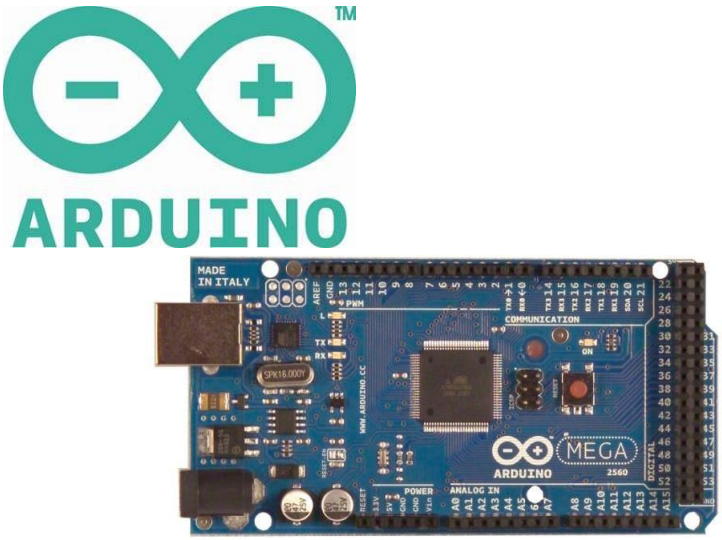
LAMPIRAN A

DATA *SHEET*

1. Data Sheet Arduino Mega 2560



Overview

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560 (datasheet). It has 54 digital *input*/*output* pins (of which 14 can be used as PWM *output*s), 16 analog *input*s, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a *power* jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or *power* it with a AC-to-DC adapter or battery to get started. The Mega is compatible with most shields designed for the Arduino Duemilanove or Diecimila.

The Mega 2560 is an update to the Arduino Mega, which it replaces.

Summary

Microcontroller	ATmega2560
Operating Voltage	5V
Input Voltage (recommended)	7-9V
Input Voltage (limits)	6-20V
Digital I/O Pins	54 (of which 14 provide PWM *output*)
Analog *Input* Pins	16
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	256 KB (8 KB used by bootloader)
SRAM	8 KB
EEPROM	4 KB (ATmega328)
Clock Speed	16 MHz

Schematic & Reference Design

EAGLE files: arduino-mega2560-reference-design.zip
Schematic: arduino-mega2560-schematic.pdf

Power

The Arduino Mega can be *power*ed via the USB connection or with an external *power* supply. The *power* source is selected automatically.

External (non-USB) *power* can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's *power* jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector.

The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

The Mega2560 differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.
The *power* pins are as follows:

– **VIN.**

The *input* voltage to the Arduino board when it's using an external *power* source (as opposed to 5 volts from the USB connection or other regulated *power* source). You can supply voltage through this pin, or, if supplying voltage via the *power* jack, access it through this pin.

– **5V.**

The regulated *power* supply used to *power* the microcontroller and other components on the board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply.

– **3V3.**

3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 Ma.

– **GND.** Ground pins.

Memory

The ATmega2560 has 256 KB of flash memory for storing code (of which 8 KB is used for the bootloader), 8 KB of SRAM and 4 KB of EEPROM (which can be read and written with the EEPROM library).

Input* and *Output

Each of the 54 digital pins on the Mega can be used as an *input* or *output*, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms. In addition, some pins have specialized functions:

– **Serial: 0 (RX) and 1 (TX); Serial 1: 19 (RX) and 18 (TX); Serial 2: 17 (RX) and 16 (TX); Serial 3: 15 (RX) and 14 (TX).** Used to receive (RX) and transmit (TX) TTL serial data. Pins 0 and 1 are also connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.
– **External Interrupts: 2 (interrupt 0), 3 (interrupt 1), 18 (interrupt 5), 19 (interrupt 4), 20 (interrupt 3), and 21 (interrupt 2).** These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attachInterrupt() function for details.
– **PWM: 0 to 13.** Provide 8-bit PWM *output* with the analogWrite() function.
– **SPI: 50 (MISO), 51 (MOSI), 52 (SCK), 53 (SS).** These pins support SPI communication using the SPI library. The SPI pins are also broken out on the ICSP header, which is physically compatible with the Uno, Duemilanove and Diecimila.
– **LED: 13.** There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.
– **I^2C: 20 (SDA) and 21 (SCL).** Support I^2C (TWI) communication using the Wire library

(documentation on the Wiring website). Note that these pins are not in the same location as the I^2C pins on the Duemilanove or Diecimila.

