KWH
Meter IoT

REAL TIME MONITORING
Menggunakan **ESP**
+ **PHP MySQL JS Bootstrap 5**

KelasRobot
Learning Robot is Easy and Fun

Salam Kenal_

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Asal	:	Sumedang, Jawa Barat
Hobi	:	Microcontroller Arduino
		Internet of Things
		Web Programming

#1 ESP8266 & ESP32 Dasar_

Pembahasan #1_

1. Pengenalan ESP8266 / ESP32
2. Instalasi Software Arduino IDE
3. Menambahkan ESP8266 & ESP32 ke Software Arduino IDE
4. Tes Upload Blink Program
5. Rangkaian dan Program Test Sensor PZEM-004T
6. Rangkaian dan Program Test Sensor LCD I2C 20x4
7. Rangkaian dan Program Test Buzzer Aktif
8. Rangkaian dan Program Relay
9. Program HTTP GET Request

1.1 Pengenalan ESP8266/ESP32

ESP8266 / ESP32 Adalah_

Board keluaran dari perusahaan **Espressif Systems**, yang berlokasi di China.

ESP8266 dan **ESP32** sudah **terdapat WiFi** pada Modulenya, Bahkan **ESP32** memiliki **Bluetooth 4.2** dan **BLE**.

Memiliki memory yang jauh lebih besar dibandingkan board Arduino (Uno, Nano, Mega).

Arduino Uno x ESP8266 x ESP32_

	Arduino Uno	ESP8266	ESP32
MCU	ATMega38	Xtensa Single-core 32-bit L106	Xtensa Dual-core 32-bit LX6 with 600 DMIPS
802.11 b/g/n Wi-Fi	No	HT20	HT40
Bluetooth	No	No	Bluetooth 4.0 dan BLE
Frequency	16MHz	80MHz	160MHz
GPIO	20	17	36
Flash Memory	32KB (5kB Bootl)	512K - 4MB (Ekt)	4MB (Int)
SRAM	2KB	64KB	520KB

1.2 Instalasi Arduino IDE

Download Arduino IDE_

Download di web resmi:

https://www.arduino.cc/en/software

Skroll kebawah, Download **Legacy IDE** (1.8.x)

Install Arduino IDE

Install seperti Software pada umumnya.

Centang semuanya…

Pada bagian Driver Install saja Semuanya…

1.3 Tambah Board ESP8266/ESP32 ke Arduino IDE

Add Link Referensi ESP8266/ESP32_

1. klik menu **File**, pilih **Preferences**

2. pada **Additional Board Manager URLs**: masukan **https://raw.githubusercontent.com/espressif/arduino-esp32/gh-pages/package_esp32_index.json**, **https://arduino.esp8266.com/stable/package_esp8266com_index.json**

3. klik **OK**

Add Link Referensi ESP8266/ESP32_
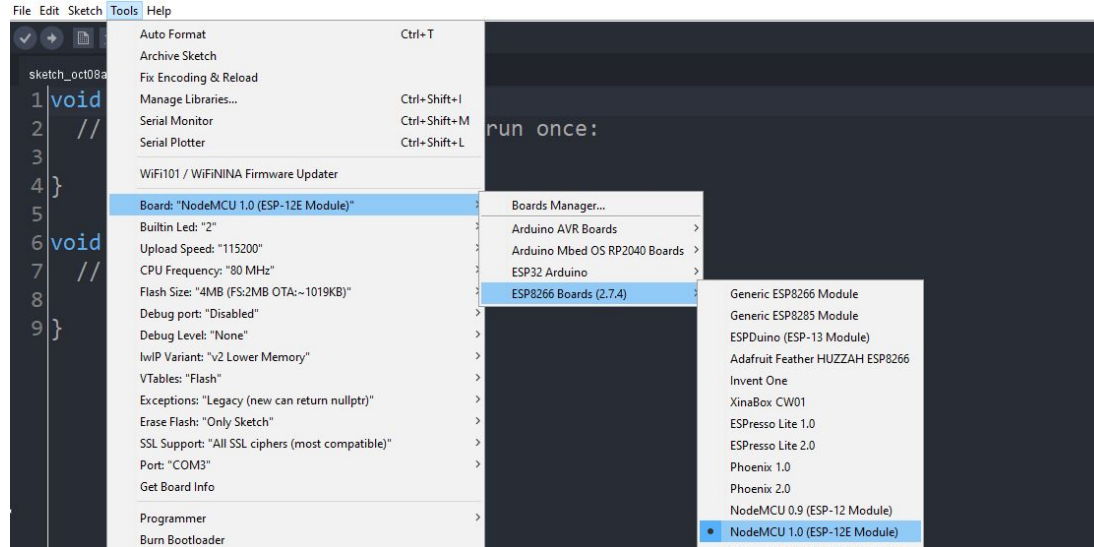
1. klik menu **Tools**, pilih **Board**, pilih **Boards Manager...**

2. Cari **esp8266** pilih **versi 2.7.4**, klik **Install**

3. Cari **esp32** pilih **versi 1.0.6**, klik **Install**

4. jika sudah klik **Close**

1.4 Tes Upload Program Blink_

Pilih Board Yang Benar_

1. klik menu **Tools**, pilih **Board**, pilih **ESP8266 Board**, kemudian pilih **NodeMCU 1.0**

Pilih Port Yang Benar_

1. Untuk memastikan port ada, silakan ke pencarian Windows, cari Device Manager.

2. Cek bagian Port, saya menggunakan NodeMCU Lolin dengan IC Uploader CH340.
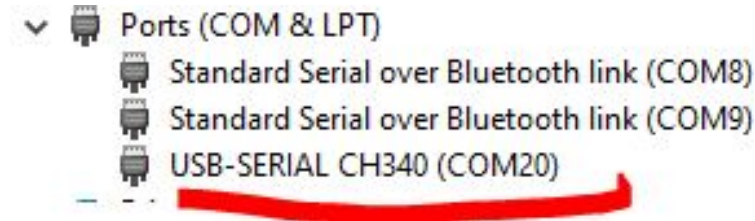
Pilih Port Yang Benar_

