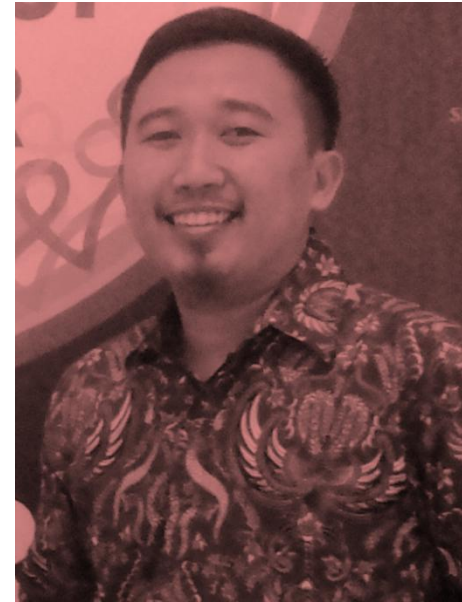


Rudi Susanto

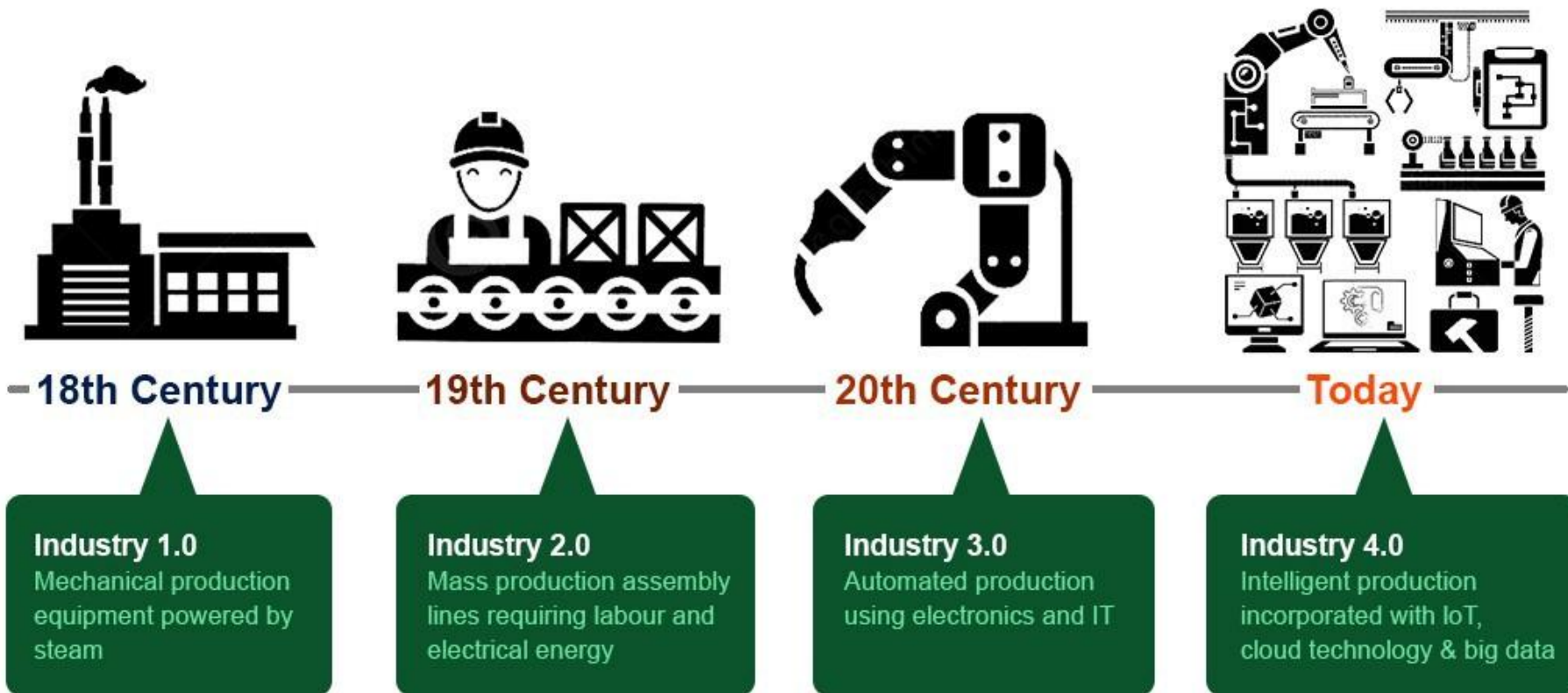
- **SD Pucung 2** Kismantoro , Wonogiri (1998)
- **SMPN 1 Kismantoro** , Wonogiri (2002)
- **SMA N1 Purwantoro** , Wonogiri (2005)
- **S1 Fisika**, Universitas Sebelas Maret (2009)
- S2 Ilmu Fisika **Universitas Sebelas Maret** (2012)
- **S3 in Malaysian Institute of Information Technology (MIIT)**, Universiti Kuala Lumpur (UniKL), Malaysia (2019-Now)
- Research Interests: Physics, **Intrumentation**, Education Technology
- **Certification**: certified labview associate developer (CLAD)
- Dosen di **Universitas Duta Bangsa Surakarta**