The Mega2560 has 16 analog *inputs*, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and analogReference() function.

2. Ultrasonic Ranging Module HC - SR04

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of work:

(1) Using IO trigger for at least 10us high level signal,

(2) The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.

(3) IF the signal back, through high level , time of high *output* IO duration is the time from sending ultrasonic to returning.

Test distance = (high level time×velocity of sound (340M/S) / 2, λ

Wire connecting direct as following:

- 5V Supply
- Trigger Pulse *Input*
- Echo Pulse *Output*
- 0V Ground

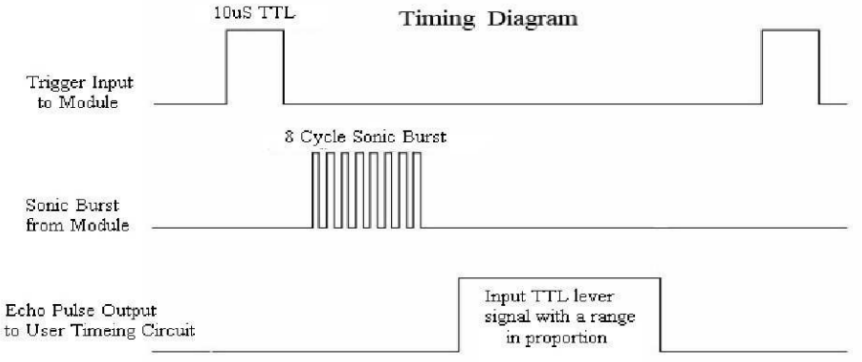
Electric Parameter

Working Voltage	DC 5 V
Working Current	15mA
Working Frequency	40Hz
Max Range	4m
Min Range	2cm
MeasuringAngle	15 degree
Trigger Input Signal	10uS TTL pulse
Echo Output Signal	*Input* TTL lever signal and the range in proportion
*Dimension 45*20*15mm*	Dimension 45*20*15mm

Timing diagram

The Timing diagram is shown below. You only need to supply a short 10uS pulse to the trigger *input* to start the ranging, and then the module will send out an 8 cycle burst of ultrasound at 40 kHz and raise its echo. The Echo is a distance object that is pulse width and the range in proportion .You can calculate the range through the time interval between sending trigger signal and receiving

echo signal. Formula: uS / 58 = centimeters or uS / 148 =inch; or: the range = high level time * velocity (340M/S) / 2; we suggest to use over 60ms measurement cycle, in order to prevent trigger signal to the echo signal.



Attention:

- The module is not suggested to connect directly to electric, if connected electric, the GND terminal should be connected the module first, otherwise, it will affect the normal work of the module.
- When tested objects, the range of area is not less than 0.5 square meters and the plane requests as smooth as possible, otherwise, it will affect the results of measuring.

3. Clock (RTC) DS3231

The DS3231 is a low-cost, extremely accurate I2C realtime *clock* (RTC) with an integrated *temperature*compensated crystal oscillator (TCXO) and crystal. The device incorporates a battery *input*, and maintains accurate timekeeping when main *power* to the device is interrupted. The integration of the crystal resonator enhances the long-term accuracy of the device as well as reduces the piece-part count in a manufacturing line. The DS3231 is available in commercial and industrial *temperature* ranges, and is offered in a 16-pin, 300-mil SO package. The RTC maintains seconds, minutes, hours, day, date, month, and year information. The date at the end of the month is automatically adjusted for months with fewer than 31 days, including corrections for leap year. The *clock* operates in either the 24-hour or 12-hour format with an AM/PM indicator. Two programmable time-ofday alarms and a programmable square-wave *output* are provided. Address and data are transferred serially through an I2C bidirectional bus. A precision *temperature*-compensated voltage reference and comparator circuit monitors the status of VCC to detect *power* failures, to provide a reset *output,* and to automatically switch to the backup supply when necessary. Additionally, the RST pin is monitored as a pushbutton *input* for generating a reset externally.