1. ke menu **Tools**, pilih **Port**, pilih **Port yang Sesuai** dengan Board-nya.
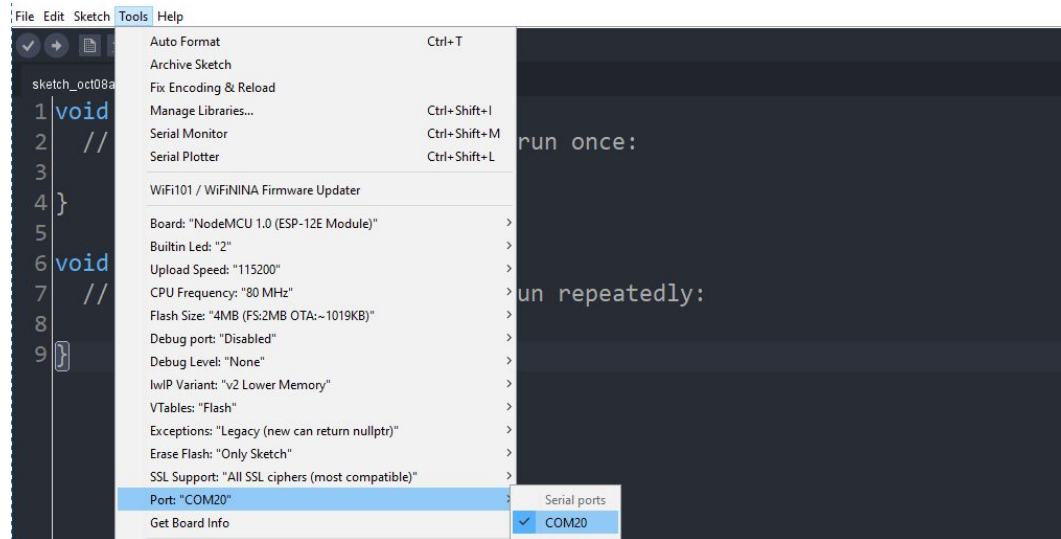
Coba Program Blink Example

1. Ke menu **File**, pilih **Examples**, pilih **0.1Basics**, pilih **Blink**.
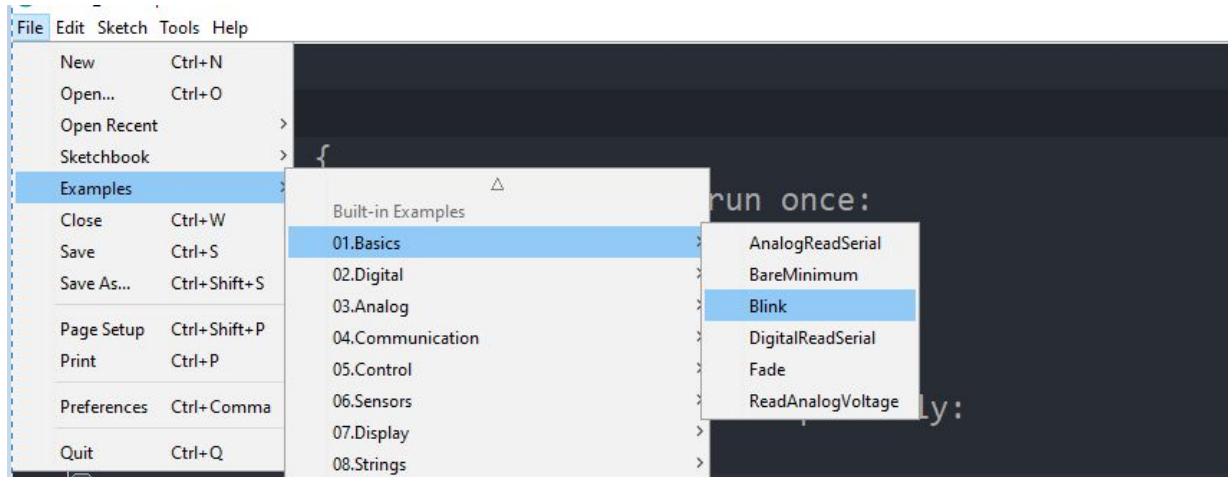
Upload Program

1. Silakan klik icon Upload seperti gambar dibawah ini

2. Jika berhasil lampu pada NodeMCU akan berkedip.
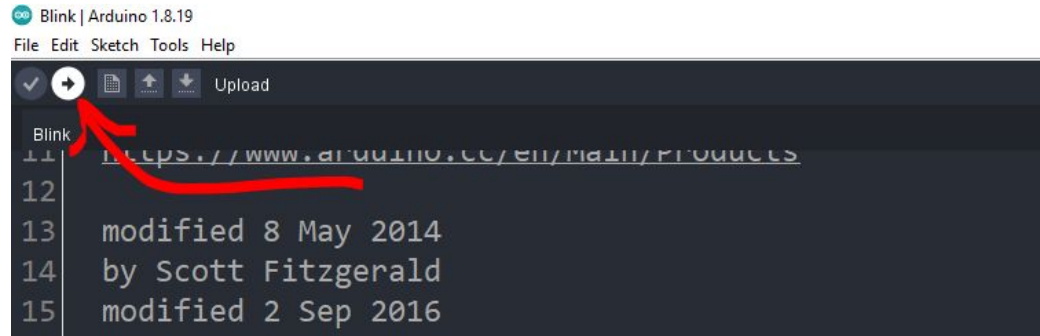
1.5 Rangkan dan Program Test PZEM-004T