Agenda **Webinar IoT**

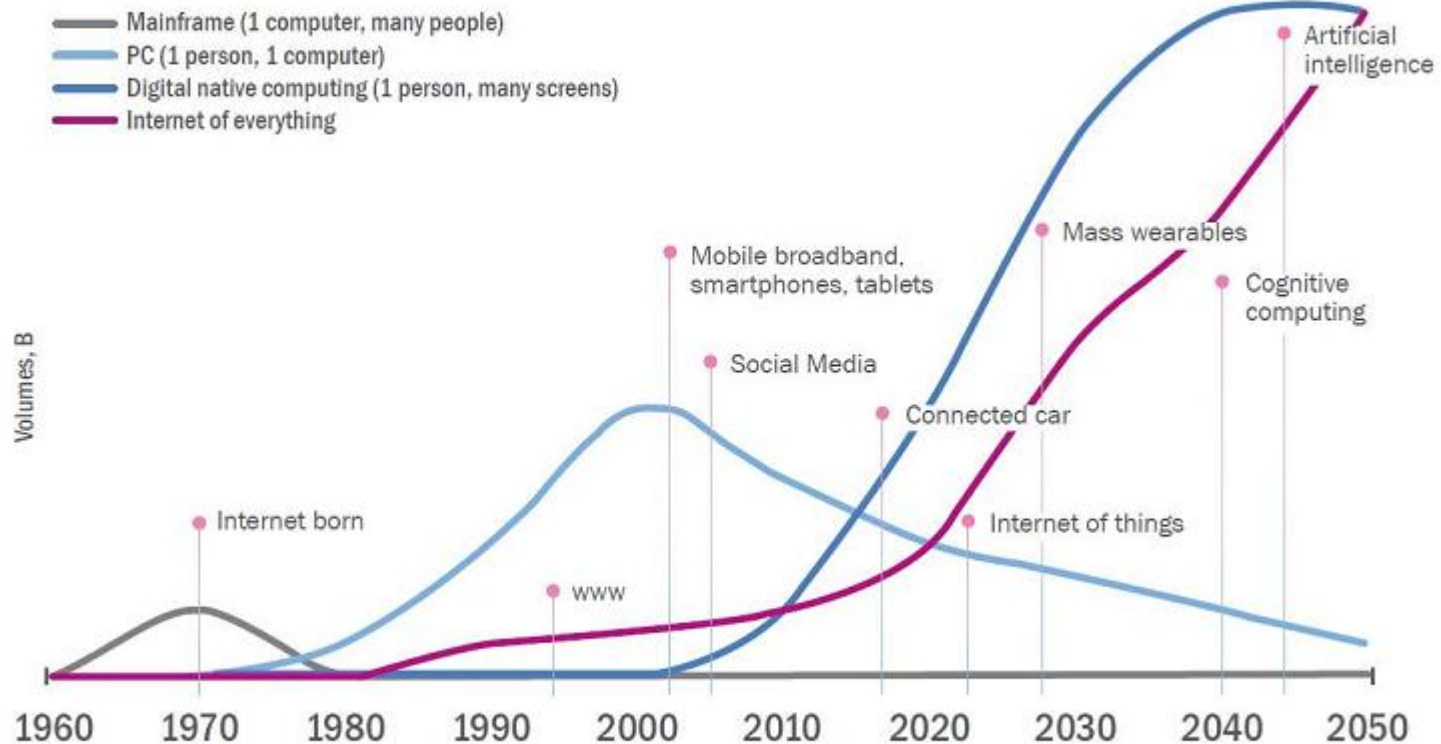
- **Mengenal IoT dan Arduino**
- **Input Output Sensor dan Arduino**
- **Pengendalian dan Kontrol Hardware**
- **Komunikasi Arduino dengan Internet**
- **Web dan mobile application**
- **Project IoT**

Trend Internet of Things (IoT)



Trend Internet of Things (IoT)

One to many to any: ICTs from happy few to the masses



Digital revolution: are we ready? | Mario Maniewicz, Chief, Infrastructure, Enabling environment and ICT applications, ITU/BDT

