

LAMPIRAN

Lampiran - 1 Program alat

```
#include <LiquidCrystal_I2C.h>

LiquidCrystal_I2C lcd(0x27,16,2);

unsigned long T0=0, T1=0, TC;

float C,VC;

bool cetak=0, ok=0, start=0 , count=0;

void setup() {
    //Serial.begin(9600);

    pinMode(A1,INPUT);

    lcd.init();

    lcd.backlight();
}

void loop() {

    if(digitalRead(A1)==LOW) {
        if(!start && !count){
            lcd.setCursor(0,0);

            lcd.print("Mode-1 Discharge");
        }

        if(analogRead(A0)==1023 && !start) {
            start=1; count=1;

            lcd.setCursor(0,1);

            lcd.print("Mulai Vc = 5.0V ");
            //lcd.print("                ");
        }

        if(analogRead(A0)==1023) {
            T0=micros();

            //T0=millis();

            ok=1;
        }
    }
}
```

```

    }

    if(analogRead(A0)==376 && ok) {

        T1=micros();

        //T1=millis();

        cetak=1;

    }

    if(cetak && ok) {

        TC = T1-T0;

        lcd.clear();

        /*

        Serial.print("Time Constant : ");

        Serial.print(TC*0.001);

        Serial.println(" mS");

        */

        lcd.setCursor(0,0);

        lcd.print("TC = ");

        lcd.print(TC*0.001,0);

        lcd.print(" mS");

        C = TC/100000.0;

        lcd.setCursor(0,1);

        lcd.print("C = "); lcd.print(C,0); lcd.print(" uF");

        cetak=0; ok=0; start=0;

    }

    VC=analogRead(A0)*5.0/1023;

    if(VC>=2.0 && VC<=4.0) {