Rangkaian PZEM - NodeMCU_

--- PZEM => NodeMCU ---
GND => GND
TX (hijau) => D3
RX (kuning) => D4
5V => 5v

AC 220V PLN
Coklat L
Biru N

--- PZEM => NodeMCU ---
GND => GND
TX (hijau) => D3
RX (kuning) => D4
5V => 5v
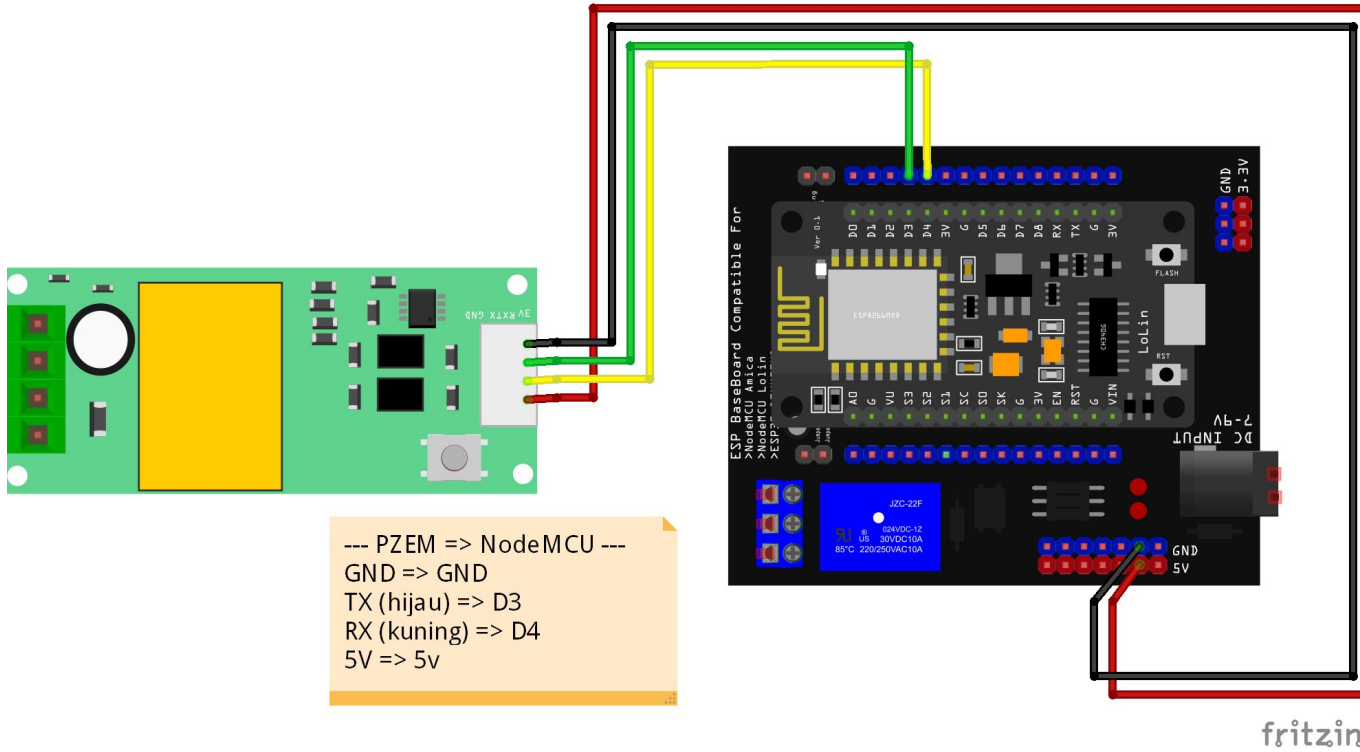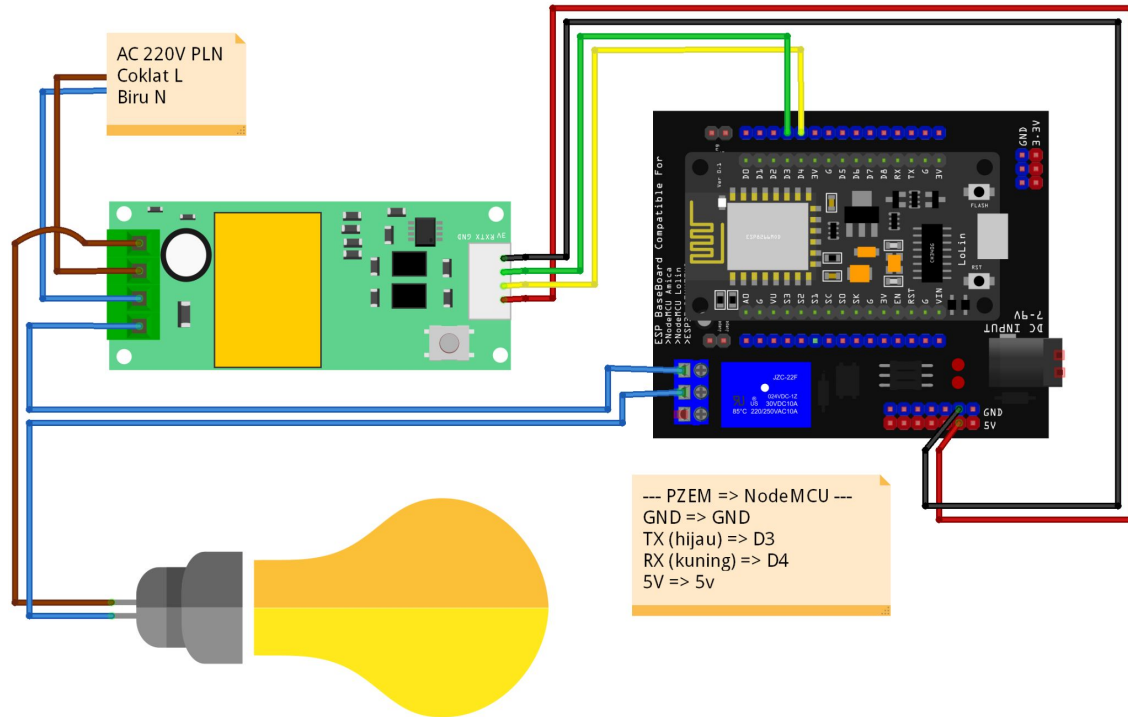
fritzing

PZEM-004T-100A With Coil - Instalasi_

AC 220V PLN
Coklat L
Biru N

CT

--- PZEM => NodeMCU ---
GND => GND
TX (hijau) => D3
RX (kuning) => D4
5V => 5v
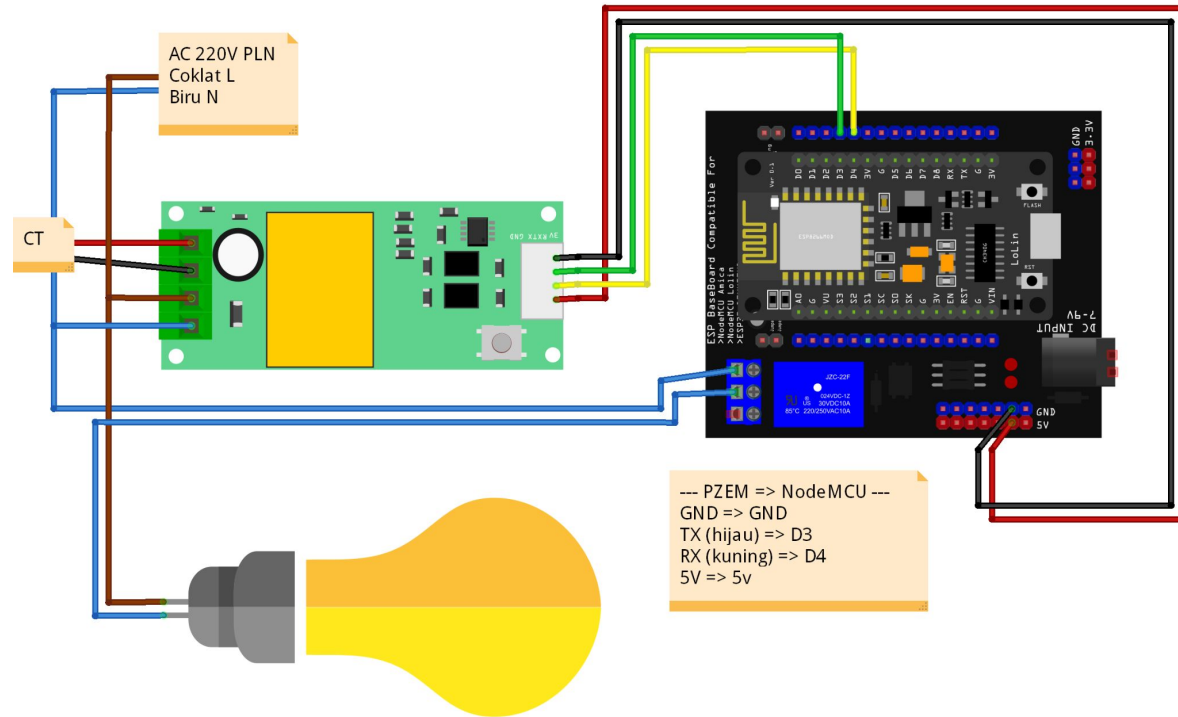
fritzing