Apa Itu Internet of Things (IoT)

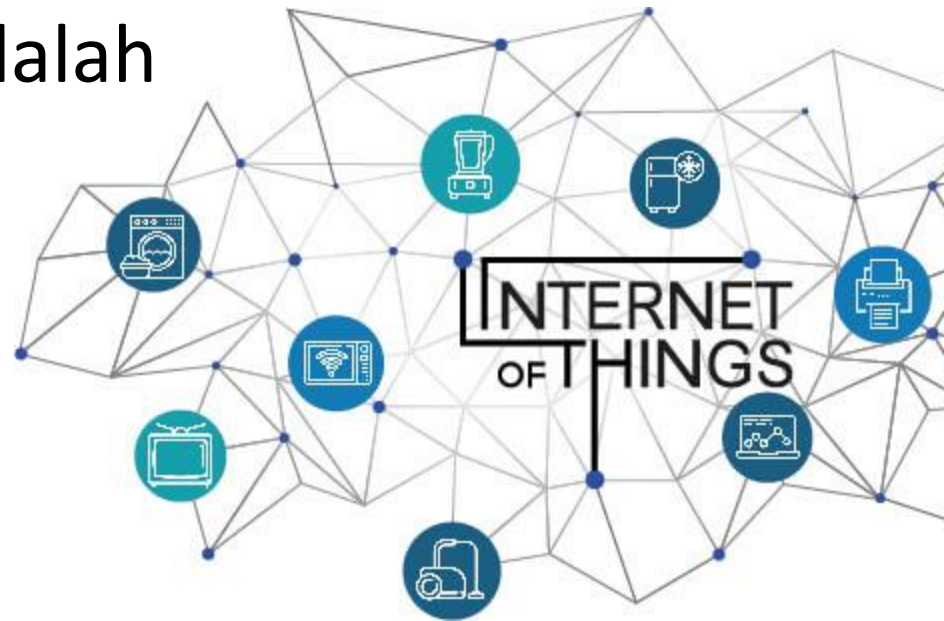
Banyak Definisi tentang Internet of Things (IoT)

***Physical Objects +
Controllers, Sensors,
Actuators + Internet = IoT***



Apa Itu **Internet of Things (IoT)**

IoT **secara sederhana** adalah sebuah konsep yang menghubungkan **semua objek** fisik di kehidupan sehari-hari **ke Internet**.