        lcd.setCursor(0,1);

        lcd.print(" Vc = ");lcd.print(VC); lcd.print(" V ");

    }

}

//===== Mode-2 =====

if(digitalRead(A1)==1) {

```

```

    if(!start && !count){
        lcd.setCursor(0,0);
        lcd.print("Mode-2 Charging ");
    }

    if(analogRead(A0)==0 && !start) {
        start=1; count=1;
        lcd.setCursor(0,1);
        lcd.print("Mulai Vc = 0.0V ");
        //lcd.print("                ");
    }

    if(analogRead(A0)==0) {
        T0=micros();
        //T0=millis();
        ok=1;
    }

    if(analogRead(A0)==647 && ok) {
        T1=micros();
        //T1=millis();
        cetak=1;
    }

    if(cetak && ok) {
        TC = T1-T0;
        lcd.clear();
        /*
        Serial.print("Time Constant : ");
        Serial.print(TC*0.001);
        Serial.println(" mS");
        */
        lcd.setCursor(0,0);
    }

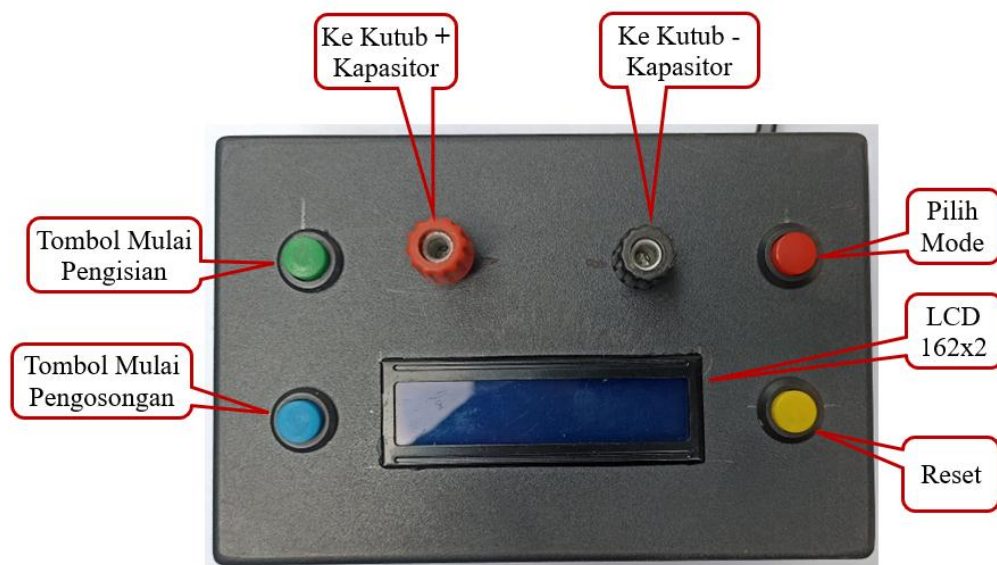
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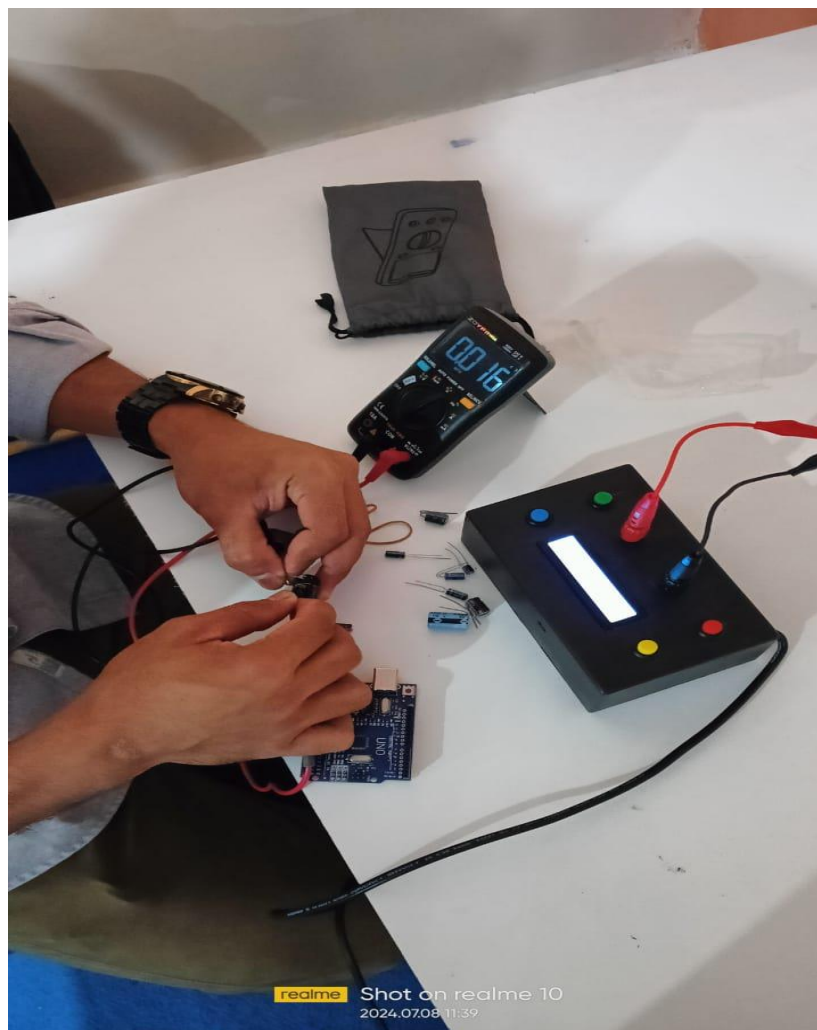
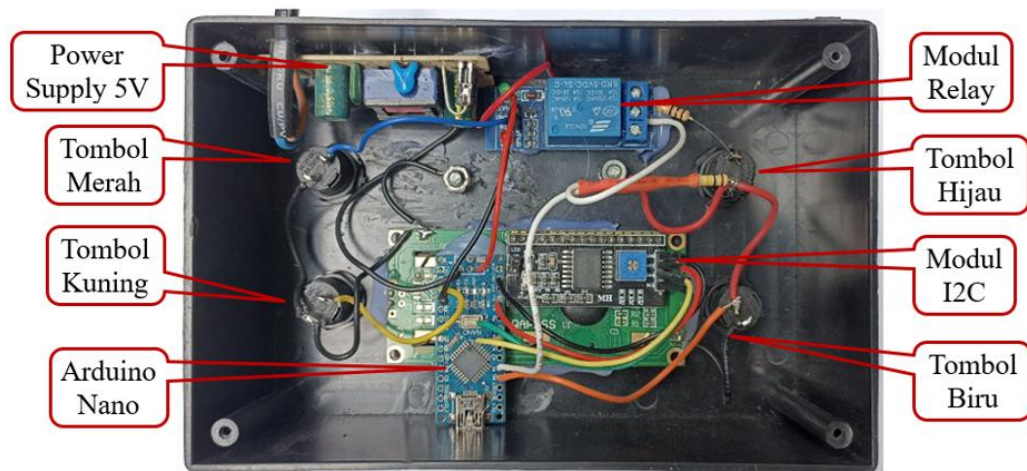
```

    lcd.print("TC = ");
    lcd.print(TC*0.001,0);
    lcd.print(" mS");
    C = TC/100000.0;
    lcd.setCursor(0,1);
    lcd.print("C = "); lcd.print(C,0); lcd.print(" uF");
    cetak=0; ok=0; start=0;
}
VC=analogRead(A0)*5.0/1023;
if(VC>=0.5 && VC<=3.0) {
    lcd.setCursor(0,1);
    lcd.print(" Vc = ");lcd.print(VC); lcd.print(" V ");
}
}
}

```

Lampiran - 2 Alat penelitian





Lampiran – 3 datasheet