Features

♦ Accuracy ±2ppm from 0°C to +40°C
♦ Accuracy ±3.5ppm from -40°C to +85°C
♦ Battery Backup *Input* for Continuous Timekeeping
♦ Operating *Temperature* Ranges Commercial: 0°C to +70°C Industrial: -40°C to +85°C
♦ Low-Power Consumption
♦ Real-Time Clock Counts Seconds, Minutes, Hours, Day, Date, Month, and Year with Leap Year Compensation Valid Up to 2100
♦Two Time-of-Day Alarms
♦ Programmable Square-Wave *Output*
♦ Fast (400kHz) I2C Interface
♦ 3.3V Operation
♦ Digital Temp Sensor *Output*: ±3°C Accuracy
♦ Register for Aging Trim
♦ RST *Input*/*Output*

4. Capacitive Soil Moisture

Capacitive Soil Moisture Sensor SKU:SEN0193

Contents

(https://www.dfrobot.com/product-1385.html)
Capacitive Soil Moisture Sensor
(https://www.dfrobot.com/product-1385.html)

Introduction

Our **soil moisture sensor** (https://www.dfrobot.com/product-1385.html) measures soil mositure levels by capacitive sensing rather than resistive sensing like other sensors on the market. It is made of corrosion resistant material which gives it an excellent service life.
Insert it in to the soil around your plants and impress your friends with real-time soil moisture data!
This module includes an on-board voltage regulator which gives it an operating voltage range of 3.3 ~ 5.5V. It is perfect for low-voltage MCUs, both 3.3V and 5V. For compatibility with a Raspberry Pi it will need an ADC converter.
This soil moisture sensor is compatible with our 3-pin "Gravity" interface, which can be directly connected to the Gravity I/O expansion shield.

Specification

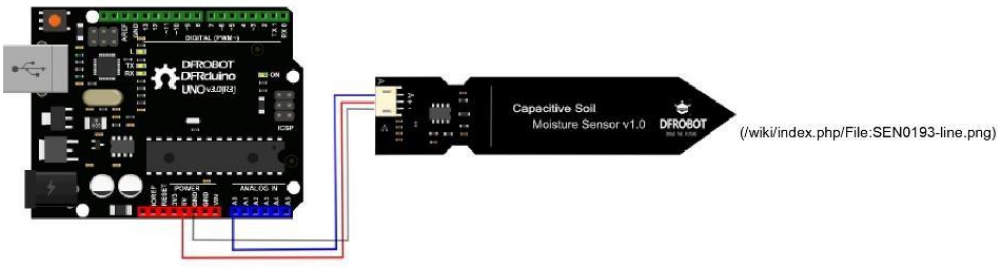
- Operating Voltage: 3.3 ~ 5.5 VDC
- Output Voltage: 0 ~ 3.0VDC
- Operating Current: 5mA
- Interface: PH2.0-3P
- Dimensions: 3.86 x 0.905 inches (L x W)
- Weight: 15g

Tutorial

Requirements

- **Hardware**
  - DFRduino UNO x1
  - Capacitive Soil Moisture Sensor x1
  - Jumper Cable x3
- **Software**
  - Arduino IDE V1.6.5 Click to Download Arduino IDE (https://www.arduino.cc/en/Main/Software)

Connection Diagram



(/wiki/index.php/File:SEN0193-line.png)