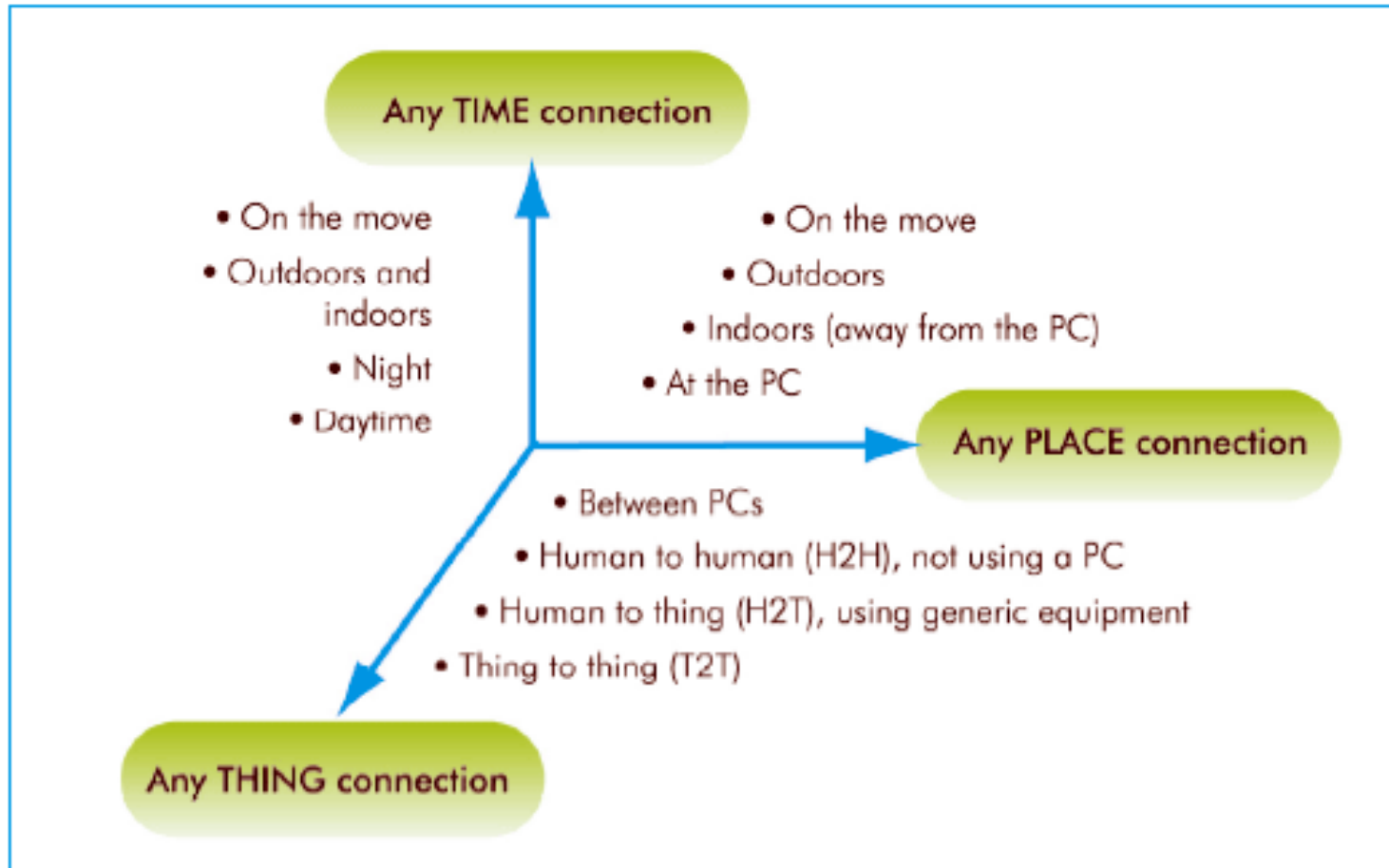


Prinsip Internet of Things (IoT)

- Internet of Things terdiri atas dua bagian utama yaitu
- **(1) Internet** yang mengatur konektivitas
- **(2) Things** yang berarti objek atau perangkat.

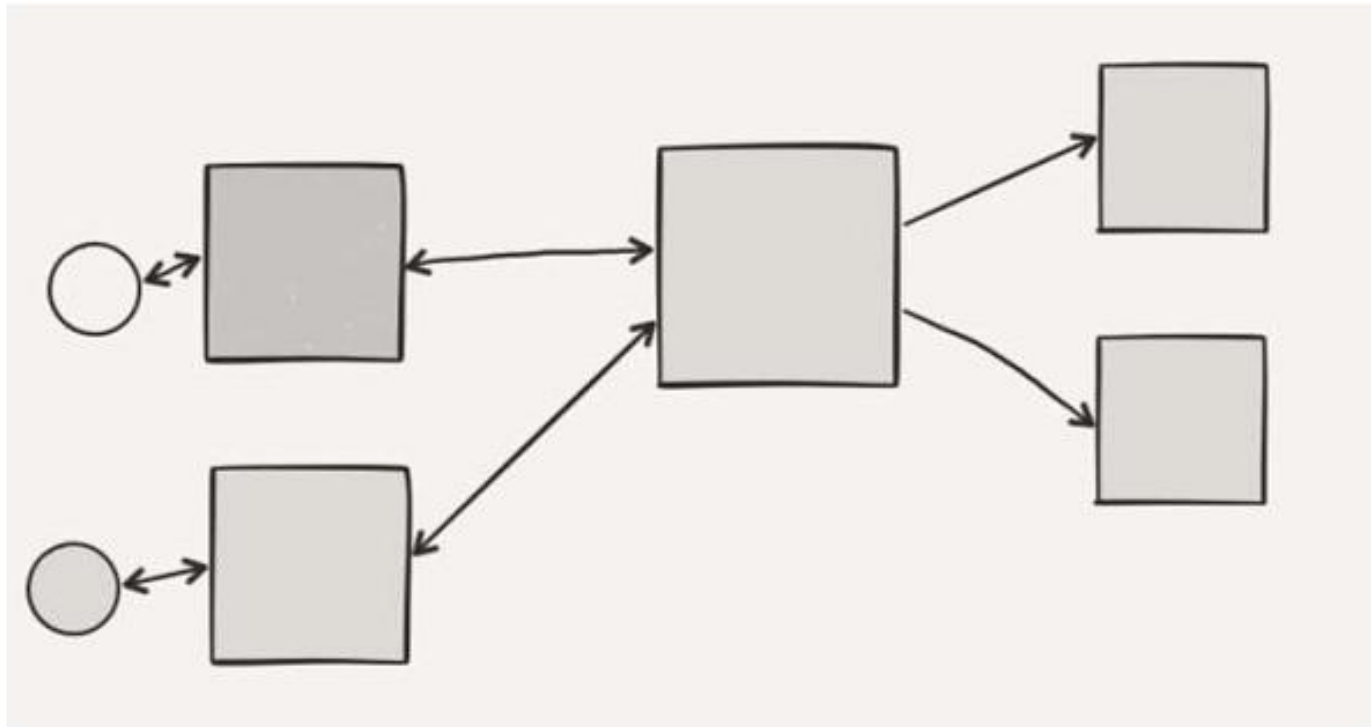


Dimension **Internet of Things (IoT)**



Source: ITU, adapted from Nomura Research Institute.