1. Arduino nano



Arduino® Nano

Product Reference Manual

SKU: A000005



Description

Arduino® Nano is an intelligent development board designed for building faster prototypes with the smallest dimension. Arduino Nano being the oldest member of the Nano family, provides enough interfaces for your breadboard-friendly applications. At the heart of the board is **ATmega328 microcontroller** clocked at a frequency of 16 MHz featuring more or less the same functionalities as the Arduino® Duemilanove. The board offers 20 digital input/output pins, 8 analog pins, and a mini-USB port.

Target Areas

Maker, Security, Environmental, Robotics and Control Systems

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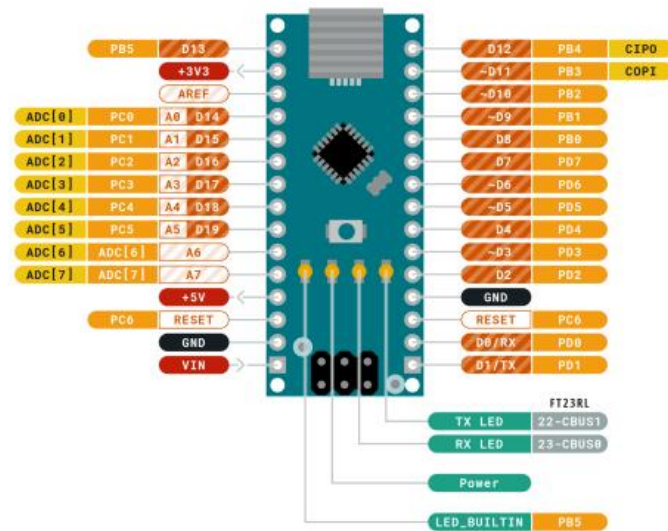
Features

- **ATmega328** Microcontroller
 - High-performance low-power 8-bit processor
 - Achieve up to 16 MIPS for 16 MHz clock frequency
 - 32 kB of which 2 kB used by bootloader
 - 2 kB internal SRAM
 - 1 kB EEPROM
 - 32 x 8 General Purpose Working Registers
 - Real Time Counter with Separate Oscillator
 - Six PWM Channels
 - Programmable Serial USART
 - Master/Slave SPI Serial Interface
- **Power**
 - Mini-B USB connection
 - 7-15V unregulated external power supply (pin 30)
 - 5V regulated external power supply (pin 27)
- **Sleep Modes**
 - Idle
 - ADC Noise Reduction
 - Power-save
 - Power-down
 - Standby
 - Extended Standby
- **I/O**
 - 20 Digital
 - 8 Analog
 - 6 PWM Output

Activ
Go to !