Library PZEM_

1. Silakan Download:

   https://github.com/mandulaj/PZEM-004T-v30/archive/refs/heads/master.zip

2. Cara menambahkan library:

   https://kelasrobot.com/bagaimana-cara-memasukan-library-ke-aplikasi-arduino-ide/

Contoh Koding PZEM_

Koding terlalu panjang, saya simpan di Github

https://gist.github.com/ajangrahmat/a9e404d8cbba32e8aef6099ba400efa8

1.6 Rangkan dan Program Test LCD I2C 20x4

Rangkaian LCD I2C - NodeMCU_

LCD I2C --- NodeMCU
GND - GND
VCC - 5V
SCL - D1
SDA - D2
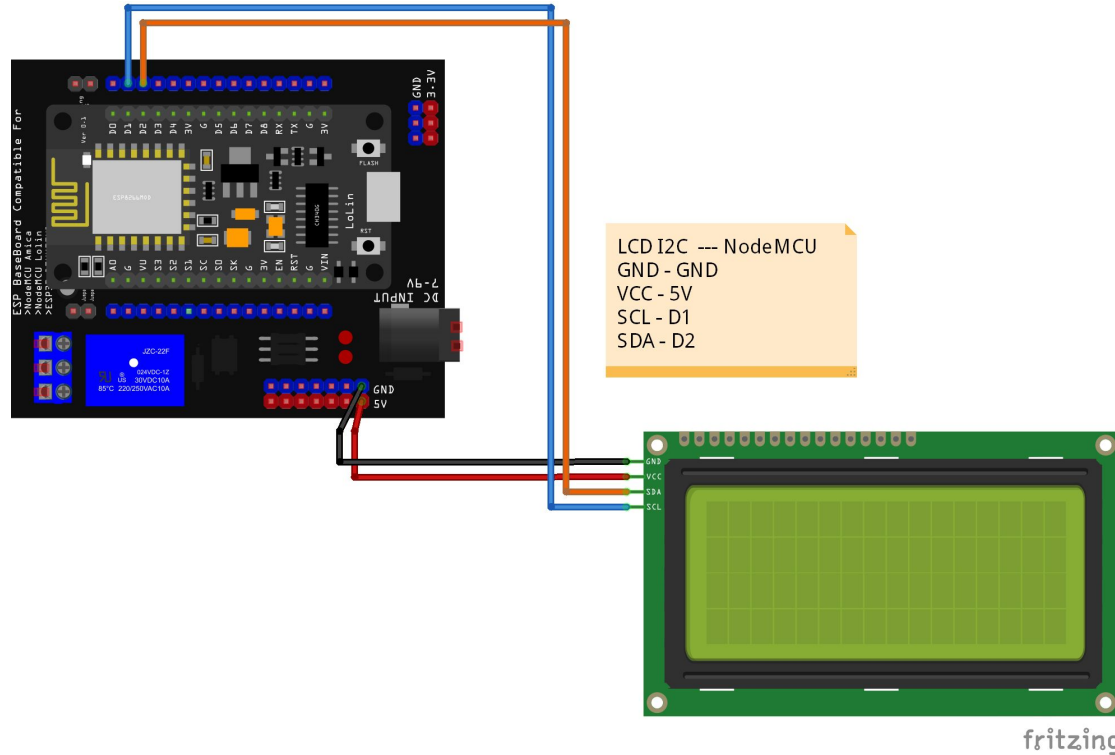
Library LCD I2C

1. Silakan Download:

   https://www.dropbox.com/s/asp8w5ja64bn7u9/Arduino-LiquidCrystal-I2C-library-master.zip

2. Cara menambahkan library:

   https://kelasrobot.com/bagaimana-cara-memasukan-library-ke-aplikasi-arduino-ide/

3. Cek ke **Documents**, **Arduino**, **Libraries**, jika ada folder library LCD I2C yang lain, silakan hapus.

Contoh Koding LCD I2C_

```cpp
#include <LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x27, 20, 4);

void setup() {
  lcd.begin();
}

void loop(){
  lcd.setCursor(0,0);
  lcd.print("TEST LCD i2C");
  lcd.setCursor(0,1);
  lcd.print("KelasRobot.com");
  lcd.setCursor(0,2);
  lcd.print("Belajar Robot Itu");
  lcd.setCursor(0,3);
  lcd.print("Mudah & Menyenangkan");
}
```