IoT Architecture



Node

Gateway

Services

Komponen pada IoT Architecture



Sensor

Device
Kontroler

Gateway

Server/cloud

Aplication



LM 35 (Sensor Suhu)

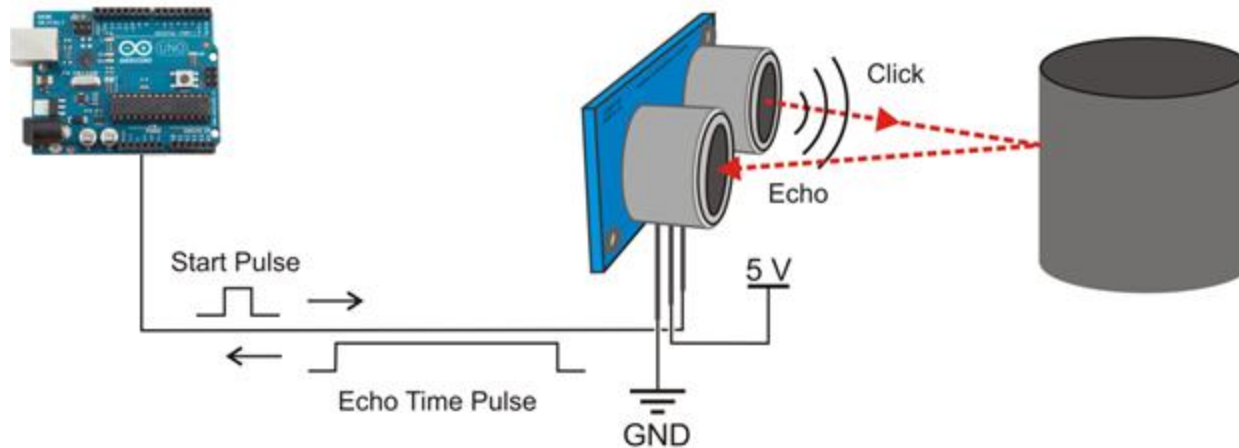


Arduino



Sensor

A sensor is a **device** that **receives a stimulus** and **responds with an electrical signal** (Jacob Fraden, 2003)



Menilai/melihat **Sensor**

Table 1.1. Specifications

| | |
|---------------------------------|--------------------------|
| Sensitivity | Stimulus range (span) |
| Stability (short and long term) | Resolution |
| Accuracy | Selectivity |
| Speed of response | Environmental conditions |
| Overload characteristics | Linearity |
| Hysteresis | Dead band |
| Operating life | Output format |
| Cost, size, weight | Other |

Table 1.2. Sensor Material

| Inorganic | Organic |
|----------------------|------------------------|
| Conductor | Insulator |
| Semiconductor | Liquid, gas, or plasma |
| Biological substance | Other |

Table 1.3. Detection Means Used in Sensors

| |
|---|
| Biological |
| Chemical |
| Electric, magnetic, or electromagnetic wave |
| Heat, temperature |
| Mechanical displacement or wave |
| Radioactivity, radiation |
| Other |

Table 1.4. Conversion Phenomena

| Physical | Chemical |
|-----------------|----------------------------|
| Thermoelectric | Chemical transformation |
| Photoelectric | Physical transformation |
| Photomagnetic | Electrochemical process |
| Magnetolectric | Spectroscopy |
| Electromagnetic | Other |
| Thermoelastic | Biological |
| Electroelastic | Biochemical transformation |
| Thermomagnetic | Physical transformation |
| Thermooptic | Effect on test organism |
| Photoelastic | Spectroscopy |
| Other | Other |