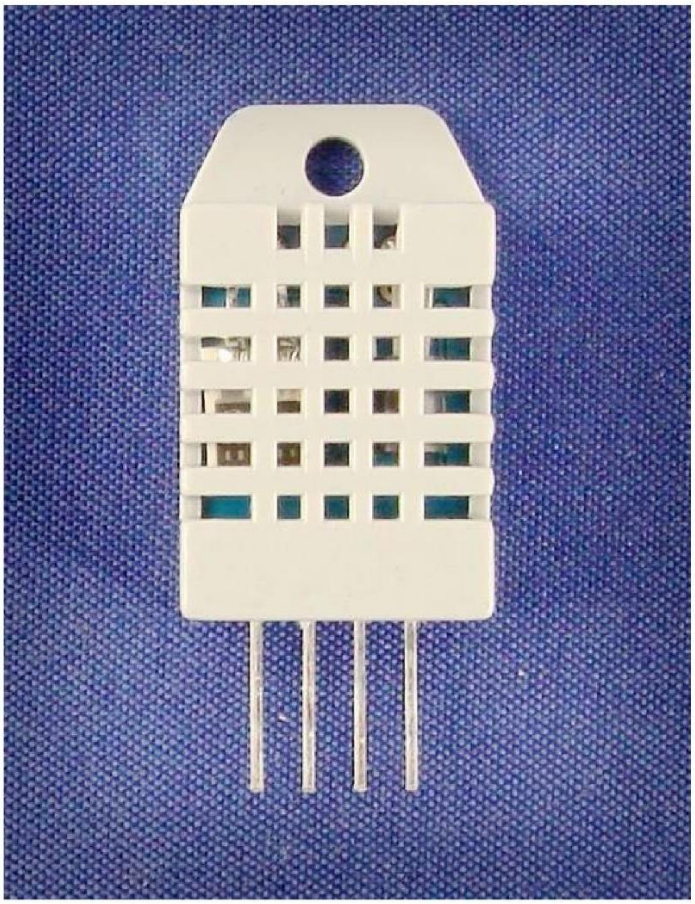
4. DHT 22

Aosong Electronics Co.,Ltd

Your specialist in innovating humidity & temperature sensors

Digital-output relative humidity & temperature sensor/module

DHT22 (DHT22 also named as AM2302)



Capacitive-type humidity and temperature module/sensor

1

Thomas Liu (Business Manager)

Email: thomasliu198518@yahoo.com.cn

Aosong Electronics Co.,Ltd

Your specialist in innovating humidity & temperature sensors

1. Feature & Application:

* Full range temperature compensated * Relative humidity and temperature measurement
* Calibrated digital signal *Outstanding long-term stability *Extra components not needed
* Long transmission distance * Low power consumption *4 pins packaged and fully interchangeable

2. Description:

DHT22 output calibrated digital signal. It utilizes exclusive digital-signal-collecting-technique and humidity sensing technology, assuring its reliability and stability.Its sensing elements is connected with 8-bit single-chip computer.

Every sensor of this model is temperature compensated and calibrated in accurate calibration chamber and the calibration-coefficient is saved in type of programme in OTP memory, when the sensor is detecting, it will cite coefficient from memory.

Small size & low consumption & long transmission distance(20m) enable DHT22 to be suited in all kinds of harsh application occasions.

Single-row packaged with four pins, making the connection very convenient.

3. Technical Specification:

Model	DHT22
Power supply	3.3-6V DC
Output signal	digital signal via single-bus
Sensing element	Polymer capacitor
Operating range	humidity 0-100%RH; temperature -40~80Celsius
Accuracy	humidity +-2%RH(Max +-5%RH); temperature <+-0.5Celsius
Resolution or sensitivity	humidity 0.1%RH; temperature 0.1Celsius
Repeatability	humidity +-1%RH; temperature +-0.2Celsius
Humidity hysteresis	+-0.3%RH
Long-term Stability	+-0.5%RH/year
Sensing period	Average: 2s
Interchangeability	fully interchangeable
Dimensions	small size 14*18*5.5mm; big size 22*28*5mm

