LAMPIRAN

Lampiran 1 Kode Program

```
#define BLYNK_PRINT Serial
#define BLYNK_TEMPLATE_ID "TMPL64utceU4u"
#define BLYNK_TEMPLATE_NAME "biodesu"

#include <WiFi.h>
#include <WiFiClient.h>
#include <HTTPClient.h>
#include <WiFiManager.h>
#include <BlynkSimpleEsp32.h>
#include <Bonezegei_LCD1602_I2C.h>

// Inisialisasi LCD I2C
Bonezegei_LCD1602_I2C lcd(0x27);

// WhatsApp CallMeBot
String phoneNumber = "+6285134953584";
String apiKey = "4965419";

// Blynk Auth Token
char auth[] = "kAv5PMtywQ3VOIj_s5dmtm6UerK6kTJQ";

// Pin sensor dan LED
const int pressurePin = 34;
const int gasPin1 = 18;
const int gasPin2 = 19;
```

```
const int ledPressurePin = 4;
const int ledGasPin = 2;

// Kalibrasi tekanan
const float sensorMinVoltage = 0.5;
const float sensorMaxVoltage = 4.5;
const float pressureMaxPSI = 145.0;
const float R1 = 1800.0;
const float R2 = 1800.0;
const float dividerRatio = R2 / (R1 + R2);
const float correctionSlope = 1.0;
const float correctionOffset = -7.0;
const float pressureThreshold = 5;  // Ambang batas tekanan

unsigned long lastSendTime = 0;
const unsigned long sendInterval = 2000;

bool sentPressureAlert = false;
bool sentGasAlert = false;

// Fungsi encode teks ke URL (untuk WhatsApp)
String urlEncode(String str) {
  String encoded = "";
  char c, code0, code1;
  for (int i = 0; i < str.length(); i++) {
    c = str.charAt(i);
    if (isalnum(c)) {
```

```
      encoded += c;
    } else {
      code1 = (c & 0xf) + '0';
      if ((c & 0xf) > 9) code1 = (c & 0xf) - 10 + 'A';
      c = (c >> 4) & 0xf;
      code0 = c + '0';
      if (c > 9) code0 = c - 10 + 'A';
      encoded += '%';
      encoded += code0;
      encoded += code1;
    }
  }
  return encoded;
}

// Fungsi kirim WhatsApp
bool sendMessage(String message) {
  String url = "https://api.callmebot.com/whatsapp.php?phone=" + phoneNumber +
               "&apikey=" + apiKey +
               "&text=" + urlEncode(message);
  HTTPClient http;
  http.begin(url);
  http.addHeader("Content-Type", "application/x-www-form-urlencoded");
  int httpResponseCode = http.POST("");
  http.end();
  return (httpResponseCode == 200);
}
```

```
void setup() {
  Serial.begin(115200);
  analogReadResolution(12);

  pinMode(gasPin1, INPUT);
  pinMode(gasPin2, INPUT);
  pinMode(ledPressurePin, OUTPUT);
  pinMode(ledGasPin, OUTPUT);
  digitalWrite(ledPressurePin, LOW);
  digitalWrite(ledGasPin, LOW);

  // LCD setup
  lcd.begin();
  lcd.print("Menghubungkan WiFi");

  // WiFi Manager setup
  WiFiManager wm;
  if (!wm.autoConnect("ESP32_AP", "12345678")) {
    lcd.clear();
    lcd.print("WiFi gagal");
    delay(3000);
    ESP.restart();
  }

  lcd.clear();
  lcd.print("WiFi: CONNECTED");
```

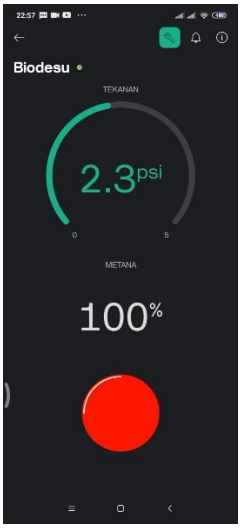
```
  Blynk.begin(auth, WiFi.SSID().c_str(), WiFi.psk().c_str());
}

void loop() {
  Blynk.run();
  unsigned long now = millis();
  if (now - lastSendTime >= sendInterval) {
    lastSendTime = now;

    // ---------- Baca sensor tekanan ----------
    int adcPressure = analogRead(pressurePin);
    float vAtPin = (adcPressure / 4095.0) * 3.3;
    float vSensor = vAtPin / dividerRatio;
    float pressurePSI = (vSensor - sensorMinVoltage) * pressureMaxPSI / (sensorMaxVoltage
- sensorMinVoltage);
    pressurePSI = pressurePSI * correctionSlope + correctionOffset;
    if (pressurePSI < 0) pressurePSI = 0;

    // ---------- Baca sensor gas ----------
    int gas1 = digitalRead(gasPin1);
    int gas2 = digitalRead(gasPin2);
    bool gasDetected = (gas1 == HIGH || gas2 == HIGH);
    float gasLevel = gasDetected ? 100.0 : 0.0;

    // ---------- Tampilkan ke LCD ----------
    lcd.clear();
    lcd.setPosition(0, 0);
    lcd.print("Tek:");
```