1.7 Rangkan dan Program Test Buzzer Aktif

Rangkaian Buzzer - NodeMCU_
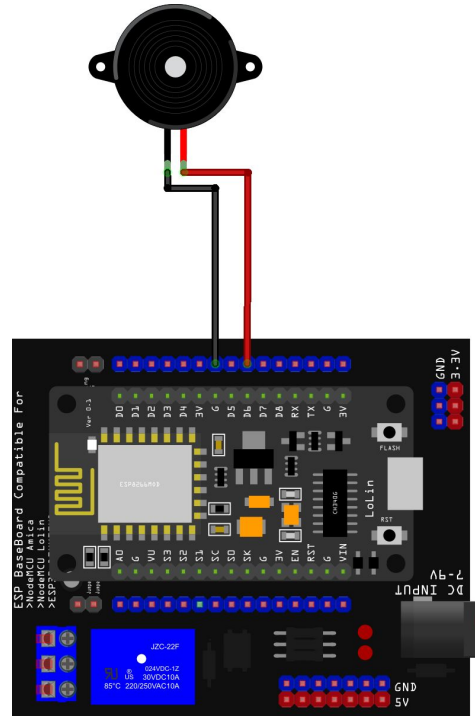
NodeMCU - Buzzer Module
GND - GND
I/O - D6
VCC - 5V

fritzing

Contoh Koding Buzzer_

```c
#define buzzer D6
void buzz(int jumlah, int Delay) {
  for (int i = 0; i < jumlah; i++) {
    digitalWrite(buzzer, HIGH);
    delay(Delay);
    digitalWrite(buzzer, LOW);
    delay(Delay);
  }
}

void setup() {
  pinMode(buzzer, OUTPUT);
  buzz(10, 500);
}

void loop() {

}
```

1.8 Rangkan dan Program Test Relay

Rangkaian Relay - NodeMCU_
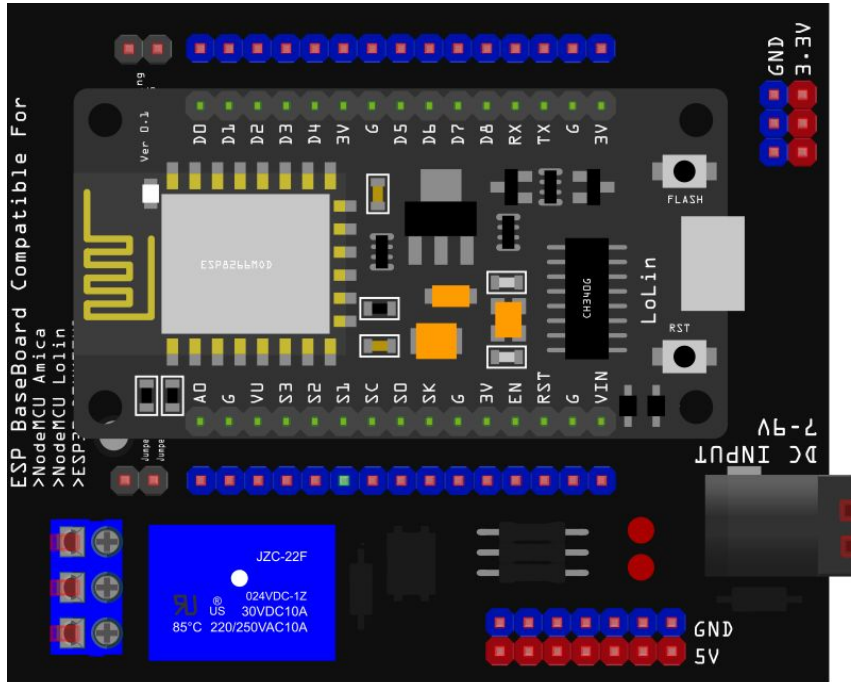
Relay - NodeMCU

Relay ke pin D5

Contoh Koding Relay

```cpp
void setup() {
  pinMode(D5, OUTPUT);
}

void loop() {
    digitalWrite(D5, HIGH);
    delay(3000);
    digitalWrite(D5, LOW);
    delay(3000);
}
```

1.9 Program HTTP GET Request_

Contoh Koding HTTP Get Request_

```cpp
#include <ESP8266WiFi.h>
#include <ESP8266HTTPClient.h>
const char* ssid = "KelasRobot.com";
const char* password = "k3l4sr0b0t";
String url = "http://example.org";

void setup() {
  Serial.begin(115200);
  WiFi.begin(ssid, password);
  Serial.print("Connecting to WiFi");
  while (WiFi.status() != WL_CONNECTED) {
    delay(500); Serial.print(".");
  }
  Serial.print("OK! IP=");
  Serial.println(WiFi.localIP());
  HTTPClient http;
  http.begin(url);
  int httpResponseCode = http.GET();
  if (httpResponseCode > 0) {
    Serial.print("HTTP ");
    Serial.println(httpResponseCode);
    String payload = http.getString();
    Serial.println();
    Serial.println(payload);
  }
  else {
    Serial.print("Error code: ");
    Serial.println(httpResponseCode);
    Serial.println(":-(");
  }
}

void loop() {}
```

#2 Pemrograman Web Dasar_

Pembahasan #2_

1. Pengenalan Pemrograman Web #sekilas
2. Instalasi XAMPP dan VSCode
3. HTML dan CSS Dasar Untuk Pemula
4. JavaScript Dasar Untuk Pemula
5. PHP dan MySQL Dasar Untuk Pemula
6. Membuat Tampilan UI Menggunakan Bootstrap dan CSS Custom

2.1 Pengenalan Web Programming #Sekilas

Web Programming

1. Basic Sisi Client (Front End) => (HTML, CSS, JS)
2. Basic Sisi Server (Back End) => PHP MySQL
3. CSS Framework (Bootstrap, Tailwind, Bulma)
4. Material Icon (Bootstrap Icon, Font Awesome)
5. JS Grafik (ChartJS)
6. JS Framework Front End (React, Vue) (Next, Nuxt)
7. PHP Framework (Code Iginiter, Laravel)
8. JS Framework Back End (Express)
9. Python Framework (Flask, Djanggo)
10. DevOps (AWS, GCloud), GIT, Kubernetes, Docker, dll…

2.2 Instalasi XAMPP dan VSCode_

Download XAMPP

Download di web resmi:

https://www.apachefriends.org/download.html

Download versi 8.0.x

Instalasi XAMPP_

Silakan klik **More Info**, pilih **Run anyway**
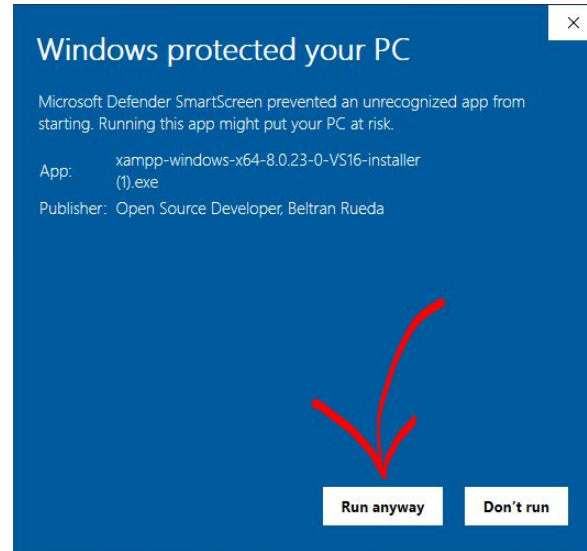
Instalasi XAMPP_

jika muncul seperti ini, **abaikan saja** dengan **klik OK**...