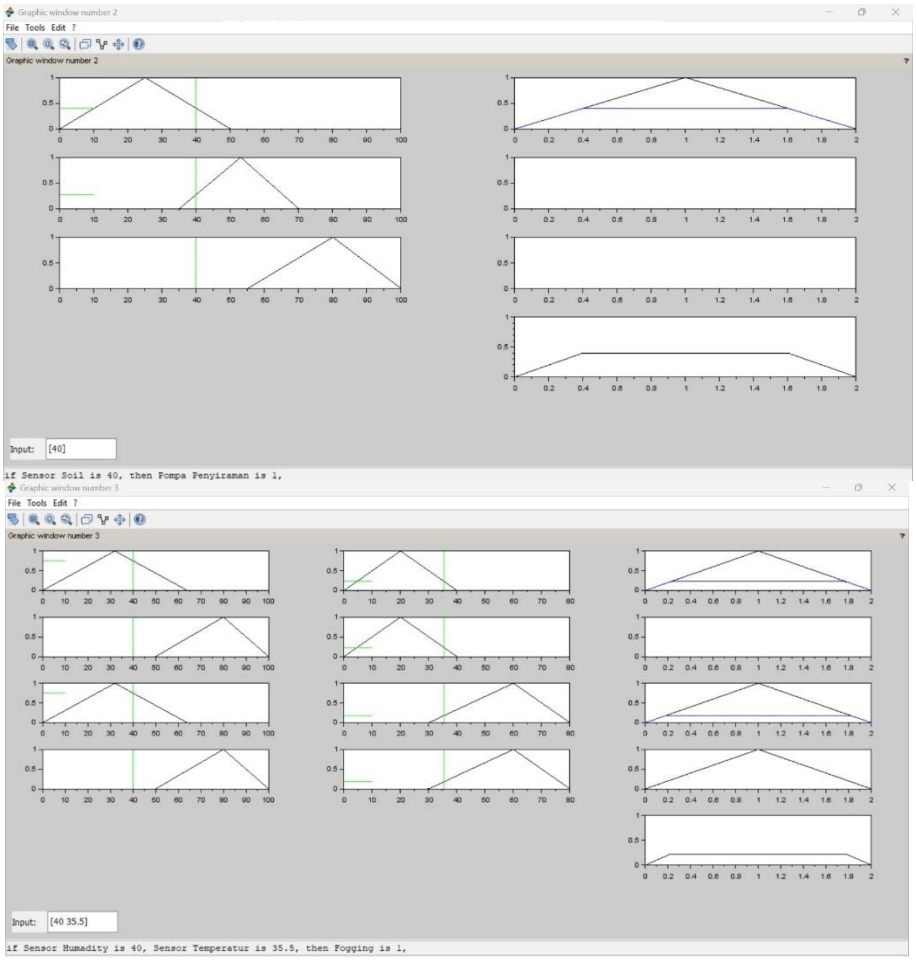
4. Dimensions: (unit----mm)

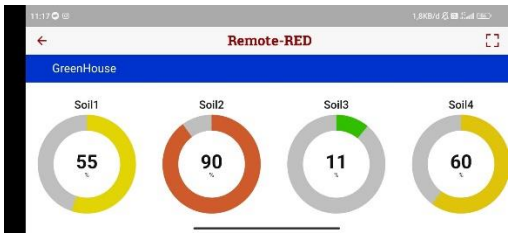
1) Small size dimensions: (unit----mm)

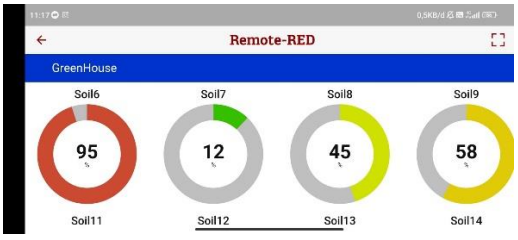
Thomas Liu (Business Manager)

