HTML
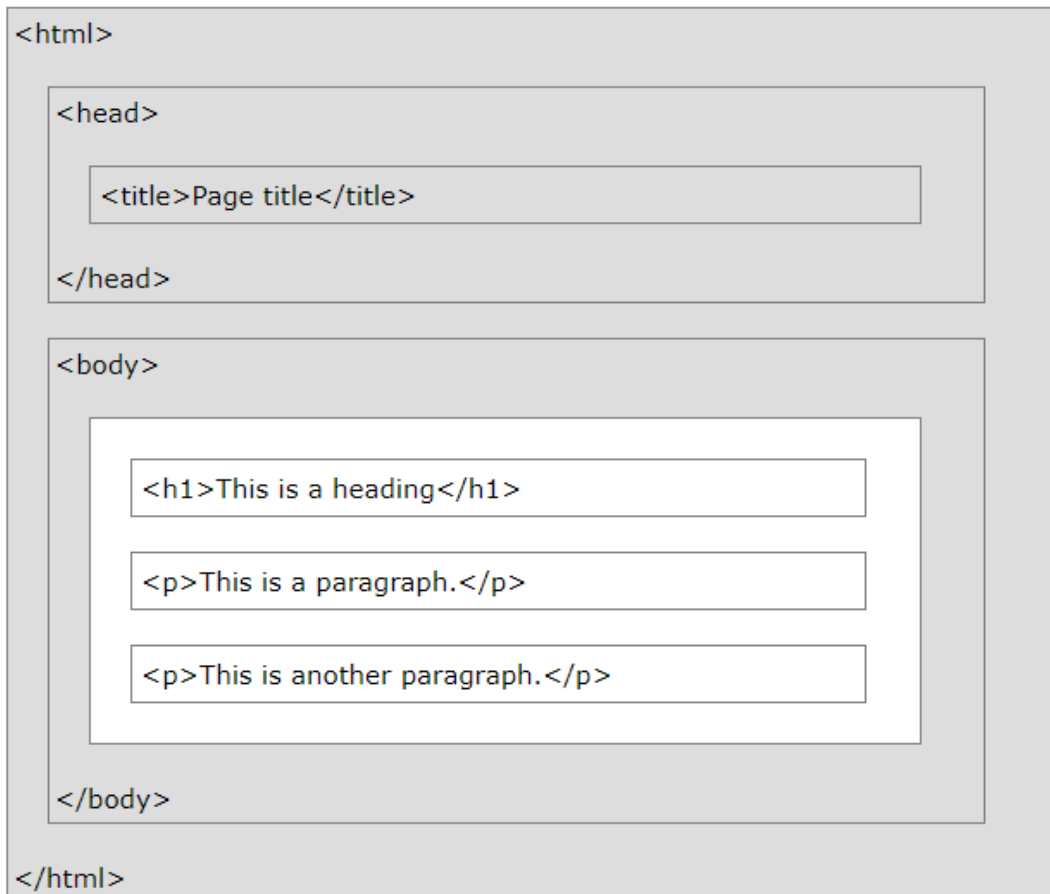
Web Browsers

The purpose of a web browser (Chrome, IE, Firefox, Safari) is to read HTML documents and display them.

The browser does not display the HTML tags, but uses them to determine how to display the document:
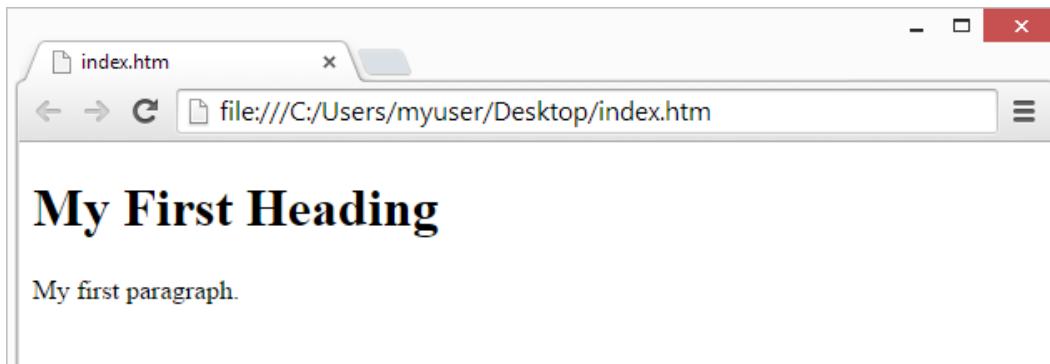
HTML Page Structure