ARDUINO NANO



Ground	Internal Pin	Digital Pin	Microcontroller's Port
Power	SWD Pin	Analog Pin	
LED	Other Pin	Default	

ARDUINO.CC



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5.1 Analog

Pin	Function	Type	Description
1	+3V3	Power	5V USB Power
2	A0	Analog	Analog input 0 /GPIO
3	A1	Analog	Analog input 1 /GPIO
4	A2	Analog	Analog input 2 /GPIO
5	A3	Analog	Analog input 3 /GPIO
6	A4	Analog	Analog input 4 /GPIO
7	A5	Analog	Analog input 5 /GPIO
8	A6	Analog	Analog input 6 /GPIO
9	A7	Analog	Analog input 7 /GPIO
10	+5V	Power	+5V Power Rail
11	Reset	Reset	Reset
12	GND	Power	Ground
12	VIN	Power	Voltage Input

5.2 Digital

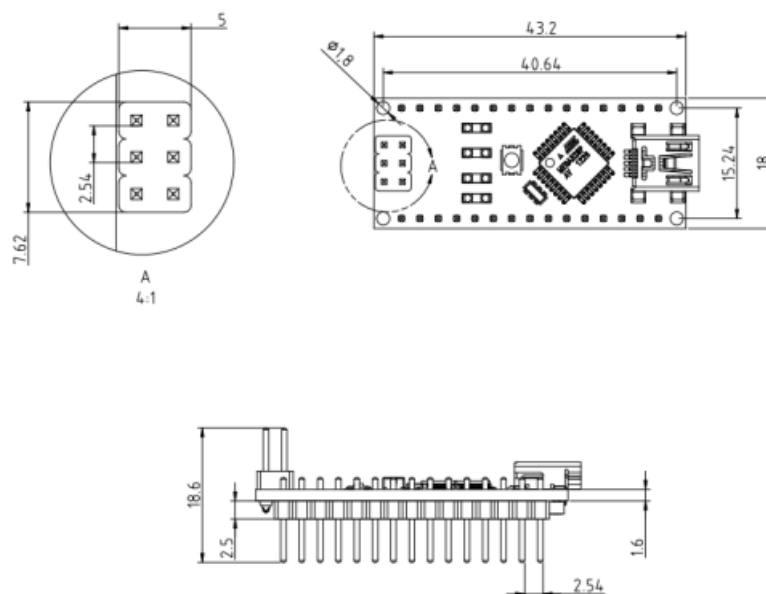
Pin	Function	Type	Description
1	D1/TX1	Digital	Digital Input 1 /GPIO
2	D0/RX0	Digital	Digital Input 0 /GPIO
3	D2	Digital	Digital Input 2 /GPIO
4	D3	Digital	Digital Input 3 /GPIO
5	D4	Digital	Digital Input 4 /GPIO
6	D5	Digital	Digital Input 5 /GPIO
7	D6	Digital	Digital Input 6 /GPIO
8	D7	Digital	Digital Input 7 /GPIO
9	D8	Digital	Digital Input 8 /GPIO
10	D9	Digital	Digital Input 9 /GPIO
11	D10	Digital	Digital Input 10 /GPIO
12	D11	Digital	Digital Input 11 /GPIO
13	D12	Digital	Digital Input 12 /GPIO
14	D13	Digital	Digital Input 13 /GPIO
15	Reset	Reset	Reset
16	GND	Power	Ground

5.3 ATmega328

Pin	Function	Type	Description
1	PB0	Internal	Serial Wire Debug
2	PB1	Internal	Serial Wire Debug
3	PB2	Internal	Serial Wire Debug
4	PB3	Internal	Serial Wire Debug
5	PB4	Internal	Serial Wire Debug
6	PB5	Internal	Serial Wire Debug

6 Mechanical Information

ARDUINO
NANO
Size



Mechanical dimensions of Arduino Nano

2020/11/19

2. relay 1 channel



HT

Handson Technology

User Guide

1 Channel 5V Optical Isolated Relay Module

This is a LOW Level 5V 1-channel relay interface board, needs a 15-20mA driver current. It can be used to control various appliances and equipment with large current. It is equipped with high-current relays that work under AC250V 10A or DC30V 10A. It has a standard interface that can be controlled directly by microcontroller. This module is optically isolated from high voltage side for safety requirement and also prevent ground loop when interface to microcontroller.