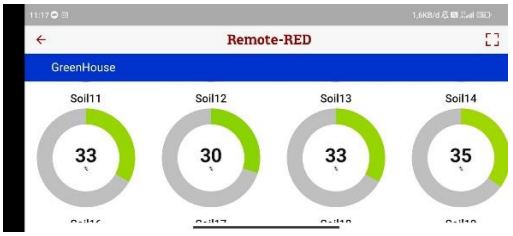
Email: thomasliu198518@yahoo.com.cn

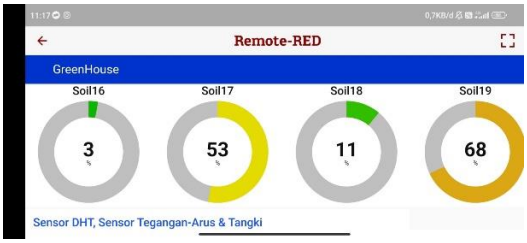
LAMPIRAN B

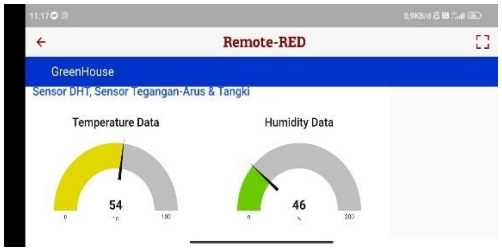

Graphic window number 2
File Tools Edit ?
Graphic window number 2
Input: [40]
if Sensor Soil is 40, then Pompa Penyiraman is 1,
Graphic window number 3
File Tools Edit ?
Graphic window number 3
Input: [40 35.5]
if Sensor Humadity is 40, Sensor Temperatur is 35.5, then Fogging is 1,

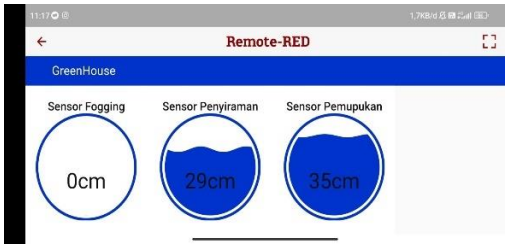

Remote-RED
GreenHouse
Soil1
55
Soil2
90
Soil3
11
Soil4
60

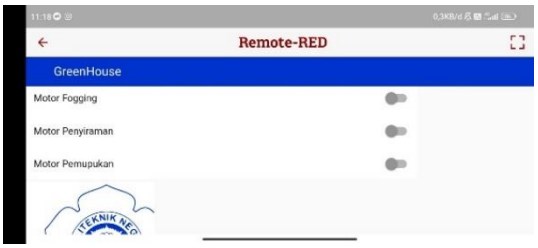

Remote-RED
GreenHouse
Soil6
95
Soil7
12
Soil8
45
Soil9
58
Soil11
Soil12
Soil13
Soil14


Remote-RED
GreenHouse
Soil11
33
Soil12
30
Soil13
33
Soil14
35


Remote-RED
GreenHouse
Soil16
3
Soil17
53
Soil18
11
Soil19
68
Sensor DHT, Sensor Tegangan-Arus & Tangki


Remote-RED
GreenHouse
Sensor DHT, Sensor Tegangan-Arus & Tangki
Temperature Data
Humidity Data
54
46


Remote-RED
GreenHouse
Sensor Fogging
Sensor Penyiraman
Sensor Pemupukan
0cm
29cm
35cm


Remote-RED
GreenHouse
Motor Fogging
Motor Penyiraman
Motor Pemupukan


Sab, 5 Ags 23/14:17
S:755 |T:37°C|Vs:13V
S:57 %|H:56 %|Is:2.A
P:30cm|F:25cm|P:26cm


TEMPERATURE
CLOCK / HUMIDITY
HTC-1

LAMPIRAN C

KEMENTERIAN PENDIDIKAN DAN KEBUDAYAAN
POLITEKNIK NEGERI SRIWIJAYA
Jalan Srijaya Negara, Palembang 30139
Telp. 0711-353414 Fax. 0711-355918
Website : www.polisriwijaya.ac.id E-mail : info@polsri.ac.id