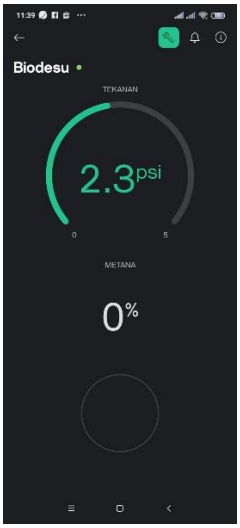
```
lcd.print(String(pressurePSI, 1).c_str());
lcd.print("PSI");

lcd.setPosition(0, 1);
if (gasDetected) {
  lcd.print("Gas: TERDETEKSI");
} else {
  lcd.print("Gas: AMAN       ");
}

// ---------- Logika tekanan ----------
if (pressurePSI > pressureThreshold) {
  digitalWrite(ledPressurePin, HIGH);
  if (!sentPressureAlert) {
    if (sendMessage("⚠ Tekanan melebihi batas: " + String(pressurePSI, 1) + " PSI")) {
      Serial.println("✅ WA tekanan terkirim");
    }
    sentPressureAlert = true;
  }
} else {
  digitalWrite(ledPressurePin, LOW);
  sentPressureAlert = false;
}

// ---------- Logika gas ----------
if (gasDetected) {
  digitalWrite(ledGasPin, HIGH);
```

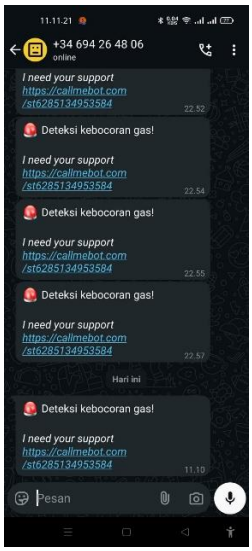
```
    if (!sentGasAlert) {
      if (sendMessage("🚨 Deteksi kebocoran gas!")) {
        Serial.println("✅ WA gas terkirim");
      }
      sentGasAlert = true;
    }
  } else {
    digitalWrite(ledGasPin, LOW);
    sentGasAlert = false;
  }

  // ---------- Kirim ke Blynk ----------
  Blynk.virtualWrite(V2, pressurePSI);
  Blynk.virtualWrite(V3, gasLevel);

  // ---------- Serial Debug ----------
  Serial.print("Tekanan: ");
  Serial.print(pressurePSI, 1);
  Serial.print(" PSI | Gas: ");
  Serial.println(gasDetected ? "TERDETEKSI" : "AMAN");
 }
}
```

Lampiran 2 Dokumentasi Pengisian Biodigester dengan Kulit Nanas

Lampiran 3 Dokumentasi Tampilan pembacaan LCD i2C, Platfom monitoring Blynk dan Notivikasi WhastApp







Lampiran 4 Data Shett Dari Alat-Alat Yang Digunakan

Datasheet ESP32

Features

Wi-Fi

- 802.11b/g/n
- 802.11n (2.4 GHz), up to 150 Mbps
- WMM
- TX/RX A-MPDU, RX A-MSDU
- Immediate Block ACK
- Defragmentation
- Automatic Beacon monitoring (hardware TSF)
- Four virtual Wi-Fi interfaces
- Simultaneous support for Infrastructure Station, SoftAP, and Promiscuous modes
  Note that when ESP32 is in Station mode, performing a scan, the SoftAP channel will be changed.
- Antenna diversity