SKU: [MDU1091](#)

Brief Data:

- Operating Voltage: 5Vdc.
- Relay Maximum output: DC 30V/10A, AC 250V/10A.
- 1 Channel Relay Module with Opto-coupler. LOW Level Trigger expansion board, which is compatible with Arduino control board.
- Standard interface that can be controlled directly by microcontroller (8051, AVR, *PIC, DSP, ARM, ARM, MSP430, TTL logic).
- Relay of high quality low noise relays SPDT. A common terminal, a normally open, one normally closed terminal.
- Opto-Coupler isolation, for high voltage safety and prevent ground loop with microcontroller.

1

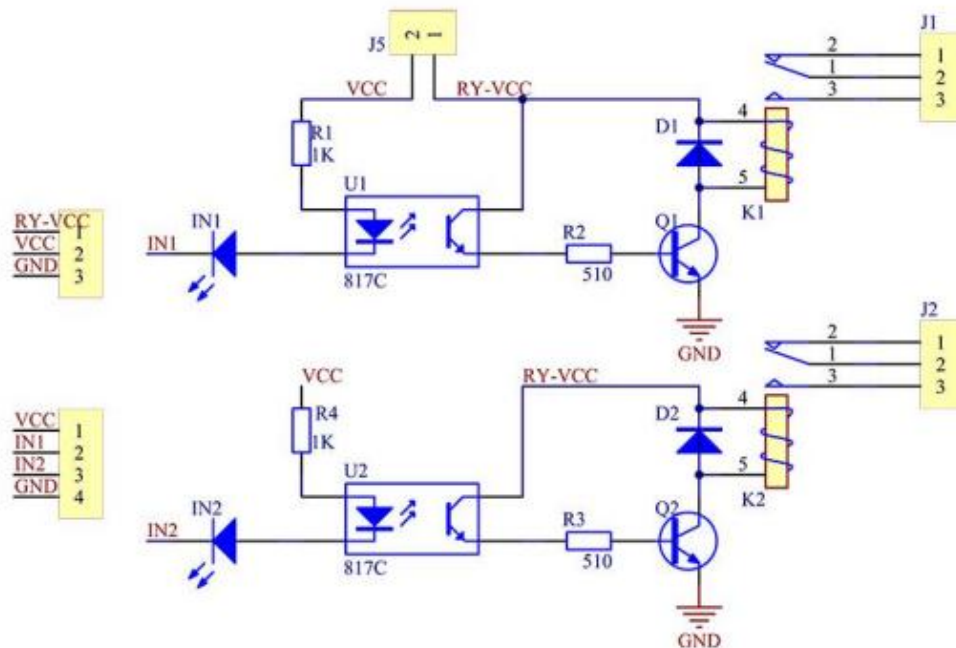
www.handsontec.com

Schematic:

VCC and RY-VCC are also the power supply of the relay module. When you need to drive a large power load, you can take the jumper cap off and connect an extra power to RY-VCC to supply the relay; connect VCC to 5V of the MCU board to supply input signals.

NOTES: If you want complete optical isolation, connect "Vcc" to Arduino +5 volts but do NOT connect Arduino Ground. Remove the Vcc to JD-Vcc jumper. Connect a separate +5 supply to "JD-Vcc" and board Gnd. This will supply power to the transistor drivers and relay coils.

If relay isolation is enough for your application, connect Arduino +5 and Gnd, and leave Vcc to JD-Vcc jumper in place.



It is sometimes possible to use this relay boards with 3.3V signals, if the JD-VCC (Relay Power) is provided from a +5V supply and the VCC to JD-VCC jumper is removed. That 5V relay supply could be totally isolated from the 3.3V device, or have a common ground if opto-isolation is not needed. If used with isolated 3.3V signals, VCC (To the input of the opto-isolator, next to the IN pins) should be connected to the 3.3V device's +3.3V supply.

NOTE: Some Raspberry-Pi users have found that some relays are reliable and others do not actuate sometimes. It may be necessary to change the value of R1 from 1000 ohms to something like 220 ohms, or supply +5V to the VCC connection.