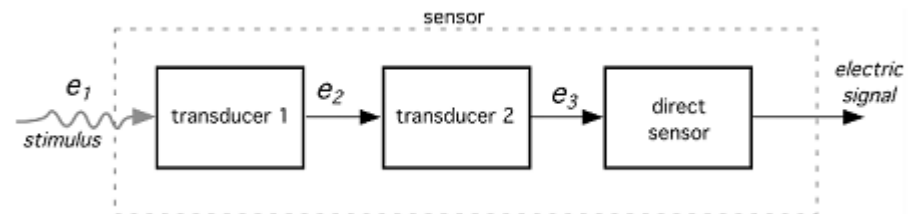
Table 1.5. Field of Applications

| | |
|---------------------------------------|------------------------------------|
| Agriculture | Automotive |
| Civil engineering, construction | Domestic, appliances |
| Distribution, commerce, finance | Environment, meteorology, security |
| Energy, power | Information, telecommunication |
| Health, medicine | Marine |
| Manufacturing | Recreation, toys |
| Military | Space |
| Scientific measurement | Other |
| Transportation (excluding automotive) | |

Stimulus/input **Sensor**

Table 1.6. Stimulus

| | |
|---|---------------------------------------|
| Acoustic | Mechanical |
| Wave amplitude, phase, polarization | Position (linear, angular) |
| Spectrum | Acceleration |
| Wave velocity | Force |
| Other | Stress, pressure |
| Biological | Strain |
| Biomass (types, concentration, states) | Mass, density |
| Other | Moment, torque |
| Chemical | Speed of flow, rate of mass transport |
| Components (identities, concentration, states) | Shape, roughness, orientation |
| Other | Stiffness, compliance |
| Electric | Viscosity |
| Charge, current | Crystallinity, structural integrity |
| Potential, voltage | Other |
| Electric field (amplitude, phase, polarization, spectrum) | Radiation |
| Conductivity | Type |
| Permittivity | Energy |
| Other | Intensity |
| Magnetic | Other |
| Magnetic field (amplitude, phase, polarization, spectrum) | Thermal |
| Magnetic flux | Temperature |
| Permeability | Flux |
| Other | Specific heat |
| Optical | Thermal conductivity |
| Wave amplitude, phase, polarization, spectrum | Other |
| Wave velocity | |
| Refractive index | |
| Emissivity | |
| reflectivity, absorption | |
| Other | |



Karakteristik Sensor

- Linearitas Sensor
- Sensitivitas Sensor
- Tanggapan Waktu Sensor (Respon Time)

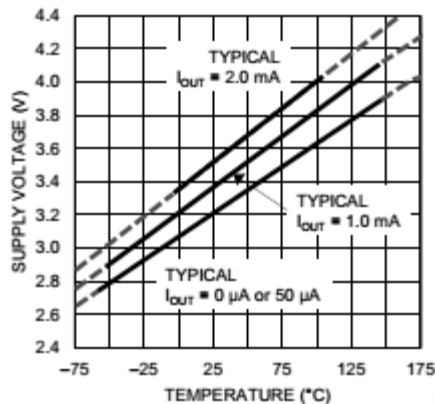


Figure 5. Minimum Supply Voltage vs Temperature

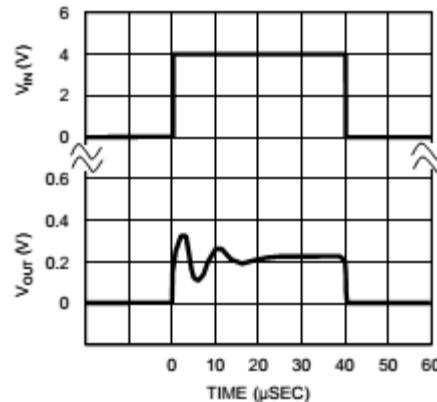
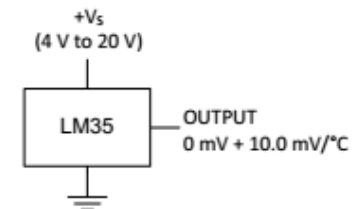


Figure 11. Start-Up Response

karakteristik LM35
sesuai data sheet

Basic Centigrade Temperature Sensor
(2°C to 150°C)