Silakan lanjutkan instalasi, sampai selesai...
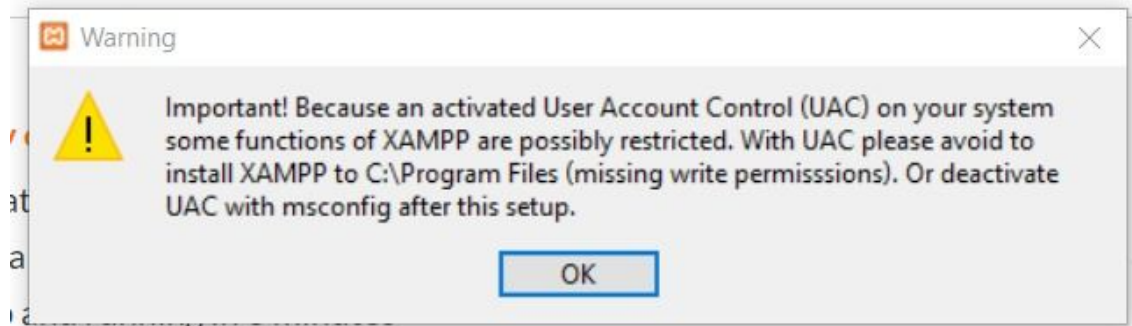
Download VSCode_

Download di web resmi:

https://code.visualstudio.com/download

Download versi terbaru saja.
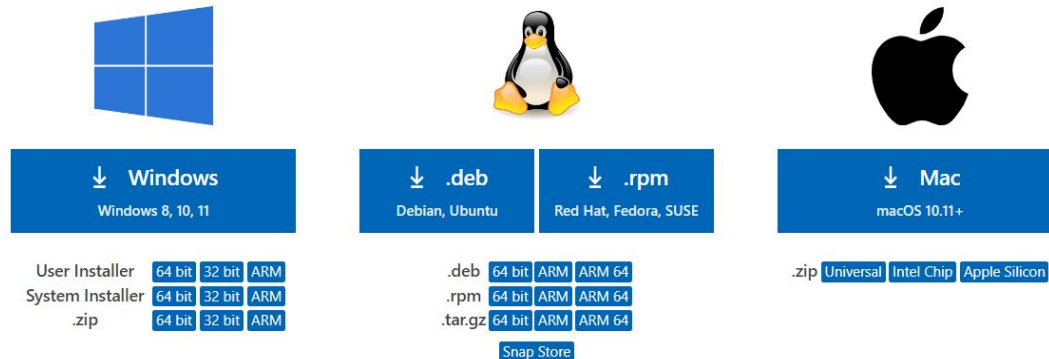
Instalasi VSCode

Instalasi VSCode tidak susah, silakan ikuti aja.

Jika ada yang perlu di centang, **Centang Semuanya**!

Silakan install sampai selesai…

Extensioon VSCode

1. Atom One Dark Theme
2. Material Icon Theme
3. PHP Intelephense

2.3 HTML dan CSS Dasar Untuk Pemula

Struktur Kode HTML_

```html
<!DOCTYPE html>
<html lang="id">

<head>
    <title>Judul Website</title>
</head>

<body>
    <h1>Judul Halaman</h1>
    <p>Isi halaman</p>
</body>

</html>
```

HTML - Heading dan Paragraf_

```
<h1>Judul Halaman</h1>
<h2>Sub Judul Halaman</h2>
<h3>Sub Sub Judul Halaman</h3>
<h4>Sub Sub Sub Judul Halaman</h4>
<h5>Sub Sub Sub Sub Judul Halaman</h5>
<h6>Sub Sub Sub Sub Sub Judul Halaman</h6>
<p>Paragraf Halaman, ini adalah paragraf halaman</p>
```

HTML - Link_

```
<a href="https://kelasrobot.com">kelasrobot</a>
<a href="https://kelasrobot.com" target="_blank">kelasrobot</a>
<a href="index.php">Home</a>
```

HTML - Button_

```html
<button type="button">Button</button>
<br><br>
<form action="post.php" method="GET">
    <input type="text" name="nama" placeholder="Nama">
    <button type="button">Simpan</button>
</form>
```

HTML - Table_

```html
<table>
    <thead>
        <tr>
            <th>Tanggal</th>
            <th>Waktu</th>
            <th>Nilai Sensor</th>
        </tr>
    </thead>
    <tbody>
        <tr>
            <td>2020-01-01</td>
            <td>00:00:00</td>
            <td>0</td>
        </tr>
    </tbody>
</table>
```

Menambahkan CSS_

1. Buat file **style.css**
2. Tambahkan koding berikut di dalam **tag <head>** html

```
<link rel="stylesheet" href="style.css">
```

CSS - body_

```css
body{
    background-color: #000000;
    color: #ffffff;
    font-size: 14px;
    line-height: 1.42857143;
    margin: 0;
}
```

CSS - heading & paragraf_

```css
h1{
    font-size: 2em;
    font-weight: bold;
    color: rgb(255, 255, 255);
    margin-bottom: 0.7em;
}

p{
    font-size: 1.2em;
    color: rgb(255, 255, 255);
    margin-bottom: 0.7em;
}
```

CSS - link_

```css
a:link, a:visited{
    color: rgb(255, 255, 255);
    background-color: aqua;
    padding: 20px;
}
a:hover{
    color: rgb(255, 255, 255);
    background-color: #00a6cf;
    padding: 20px;
}
```

CSS - button_

```css
button{
    background-color: #00a6cf;
    color: #ffffff;
    padding: 20px;
    border-radius: 5px;
    font-size: 1.2em;
    font-weight: bold;
}

button:hover{
    background-color: #006680;
    color: #ffffff;
    padding: 20px;
    border-radius: 5px;
    font-size: 1.2em;
    font-weight: bold;
}
```

CSS - table_

```css
table,th,td{
    border: 1px solid #ffffff;
    border-collapse: collapse;
    padding: 10px;
}
```

2.4 Javascript Dasar

Basic Penerapan JS di HTML_

```html
<h1 id="hello">Selamat Datang</h1>

<script>
    document.getElementById('hello').innerHTML = 'Hello World';
</script>
```

Button Function - Text_

```
<button onclick="hello()">Button</button>

<script>
    function hello() {
        document.getElementById("hello").innerHTML = "Hello World";
    }
</script>
```