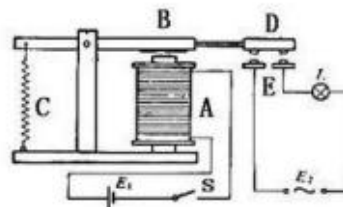
NOTE: The digital inputs from Arduino are Active LOW: The relay actuates and LED lights when the input pin is LOW, and turns off on HIGH.

Module Layout:



Operating Principle:

See the picture below: A is an electromagnet, B armature, C spring, D moving contact, and E fixed contacts. There are two fixed contacts, a normally closed one and a normally open one. When the coil is not energized, the normally open contact is the one that is off, while the normally closed one is the other that is on.



Supply voltage to the coil and some currents will pass through the coil thus generating the electromagnetic effect. So the armature overcomes the tension of the spring and is attracted to the core, thus closing the moving contact of the armature and the normally open (NO) contact or you may say releasing the former and the normally closed (NC) contact. After the coil is de-energized, the electromagnetic force disappears and the armature moves back to the original position, releasing the moving contact and normally closed contact. The closing and releasing of the contacts results in power on and off of the circuit.

Input:

VCC : Connected to positive supply voltage (supply power according to relay voltage)

GND : Connected to supply ground.

3. LCD I2C 16x2



Handson Technology

User Guide

I2C Serial Interface 1602 LCD Module

This is I2C interface 16x2 LCD display module, a high-quality 2 line 16 character LCD module with on-board contrast control adjustment, backlight and I2C communication interface. For Arduino beginners, no more cumbersome and complex LCD driver circuit connection. The real significance advantages of this I2C Serial LCD module will simplify the circuit connection, save some I/O pins on Arduino board, simplified firmware development with widely available Arduino library.



SKU: [DSP-1182](#)

Brief Data:

- Compatible with Arduino Board or other controller board with I2C bus.
- Display Type: Negative white on Blue backlight.
- I2C Address: 0x38-0x3F (0x3F default)
- Supply voltage: 5V
- Interface: I2C to 4bits LCD data and control lines.
- Contrast Adjustment: built-in Potentiometer.
- Backlight Control: Firmware or jumper wire.
- Board Size: 80x36 mm.

Setting Up:

Hitachi's HD44780 based character LCD are very cheap and widely available, and is an essential part for any project that displays information. Using the LCD piggy-back board, desired data can be displayed on the LCD through the I2C bus. In principle, such backpacks are built around PCF8574 (from NXP) which is a general purpose bidirectional 8 bit I/O port expander that uses the I2C protocol. The PCF8574 is a silicon CMOS circuit provides general purpose remote I/O expansion (an 8-bit quasi-bidirectional) for most microcontroller families via the two-line bidirectional bus (I2C-bus). Note that most piggy-back modules are centered around PCF8574T (SO16 package of PCF8574 in DIP16 package) with a default slave address of 0x27. If your piggy-back board holds a PCF8574AT chip, then the default slave address will change to 0x3F. In short, if the piggy-back board is based on PCF8574T and the address connections (A0-A1-A2) are not bridged with solder it will have the slave address 0x27.



Address selection pads in the I2C-to-LCD piggy-back board.

Table 5. PCF8574A address map

Pin connectivity			Address of PCF8574A								Address byte value		7-bit hexadecimal address without R/W
A2	A1	A0	A6	A5	A4	A3	A2	A1	A0	R/W	Write	Read	
V _{SS}	V _{SS}	V _{SS}	0	1	1	1	0	0	0	-	70h	71h	38h
V _{SS}	V _{SS}	V _{DD}	0	1	1	1	0	0	1	-	72h	73h	39h
V _{SS}	V _{DD}	V _{SS}	0	1	1	1	0	1	0	-	74h	75h	3Ah
V _{SS}	V _{DD}	V _{DD}	0	1	1	1	0	1	1	-	76h	77h	3Bh
V _{DD}	V _{SS}	V _{SS}	0	1	1	1	1	0	0	-	78h	79h	3Ch
V _{DD}	V _{SS}	V _{DD}	0	1	1	1	1	0	1	-	7Ah	7Bh	3Dh
V _{DD}	V _{DD}	V _{SS}	0	1	1	1	1	1	0	-	7Ch	7Dh	3Eh
V _{DD}	V _{DD}	V _{DD}	0	1	1	1	1	1	1	-	7Eh	7Fh	3Fh

Address Setting of PCD8574A (extract from PCF8574A data specs).