LEMBAR BIMBINGAN LAPORAN TUGAS AKHIR

Lembar : 1

Nama : Rinaldi
NIM : 061940341939
Jurusan/Program Studi : Teknik Elektro / Sarjana Terapan Teknik Elektro
Judul Laporan Tugas Akhir : Implementasi *Fuzzy Logic* Dalam Mengendalikan Input dan Output pada Penyiraman dan Pemupukan Tanaman Otomatis Berbasis IoT
Pembimbing I *) : Yurni Oktarina, S.T., M.T.

No.	Tanggal	Uraian Bimbingan	Tanda Tangan Pembimbing
1.	27-02-2023	Pengajuan Judul	
2.	03-03-2023	Revisi bab 1 proposal	
3.	16-03-2023	Revisi bab 1-2 proposal	
4.	29-03-2023	Acc bab 1 proposal, Revisi bab 2	
5.	03-04-2023	Revisi bab 2, pengajuan bab 3	
6.	02-05-2023	Acc bab 2, Revisi bab 3	
7.	26-05-2023	Mengumpulkan Jurnal	

No.	Tanggal	Uraian Bimbingan	Tanda Tangan Pembimbing
8.	09-06-2023	ACC proposal	
9.	26-06-2023	Bimbingan Bab IV dan V	
10.	28-07-2023	Revisi Bab IV dan V	
11.	31-07-2023	ACC Bab IV dan V	
12.	08-08-2023	Rekomendasi sidang	

Palembang, ...

Koordinator Program Studi
Sarjana Terapan Teknik Elektro

(Masayu Anisah, S.T., M.T.)
NIP 197012281993032001

Catatan:
*) melingkari angka yang sesuai.
Ketua Jurusan/Ketua Program Studi harus memeriksa jumlah pelaksanaan bimbingan sesuai yang dipersyaratkan dalam Pedoman Laporan Akhir sebelum menandatangani lembar bimbingan ini.
Lembar pembimbingan LA ini harus dilampirkan dalam Laporan Akhir.

KEMENTERIAN PENDIDIKAN DAN KEBUDAYAAN
POLITEKNIK NEGERI SRIWIJAYA
Jalan Srijaya Negara, Palembang 30139
Telp. 0711-353414 Fax. 0711-355918
Website : www.polisriwijaya.ac.id E-mail : info@polsri.ac.id

LEMBAR BIMBINGAN LAPORAN TUGAS AKHIR

Lembar : 1

Nama : Rinaldi
NIM : 061940341939
Jurusan/Program Studi : Teknik Elektro / Sarjana Terapan Teknik Elektro
Judul Laporan Tugas Akhir : Implementasi *Fuzzy Logic* Dalam Mengendalikan Input dan Output pada Penyiraman dan Pemupukan Tanaman Otomatis Berbasis IoT
Pembimbing II *) : Dr. Eng. Tresna Dewi, S.T., M.Eng.

No.	Tanggal	Uraian Bimbingan	Tanda Tangan Pembimbing
1.	27-02-2023	Pengajuan Judul	2
2.	03-03-2023	Revisi bab 1 proposal	2
3.	16-03-2023	Revisi bab 1-2 proposal	2
4.	29-03-2023	Acc bab 1 proposal, Revisi bab 2	2
5.	03-04-2023	Revisi bab 2, Pengajuan bab 3	2
6.	02-05-2023	Acc bab 2, Revisi bab 3	2
7.	26-05-2023	Mengumpulkan Jurnal	2

No.	Tanggal	Uraian Bimbingan	Tanda Tangan Pembimbing
8.	05-06-2023	ACC proposal	
9.	26-06-2023	Bimbingan Bab IV dan V	
10.	28-07-2023	Revisi Bab IV dan V	
11.	31-07-2023	ACC Bab IV dan V	
12.	08-08-2023	Rekomendasi sidang	

Palembang, ...