Button Function - CSS_

```
<button onclick="hello()">Button</button>

<script>
    function hello() {
        document.getElementById("hello").style.color = "red";
    }
</script>
```

Button Function - CSS Class_

```css
.bg-orange {
    background-color: #ff6600;
    width: 100%;
    padding: 25px;
    color: white;
    font-size: 25px;
    box-sizing: border-box;
}
```

```html
<button onclick="ubah_class()">Try it</button>
<div id="div">
    This is a DIV element.
</div>
<script>
    function ubah_class() {
        var element = document.getElementById("div");
        element.classList.add("bg-orange");
    }
</script>
```

2.5 PHP MySQL Untuk Pemula

Buat Database_

1. Jalankan **Apache** dan **MySQL** di **Control Panel Xampp**
2. Buka http://localhost/phpmyadmin
3. Klik **New**, masukan nama database "**kwhmeter**", klik **Create**

Buat Tabel_

1. Klik **database kwhmeter**
2. pada **Create New Table**, masukan nama tabel "**data**", atur jumlah kolom menjadi 10 misal
3. klik **Create**
4. silakan ikuti step-step dari Video.

buat folder kwhmeter_

1. masuk ke data **C:**, **xampp**, **htdocs**
2. di **dalam htdocs** buat folder dengan nama **kwhmeter**
3. silakan **buka folder kwhmeter** melalui **VSCode**

config > connection.php_

1. pada VSCode
2. **buat folder** dengan nama **config**
3. dalam folder config, buat file **connection.php**

```php
<?php
$host    = "localhost";
$user    = "root";
$pass    = "";
$db_name = "kwhmeter";
$conn    = mysqli_connect($host, $user, $pass, $db_name);
if (!$conn) {
    die("Connection failed: " . mysqli_connect_error());
}
```

create.php_

```php
<?php
include('config/connection.php');
$query = "INSERT INTO data VALUES
(NULL,'10-08-2022','19:30:21',212.34,0.1,10.12,0.02)";
$create = mysqli_query($conn, $query);
if ($create) {
    echo "Data berhasil disimpan";
} else {
    echo "Data gagal disimpan" . mysqli_error($conn);
}
```

update.php_

```php
<?php
include('config/connection.php');
$query = "UPDATE data SET tanggal='19-08-2022', waktu='12:00:00',
voltage=212.34, current=0.5, power=19.12, energy=23.02 WHERE id=1";
$update = mysqli_query($conn, $query);
if ($update) {
    echo "Data berhasil diupdate";
} else {
    echo "Data gagal diupdate" . mysqli_error($conn);
}
```

delete.php_

```php
<?php
include('config/connection.php');
$query = "DELETE FROM data WHERE id=1";
$delete = mysqli_query($conn, $query);
if ($delete) {
    echo "Data berhasil dihapus";
} else {
    echo "Data gagal dihapus" . mysqli_error($conn);
}
```

read.php_

```php
<?php
include('config/connection.php');
$query = "SELECT * FROM data";
$read = mysqli_query($conn, $query);
if ($read) {
    while ($row = mysqli_fetch_assoc($read)) {
        echo $row['id'] . " " . $row['tanggal'] . " " . $row['waktu'] . " " .
$row['voltage'] . " " . $row['current'] . " " . $row['power'] . " " .
$row['energy'] . "<br>";
    }
} else {
    echo "Data gagal dibaca" . mysqli_error($conn);
}
```

read_table.php_

```php
<table>
    <thead>
        <tr>
            <th>Tanggal</th>
            <th>Waktu</th>
            <th>Voltage</th>
            <th>Current</th>
            <th>Power</th>
            <th>Energy</th>
        </tr>
    </thead>
    <tbody>
        <?php
        include('config/connection.php');
        $query = "SELECT * FROM data";
        $read = mysqli_query($conn, $query);
        while ($row = mysqli_fetch_array($read)) {
        ?>
            <tr>
                <td><?php echo $row['tanggal'] ?></td>
                <td><?php echo $row['waktu'] ?></td>
                <td><?php echo $row['voltage'] ?></td>
                <td><?php echo $row['current'] ?></td>
                <td><?php echo $row['power'] ?></td>
                <td><?php echo $row['energy'] ?></td>
            </tr>
        <?php } ?>
    </tbody>
</table>
```

2.6 Membuat Tampilan UI menggunakan Bootstrap5 dan CSS Custom

Bootstrap Source

1. Dokumentasi Bootstrap bisa dapet dari Web Resminya: **https://getbootstrap.com/docs/5.2/getting-started/introduction/**

Template Basic Bootstrap > index.php_

```html
<!doctype html>
<html lang="en">
  <head>
    <meta charset="utf-8">
    <meta name="viewport" content="width=device-width, initial-scale=1">
    <title>Bootstrap demo</title>
    <link href="https://cdn.jsdelivr.net/npm/bootstrap@5.2.2/dist/css/bootstrap.min.css"
rel="stylesheet"
integrity="sha384-Zenh87qX5JnK2Jl0vWa8Ck2rdkQ2Bzep5IDxbcnCeuOxjzrPF/et3URy9Bv1WTRi"
crossorigin="anonymous">
  </head>
  <body>
    <h1>Hello, world!</h1>
    <script
src="https://cdn.jsdelivr.net/npm/bootstrap@5.2.2/dist/js/bootstrap.bundle.min.js"
integrity="sha384-OERcA2EqjJCMA+/3y+gxIOqMEjwtxJY7qPCqsdltbNJuaOe923+mo//f6V8Qbsw3"
crossorigin="anonymous"></script>
  </body>
</html>
```

Buat Folder Layout

1. buat folder **layout**
2. dalam folder layout buat file **header.php** dan **footer.php**

header.php_

```
<!doctype html>
<html lang="en">
  <head>
    <meta charset="utf-8">
    <meta name="viewport" content="width=device-width,
initial-scale=1">
    <title>Bootstrap demo</title>
    <link
href="https://cdn.jsdelivr.net/npm/bootstrap@5.2.2/dist/css/bootst
rap.min.css" rel="stylesheet"
integrity="sha384-Zenh87qX5JnK2Jl0vWa8Ck2rdkQ2Bzep5IDxbcnCeuOxjzrP
F/et3URy9Bv1WTRi" crossorigin="anonymous">
  </head>
  <body>
```

footer.php_

```php
<script
src="https://cdn.jsdelivr.net/npm/bootstrap@5.2.2/dist/js/bootstrap.b
undle.min.js"
integrity="sha384-OERcA2EqjJCMA+/3y+gxIOqMEjwtxJY7qPCqsdltbNJuaOe923+
mo//f6V8Qbsw3" crossorigin="anonymous"></script>
</body>

</html>
```

index.php_

```php
<?php include('layout/header.php'); ?>

<h1>Hello, world!</h1>

<?php include('layout/footer.php'); ?>
```