Note: When the pad A0~A2 is open, the pin is pull up to VDD. When the pin is solder shorted, it is pull down to VSS.

The default setting of this module is A0~A2 all open, so is pull up to VDD. The address is 3Fh in this case.

Reference circuit diagram of an Arduino-compatible LCD backpack is shown below. What follows next is information on how to use one of these inexpensive backpacks to interface with a microcontroller in ways it was exactly intended.

Lampiran – 4 Kartu monitoring bimbingan

1. Kartu monitoring bimbingan proposal

KARTU MONITORING BIMBINGAN
MAHASISWA PROGRAM STUDI TEKNIK ELEKTRO
FAKULTAS TEKNIK
UNIVERSITAS MUHAMMADIYAH PAREPARE

PROPOSAL

Mahasiswa : Andi Wahyu Febrian	Pembimbing I : Ir. A. Abd. Jabbar, MT.
NIM : 218180022	Pembimbing II : A. Irmayani Pawelloi ST., MT.
Judul Skripsi : Perancangan Alat Ukur Konstanta Waktu Resistor Kapasitor (RC)	

ARAHAN PEMBIMBING I	HARI/TGL & PARAF PEMBIMBING	ARAHAN PEMBIMBING II	HARI/TGL & PARAF PEMBIMBING
Konsultasi 1 Judul ditambahkan untuk pengutaraan Rangkaian RL.		Konsultasi 1 Perbaiki D.F. Perbanyak foto Jurnal	31/5/2024 stx.
Konsultasi 2 Perengkap materi. (teori).		Konsultasi 2	
Konsultasi 3 membuat desain 3D dan mentokan membuat simulasi.		Konsultasi 3	
Konsultasi 4 proses perancangan lebih difokuskan pada rangkaian RC. kon. RT.		Konsultasi 4	
Konsultasi 5 ok proposal. 31/6/2024		Konsultasi 5	

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
Lanjutan ...

ARAHAN PEMBIMBING I	HARI/TGL & PARAF PEMBIMBING	ARAHAN PEMBIMBING II	HARI/TGL & PARAF PEMBIMBING
Konsultasi 6		Konsultasi 6	
Konsultasi 7		Konsultasi 7	
Konsultasi 8		Konsultasi 8	
Konsultasi 9		Konsultasi 9	
Konsultasi 10		Konsultasi 10	

Mengetahui
Ketua Program Studi

Asrul, ST., MT.
NBM. 986 836

Parepare, 31-05-2024

Mahasiswa

Andi Wahyu Febrian
NIM. 218180022

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2. Kartu monitoring bimbingan skripsi

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SKRIPSI

Mahasiswa : Andi Wahyu Febrian	Pembimbing I : Ir. A. Abd. Jabbar, MT.
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ARAHAN PEMBIMBING I	HARI/TGL & PARAF PEMBIMBING	ARAHAN PEMBIMBING II	HARI/TGL & PARAF PEMBIMBING
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Konsultasi 2 gambar rangkaian	[Signature]	Konsultasi 2 Aksi	4/1
Konsultasi 3 Buat tabel presentasi kepalahan.	[Signature]	Konsultasi 3	
Konsultasi 4 Kesimpulan dan Saran.	[Signature]	Konsultasi 4	
Konsultasi 5 dh 20/9/24. Nihil	[Signature]	Konsultasi 5	

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Lanjutan...

ARAHAN PEMBIMBING I	HARI/TGL & PARAF PEMBIMBING	ARAHAN PEMBIMBING II	HARI/TGL & PARAF PEMBIMBING
Konsultasi 6		Konsultasi 6	
Konsultasi 7		Konsultasi 7	
Konsultasi 8		Konsultasi 8	
Konsultasi 9		Konsultasi 9	
Konsultasi 10		Konsultasi 10	

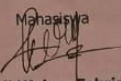
Parepare, 22/7/2024

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Ketua Program Studi



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Mahasiswa



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