Koordinator Program Studi
Sarjana Terapan Teknik Elektro

(Masayu Anisah, S.T., M.T.)
NIP 197012281993032001

Catatan:
*) melingkari angka yang sesuai.
Ketua Jurusan/Ketua Program Studi harus memeriksa jumlah pelaksanaan bimbingan sesuai yang dipersyaratkan dalam Pedoman Laporan Akhir sebelum menandatangani lembar bimbingan ini.
Lembar pembimbingan LA ini harus dilampirkan dalam Laporan Akhir.

No. Dok. : F-PBM-11

KEMENTERIAN PENDIDIKAN DAN KEBUDAYAAN
RISET DAN TEKNOLOGI
POLITEKNIK NEGERI SRIWIJAYA
Jalan Srijaya Negara, Palembang 30139
Telp. 0711-353414 fax. 0711-355918
Website : www.polisriwijaya.ac.id E-mail : info@polsri.ac.id

REKOMENDASI UJIAN LAPORAN TUGAS AKHIR (TA)

Pembimbing Tugas Akhir memberikan rekomendasi kepada,

Nama	:	Rinaldi
NIM	:	061940341939
Jurusan/Program Studi	:	Teknik Elektro/D4 Teknik Elektro Konsentrasi Mekatronika
Judul Laporan	:	Implementasi *Fuzzy Logic* dalam Mengendalikan *Input* dan *Output* pada Penyiraman dan Pemupukan Tanaman Otomatis Berbasis IoT

Mahasiswa tersebut telah memenuhi persyaratan dan dapat mengikuti Ujian Laporan Tugas Akhir (TA) pada Tahun Akademik 2022/2023.

Palembang, Agustus 2023

Dosen Pembimbing I,	Dosen Pembimbing II,
Yurni Oktarina, S.T., M.T.	**Dr. Eng. Tresna Dewi, S.T., M.Eng.**
NIP. 1977 1016 2008 122001	**NIP. 1977 1125 2000 032001**

KEMENTERIAN PENDIDIKAN DAN KEBUDAYAAN
POLITEKNIK NEGERI SRIWIJAYA
JURUSAN TEKNIK ELEKTRO
Jalan Srijaya Negara, Palembang 30139
Telp. 0711-353414 fax. 0711-355918
Website : www.polisriwijaya.ac.id **E-mail** : info@polsri.ac.id

PELAKSANAAN REVISI LAPORAN TUGAS AKHIR (TA)

Mahasiswa berikut,

Nama	:	Rinaldi
NIM	:	061940341939
Jurusan/Program Studi	:	Teknik Elektro / DIV Teknik Elektro
Judul Laporan Akhir	:	Implementasi *Fuzzy Logic* Dalam Mengendalikan *Input* dan *Output* pada Penyiraman dan Pemupukan Tanaman Otomatis Berbasis IoT

Telah melaksanakan revisi terhadap Laporan Tugas Akhir yang diujikan pada hari jumat tanggal 11 bulan Agustus tahun 2023. Pelaksanaan revisi terhadap Laporan Tugas Akhir tersebut telah disetujui oleh Dosen Penguji yang memberikan revisi:

No	Komentar	Nama Dosen Penguji *)	Tanggal	Tanda Tangan
1.	Telah diperbaiki	Ir. M. Nawawi, M.T.		
2.	Acc. di versi	Amperawan, S.T., M.T.	6/9 2023	
3.	Ok	Sabilal Rasyad, S.T., M.Kom.	22/8 -23	
4.		Yudi Wijanarko, S.T., M.T.	15/8	
5.	ACC	Yeni Irdayanti, S.T., M.Kom.	15/8-23	
6.	Ok	Yurni Oktarina, S.T., M.T.	15/8 2023	

Palembang, Agustus 2023

Ketua Penguji **),

(Ir. M. Nawawi, M.T.)
NIP.196312221991031006