Input dan Output **Sensor**

Contoh **LM35** > data sheet

**Basic Centigrade Temperature Sensor
(2°C to 150°C)**

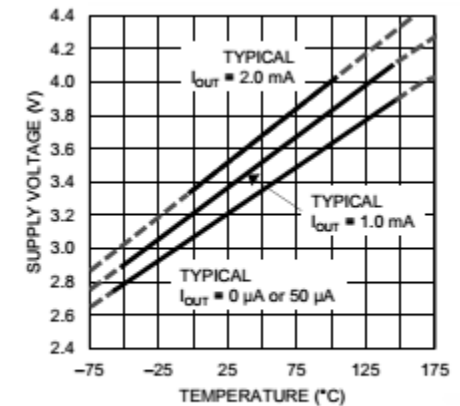
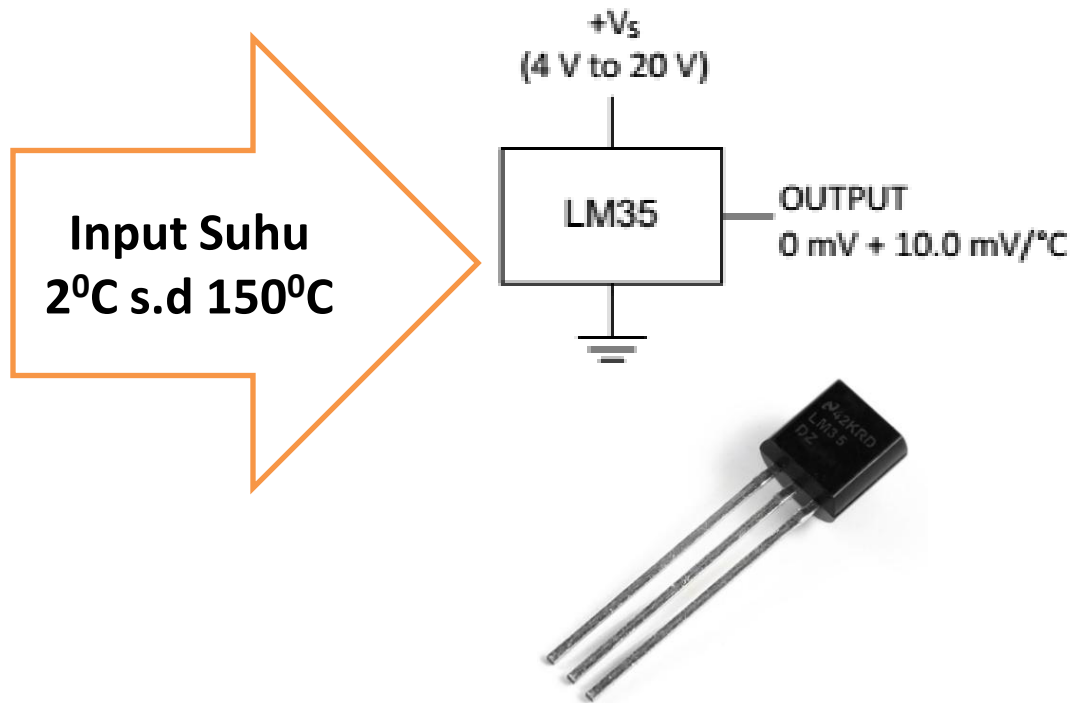
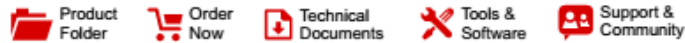


Figure 5. Minimum Supply Voltage vs Temperature

**Tegangan
10mV/°C**

Detail sensor > datasheet



LM35

SNIS159H--AUGUST 1999--REVISED DECEMBER 2017

LM35 Precision Centigrade Temperature Sensors

1 Features

- Calibrated Directly in Celsius (Centigrade)
- Linear + 10-mV/°C Scale Factor
- 0.5°C Ensured Accuracy (at 25°C)
- Rated for Full -55°C to 150°C Range
- Suitable for Remote Applications
- Low-Cost Due to Wafer-Level Trimming
- Operates From 4 V to 30 V
- Less Than 60-μA Current Drain
- Low Self-Heating, 0.08°C in Still Air
- Non-Linearity Only ±¼°C Typical
- Low-Impedance Output, 0.1 Ω for 1-mA Load

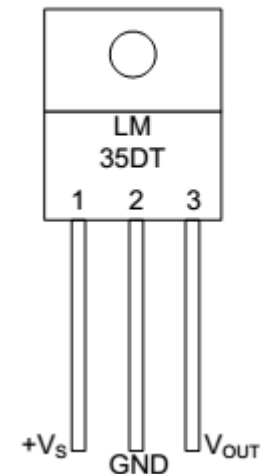
2 Applications

- Power Supplies
- Battery Management
- HVAC
- Appliances

3 Description

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly-proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling. The LM35 device does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full -55°C to 150°C temperature range. Lower cost is assured by trimming and calibration at the wafer level. The low-output impedance, linear output, and precise inherent calibration of the LM35 device makes interfacing to readout or control circuitry especially easy. The device is used with single power supplies, or with plus and minus supplies. As the LM35 device draws only 60 μA from the supply, it has very low self-heating of less than 0.1°C in still air. The LM35 device is rated to operate over a -55°C to 150°C temperature range, while the LM35C device is rated for a -40°C to 110°C range (-10° with improved accuracy). The LM35-series devices are available packaged in hermetic TO transistor