Bluetooth®

- Compliant with Bluetooth v4.2 BR/EDR and Bluetooth LE specifications
- Class-1, class-2 and class-3 transmitter without external power amplifier
- Enhanced Power Control
- +9 dBm transmitting power
- NZIF receiver with -94 dBm Bluetooth LE sensitivity
- Adaptive Frequency Hopping (AFH)
- Standard HCI based on SDIO/SPI/UART
- High-speed UART HCI, up to 4 Mbps
- Bluetooth 4.2 BR/EDR and Bluetooth LE dual mode controller
- Synchronous Connection-Oriented/Extended (SCO/eSCO)
- CVSD and SBC for audio codec
- Bluetooth Piconet and Scatternet
- Multi-connections in Classic Bluetooth and Bluetooth LE
- Simultaneous advertising and scanning

CPU and Memory

- Xtensa® single-/dual-core 32-bit LX6 microprocessor(s)
- CoreMark® score:
  - 1 core at 240 MHz: 539.98 CoreMark; 2.25 CoreMark/MHz
  - 2 cores at 240 MHz: 1079.96 CoreMark; 4.50 CoreMark/MHz
- 448 KB ROM
- 520 KB SRAM
- 16 KB SRAM in RTC
- QSPI supports multiple flash/SRAM chips

Clocks and Timers

- Internal 8 MHz oscillator with calibration
- Internal RC oscillator with calibration
- External 2 MHz ~ 60 MHz crystal oscillator (40 MHz only for Wi-Fi/Bluetooth functionality)
- External 32 kHz crystal oscillator for RTC with calibration
- Two timer groups, including 2 × 64-bit timers and 1 × main watchdog in each group
- One RTC timer
- RTC watchdog

Advanced Peripheral Interfaces

- 34 programmable GPIOs
  - Five strapping GPIOs
  - Six input-only GPIOs
  - Six GPIOs needed for in-package flash (ESP32-U4WDH) and in-package PSRAM (ESP32-D0WDR2-V3)
- 12-bit SAR ADC up to 18 channels
- Two 8-bit DAC
- 10 touch sensors
- Four SPI interfaces
- Two I2S interfaces
- Two I2C interfaces
- Three UART interfaces
- One host (SD/eMMC/SDIO)
- One slave (SDIO/SPI)
- Pulse count controller
- Ethernet MAC interface with dedicated DMA and IEEE 1588 support
- TWAI®, compatible with ISO 11898-1 (CAN Specification 2.0)
- RMT (TX/RX)

- Motor PWM
- LED PWM up to 16 channels

Power Management

- Fine-resolution power control through a selection of clock frequency, duty cycle, Wi-Fi operating modes, and individual power control of internal components
- Five power modes designed for typical scenarios: Active, Modem-sleep, Light-sleep, Deep-sleep, Hibernation
- Power consumption in Deep-sleep mode is 10 μA
- Ultra-Low-Power (ULP) coprocessors
- RTC memory remains powered on in Deep-sleep mode

Security

- Secure boot
- Flash encryption
- 1024-bit OTP, up to 768-bit for customers
- Cryptographic hardware acceleration:
  - AES
  - Hash (SHA-2)
  - RSA
  - ECC
  - Random Number Generator (RNG)

Applications

With low power consumption, ESP32 is an ideal choice for IoT devices in the following areas:

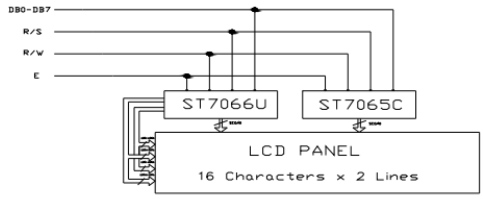
- Smart Home
- Industrial Automation
- Health Care
- Consumer Electronics
- Smart Agriculture
- POS Machines
- Service Robot
- Audio Devices
- Generic Low-power IoT Sensor Hubs
- Generic Low-power IoT Data Loggers
- Cameras for Video Streaming
- Speech Recognition
- Image Recognition
- SDIO Wi-Fi + Bluetooth Networking Card

SHENZHEN EONE ELECTRONICS CO.,LTD

5.0 PIN ASSIGNMENT

No.	Symbol	Level	Function	
1	Vss	--	0V	Power Supply
2	Vdd	--	+5V	
3	V0	--	for LCD	
4	RS	H/L	Register Select: H:Data Input L:Instruction Input	
5	R/W	H/L	H--Read L--Write	
6	E	H,H-L	Enable Signal	
7	DB0	H/L	Data bus used in 8 bit transfer	
8	DB1	H/L		
9	DB2	H/L		
10	DB3	H/L		
11	DB4	H/L	Data bus for both 4 and 8 bit transfer	
12	DB5	H/L		
13	DB6	H/L		
14	DB7	H/L		
15	BLA	--	BLACKLIGHT +5V	
16	BLK	--	BLACKLIGHT 0V-	