Below is a visualization of an HTML page structure:

```
<html>

    <head>

        <title>Page title</title>

    </head>

    <body>

            <h1>This is a heading</h1>

            <p>This is a paragraph.</p>

            <p>This is another paragraph.</p>

    </body>

</html>
```

Note: Only the content inside the <body> section (the white area above) is displayed in a browser.

The <!DOCTYPE> Declaration

The <!DOCTYPE> declaration represents the document type, and helps browsers to display web pages correctly.
It must only appear once, at the top of the page (before any HTML tags).
The <!DOCTYPE> declaration is not case sensitive.
The <!DOCTYPE> declaration for HTML5 is:
`<!DOCTYPE html>`

HTML Documents

All HTML documents must start with a document type declaration:
`<!DOCTYPE html>`.
The HTML document itself begins with `<html>` and ends with `</html>`.
The visible part of the HTML document is between `<body>` and `</body>`.

HTML Elements

An HTML element usually consists of a **start** tag and **end** tag, with the content inserted in between:
`<tagname>`Content goes here...`</tagname>`
The HTML **element** is everything from the start tag to the end tag:
`<p>`My first paragraph.`</p>`

HTML Attributes
Attributes provide additional information about HTML elements.

- All HTML elements can have **attributes**
- Attributes provide **additional information** about an element
- Attributes are always specified in **the start tag**
- Attributes usually come in name/value pairs like: **name="value"**

Ex:

HTML images are defined with the `<img>` tag.
The filename of the image source is specified in the `src` attribute:
`<img src="img_girl.jpg">`

The id Attribute

The id attribute specifies a unique id for an HTML element (the value must be unique within the HTML document).The id value can be used by CSS and JavaScript to perform certain tasks for a unique element with the specified id value

The HTML Style Attribute

Setting the style of an HTML element, can be done with the style attribute.

The HTML style attribute has the following **syntax**:

```
<tagname style="property:value;">
```

The **property** is a CSS property. The **value** is a CSS value.

Example

```
<h1 style="color:blue;">This is a heading</h1>
<p style="color:red;">This is a paragraph.</p>
```

HTML Comment Tags

Comment tags are used to insert comments in the HTML source code.

You can add comments to your HTML source by using the following syntax:

```
<!-- Write your comments here -->
```

HTML Headings

HTML headings are defined with the `<h1>` to `<h6>` tags.

`<h1>` defines the most important heading. `<h6>` defines the least important heading:

Example

```
<h1>This is heading 1</h1>
<h2>This is heading 2</h2>
<h3>This is heading 3</h3>
```

HTML Paragraphs

HTML paragraphs are defined with the `<p>` tag:

Example

```
<p>This is a paragraph.</p>
<p>This is another paragraph.</p>
```

HTML Links

HTML links are defined with the `<a>` tag:

Example

```
<a href="https://www.w3schools.com">This is a link</a>
```

The link's destination is specified in the `href` attribute.

Attributes are used to provide additional information about HTML elements.

HTML Images

HTML images are defined with the `<img>` tag.

The source file (`src`), alternative text (`alt`), `width`, and `height` are provided as attributes:

Example

```
<img src="w3schools.jpg" alt="W3Schools.com" width="104" height="142">
```

HTML Buttons

HTML buttons are defined with the `<button>` tag:

Example

```
<button>Click me</button>
```

Back End