Buat navbar.php di folder layout_

1. masuk ke folder **layout**
2. buat file **navbar.php**
3. ke **web dokumentasi bootstrap**, cari **navbar**, kemudian copas codenya ke file **navbar.php**
4. silakan sesuaikan class nya sesuai selera

Step Tantangan_

1. Tambahkan **Card** untuk di Dashboard **index.php**
2. Tambahkan **table** untuk di file baru **data.php**
3. Tambahkan **css gradient** untuk **navbar**, gunakan koding dibawah ini:

```css
.bg-gradient{
    background: linear-gradient(90deg, #663783 0%, #db1852 100%) !important;
}

body{
    background: #f5f5f5 !important;
}
```

#3 Membuat Realtime Data KWH Meter

Pembahasan #2_

1. Membuat API Create Data POST ke MySQL
2. Membuat HTTP POST Request Arduino
3. Membuat Server Sent Event

3.1 Membuat API Create POST ke MySQL

Buat Folder api_

1. buat folder **api**
2. dalam folder layout buat file **create.php**

create.php_

```php
<?php
include('../config/connection.php');

//Tanggal dan Waktu
//WITA: Asia/Makassar | WIT: Asia/Jayapura
date_default_timezone_set("Asia/Jakarta");
$tanggal    = date('d-m-Y');
$waktu      = date('H:i:s');

//Mengambil data dari ESP8266
$voltage    = $_POST['voltage'];
$current    = $_POST['current'];
$power      = $_POST['power'];
$energy     = $_POST['energy'];
$freq       = $_POST['freq'];
$pf         = $_POST['pf'];

$query  = "INSERT INTO data VALUES  (NULL, '$tanggal', '$waktu',
'$voltage', '$current', '$power', '$energy', '$freq', '$pf')";
$create  = mysqli_query($conn, $query);
if ($create) {
    $json = array("status" => 1, "pesan" => "Data Berhasil Ditambahkan");
    echo json_encode($json);
} else {
    $json = array("status" => 0, "pesan" => "Data Gagal Ditambahkan");
    echo json_encode($json);
}
```

3.2 Membuat HTTP POST Request Arduino

HTTP POST Request_

Silakan ambil koding HTTP GET Request, pada link GITHUB berikut:

https://gist.github.com/ajangrahmat/9a11e94600f6980306a8955dd8d68745

Menggabungkan Koding

1. Koding PZEM dengan HTTP Post Request
2. + Koding LCD 20x4

3.2 Membuat Server Sent Event

sse_data.php_

```php
<?php
header('Content-Type: text/event-stream');
header('Cache-Control: no-cache');

include('config/connection.php');
$data       = mysqli_query($conn, "SELECT * FROM data ORDER BY id DESC LIMIT 1");
$row        = mysqli_fetch_array($data);
$voltage    = $row['voltage'];
$current    = $row['current'];

$data = array(
    'voltage'   => $voltage,
    'current'   => $current
);
echo "data: " . json_encode($data);
echo PHP_EOL;
// Event user
echo "event: data";
echo PHP_EOL;
echo PHP_EOL;
flush();
```

JS Handle SSE Data_

```
<script>
    if (typeof(EventSource) !== "undefined") {
        var source = new EventSource("sse_data.php");
        source.addEventListener('data', function(e) {
            var data = JSON.parse(e.data);
            var voltage = data.voltage;
            var current = data.current;
            document.getElementById("voltage").innerText = voltage;
            document.getElementById("current").innerText = current;
        }, false);
    } else {
        document.getElementById("result").innerHTML = "Not Support";
    }
</script>
```

#4 Membuat Sistem Login dan Grafik

4.1 Membuat Sistem Login_

Buat form login.php

1. Buat file baru dengan nama **login.php**
2. Masuk ke **https://getbootstrap.com/**, pilih **Docs**, cari **form**
3. Copy koding form, paste di **login.php**

login.php_

```
<form action="login_proses.php" method="POST">
  <div class="mb-3">
    <labelclass="form-label">Username</label>
    <input type="text" class="form-control" name="username">
  </div>
  <div class="mb-3">
    <label class="form-label">Password</label>
    <input type="password" class="form-control" name="password">
  </div>
  <button type="submit" class="btn btn-primary">Login</button>
</form>
```

login_proses.php_

```php
<?php
session_start();
include('config/connection.php');
$username = $_POST['username'];
$password = $_POST['password'];

$query = "SELECT * FROM admin WHERE username='$username' and password='$password'";
$data = mysqli_query($conn, $query);
$cek = mysqli_num_rows($data);

if($cek > 0){
    $_SESSION['username'] = $username;
    $_SESSION['status'] = "login";
    header("location: index.php");
}else{
    header("location: login.php?pesan=gagal");
}
```

Jika Belum Login_

```php
<?php
session_start();
if ($_SESSION['status'] != "login") {
    header("location: login.php?pesan=belum_login");
}
?>
```

logout.php_

```php
<?php
session_start();
session_destroy();
header("location: login.php?pesan=logout");
?>
```

4.2 Membuat Grafik

Buat grafik.php_

```php
<?php
include('config/connection.php');
$query = "SELECT * FROM data ORDER BY id DESC LIMIT 100";
$waktu = mysqli_query($conn, $query);
$voltage = mysqli_query($conn, $query);
?>
```

Library ChartJS_

```html
<script src="https://cdn.jsdelivr.net/npm/chart.js"></script>
<div>
    <canvas id="myChart"></canvas>
</div>
```

Label Grafik_

```javascript
const labels = [
    'January',
    'February',
    'March',
    'April',
    'May',
    'June',
];
```

Data Grafik_

```javascript
const data = {
    labels: labels,
    datasets: [{
        label: 'My First dataset',
        backgroundColor: 'rgb(255, 99, 132)',
        borderColor: 'rgb(255, 99, 132)',
        data: [0, 10, 5, 2, 20, 30, 45],
    }]
};
```

Config Grafik_

```javascript
const config = {
    type: 'line',
    data: data,
    options: {}
};
```

Render Grafik_

```javascript
const myChart = new Chart(

document.getElementById('myChart'),
    config
);
```