6.0 BLOCK DIAGRAM



7.0 POWER SUPPLY BLOCK DIAGRAM

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1. 0 FEATURES

- Display Mode: STN, BLUB
- Display Formate: 16 Character x 2 Line
- Viewing Direction: 6 O'Clock
- Input Data: 4-Bits or 8-Bits interface available
- Display Font : 5 x 8 Dots
- Power Supply : Single Power Supply (5V±10%)
- Driving Scheme : 1/16Duty,1/5Bias
- BACKLIGHT (SIDE) : LED (WHITE)

2.0 ABSOLUTE MAXIMUM

Item	Symbol	Min.	Max.	Unit
Power Supply for logic	Vdd	-0.3	+7.0	V
Power supply for LCD Drive	Vlcd	Vdd-10.0	Vdd+0.3	V
Input Voltage	Vi	-0.3	Vdd+0.3	V
Operating Temperature	Ta	0	+50	℃
Storage Temperature	Tstg	-10	+60	℃

3.0ELECTRICAL CHARACTERISTICS

(Ta=25℃;Vdd=3.0V±10%,otherwise specified)

Item	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Power Supply for Logic	Vdd	--	4.7	5.0	5.5	V
Operating Voltage for LCD	Vdd-Vo	--	--	5.0	--	V
Input High voltage	Vih	--	2.2	--	Vdd	V
Input Low voltage	Vil	--	-0.3	--	0.6	V
Output High voltage	Voh	-Ioh=0.2mA	2.4	--	--	V
Output Low voltage	Vol	Iol=1.2mA	--	--	0.4	V
Power supply current	Idd	Vdd=3.0v	--	1.1	--	mA

4.0 MECHANICAL PARAMETERS

Item	Description	Unit
PCB Dimension	80.0*36.0*1.6	mm
View Dimension	69.5*14.5	mm

Lampiran 5 Form Bimbingan Tugas akhir 1

HALAMAN BIMBINGAN

LAPORAN TUGAS AKHIR

NAMA : GILANG PERMADI

NIM : 22010005

JUDUL : RANCANG BANGUN SISTEM KEAMANAN BIODIGESTER PORTABEL DENGAN MENGGUNAKAN MIKROKONTROLER ESP32 DAN INTERNET OF THINGS (IOT)

PEMBIMBING 1 : ULIL ALBAB, M.T

No	Tanggal	Uraian	TTD
1	22/4 2025	- Acc judul - Revisi Bab I dan Bab II	
2	23/5 2025	- Acc Bab I - Acc Bab II	
3	23/6 2025	- flowchart Sistem - Alur proses IOT - rangkaian / wiring Diagram alat	
4	11/7 2025	- cara kerja alat - Proses IOT	
5	15/7 2025	- Acc Bab III	
6	18/7 2025	- Projek alat Blynk di cantumkan	
7	25/7 2025	- Pengukuran Alat di Lengkapi	
8	28/7 2025	- Kesimpulan Revisi - Daftar Pustaka minimal 10 referensi	
9	30/7 2025	Acc sidang TA	

111

Lampiran 6 Form Bimbingan Tugas akhir 2

HALAMAN BIMBINGAN

LAPORAN TUGAS AKHIR

NAMA : GILANG PERMADI

NIM : 22010005

JUDUL : RANCANG BANGUN SISTEM KEAMANAN BIODIGESTER PORTABEL DENGAN MENGGUNAKAN MIKROKONTROLER ESP32 DAN INTERNET OF THINGS (IOT)

PEMBIMBING : MARTSELANI ADIAS SABARA, M.Kom.

No	Tanggal	Uraian	TTD
1	Senin 2 Juni 2025	Judul dll Revisi alur proget gambar dll Boleh di perjelas alur kerja	
2	23 juli 2025	Acc bab I	
3	23 juli 2025	Revisi bab II judul tabel yang boleh dipisah	
4	23 juli 2025	Acc bab II	
5	28 juli 2025	Revisi Bab III keterangan Gambar dll ada	
6	29 juli 2025	Acc bab III	
7	30 juli 2025	Revisi bab IV keterangan tabel upi Gbr dll sesuai tugas ini tabel	

HALAMAN BIMBINGAN

LAPORAN TUGAS AKHIR

NAMA : GILANG PERMADI

NIM : 22010005

JUDUL : RANCANG BANGUN SISTEM KEAMANAN BIODIGESTER PORTABEL DENGAN MENGGUNAKAN MIKROKONTROLER ESP32 DAN INTERNET OF THINGS (IOT)

PEMBIMBING 2 : MARTSELANI ADIAS SABARA, M.Kom.

No	Tanggal	Uraian	TTD
1	29 juli 2025	Acc bab IV	
2	29 juli 2025	Acc bab V	
3			
4			
5			
6			
7			
8			
9			

Lampiran 7 Penilaian Bimbingan Tugas Akhir Individu

PENILAIAN BIMBINGAN TUGAS AKHIR INDIVIDU

Judul : RANCANG BANGUN SISTEM KEAMANAN BIODIGESTER PORTABEL DENGAN MENGGUNAKAN MIKROKONTROLER ESP32 DAN INTERNET OF THINGS (IOT

Nama : Gilang Permadi

NIM : 22010005

Kelas : 6A / D3 Teknik Elektronika

I. Nilai Bimbingan Tugas Akhir (Pembimbing I)

No	Unsur Yang Dinilai	Nilai
1	Kedisiplinan dalam bimbingan	70
2	Kreativitas pemecahan dalam bimbingan	75
3	Penguasaan materi tugas akhir	85
4	Kelengkapan dan referensi tugas akhir	80
Total Nilai = (Jumlah Nilai / 4)		77,5

II. Nilai Bimbingan Tugas Akhir (Pembimbing II)

No	Unsur Yang Dinilai	Nilai
1	Kedisiplinan dalam bimbingan	70
2	Kreativitas pemecahan dalam bimbingan	70
3	Penguasaan materi tugas akhir	80
4	Kelengkapan dan referensi tugas akhir	80
Total Nilai = (Jumlah Nilai / 4)		75

Nilai Bimbingan = $\frac{77.5 + 75}{2} = 76,25$

Tegal, 29 Juli 2025

Mengetahui,

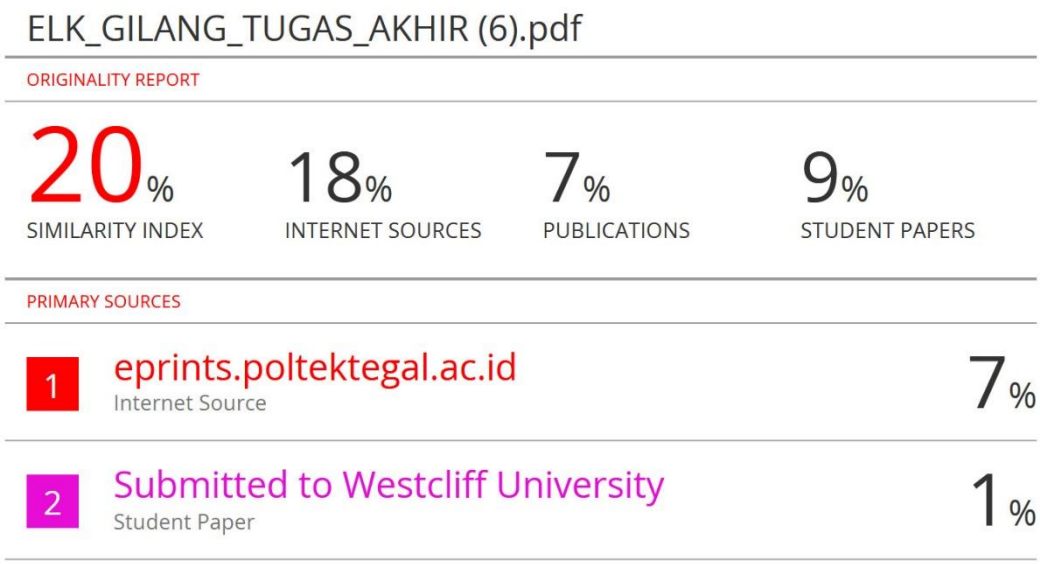
Pembimbing 1

Ulil Albab. M,T

Pembimbing 2

Martselani Adias Sabara, M.KOM

Lampiran 8 Tesk Plagiasi



ELK_GILANG_TUGAS_AKHIR (6).pdf

ORIGINALITY REPORT

20%	18%	7%	9%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

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