NEB Package
3-Pin TO-220
(Top View)



Jenis Sensor

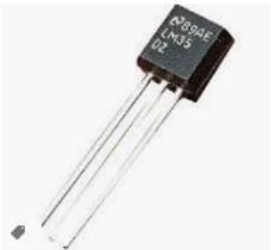
The image shows a Google search interface for the term "Sensor". The search bar contains the word "Sensor". Below the search bar, there are navigation tabs for "All", "Images", "Shopping", "Videos", "News", "More", "Settings", and "Tools". The "Images" tab is selected. Below the navigation tabs, there are several circular icons representing different sensor categories: "temperature", "humidity", "arduino", "lm35", "coolant", "probe", "bluetooth", "engine", and "water". The "temperature" icon is highlighted. Below the icons, there are two rows of search results. Each result consists of a small image of a sensor component and a caption below it. The first row includes: 1. "LM35 Temperature Sensor TO-92" from mikroe.com. 2. "TMP36 Temperature Sensor - Solarbotic..." from solarbotics.com, noted as "In stock". 3. "LM35DZ Temperature Sensor with..." from indiamart.com. 4. "DS18B20-One Wire Digital Temp..." from shenzhen2u.com, noted as "In stock". 5. "DS18B20 TO-92 Digital Temper..." from twinschip.com, noted as "In stock". 6. "LM35 Temperature Sensor, ..." from indiamart.com, with a diagram showing "Vcc 3-5.5 V", "GND", and "Out ...V/°C". The second row includes: 1. A close-up image of an LM35 sensor. 2. A diagram of an LM35 sensor with labels for "Ground", "Output Voltage", and "Supply Voltage". 3. A blue PCB module with an LM35 sensor. 4. A close-up image of an LM35 sensor. 5. A close-up image of an LM35 sensor. 6. A blue PCB module with an LM35 sensor.

Mendapatkan **sensor**


Google   

[All](#) [Images](#) [Shopping](#) [Videos](#) [News](#) [More](#) [Settings](#) [Tools](#) [Collections](#) [SafeSearch on](#)


[lm35 temperature sensor suhu lm35dz to92](#) [suhu lm35](#) [arduino](#) [arduino uno](#) [lm35dz temperature](#) [lm 35](#)




Jual LM35DZ LM35-DZ LM-35 L...
tokopedia.com · In stock




Lm 35 Dz Lm35Dz To92 Cepetan...
shopee.co.id · In stock




SENSOR SUHU LM 35 LM 35DZ ...
shopee.co.id · In stock




Jual Produk Sensor Suhu Lm3...
bukalapak.com




Sensor suhu LM35 – ElektroWiki
elektrowiki.wordpress.com



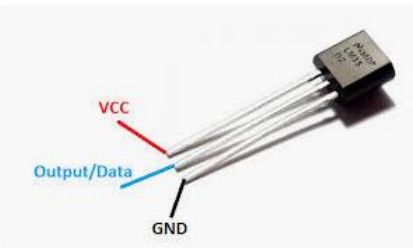
IC Temperature sensor suhu ...
tokopedia.com · In stock




Vcc 3-5.5 V
g Out ...V / °C
GND




KIVALA STORE




VCC
Output/Data
GND



6248 LM35 DZ



Hanya di SDL Project !!!
<http://shonee.com/SDLproject>



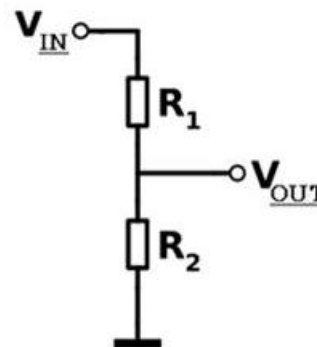
Tidak semua sensor ~~harus~~ beli

- Pengukuran tegangan keluaran dari panel surya dilakukan dengan menggunakan rangkaian seri seperti gambar. Tegangan input V_{in} adalah tegangan yang dihasilkan panel surya. Arduino mampu membaca tegangan V_{out} maksimal 5 V. Sinyal tegangan V_{out} dibaca oleh Arduino untuk kemudian dihitung/diproses. Input tegangan maksimum V_{in} sesuai dengan sirkuit terbuka tegangan V_{oc} adalah 21,4 V dan tegangan maksimum V_{out} yang diterima oleh papan mikrokontroler/arduini adalah 5 V. Oleh karena itu, tentukan nilai resistor R_1 dan R_2 pada rangkaian!

Table 1

PV module electrical characteristics.

| | |
|------------------------------------|--------|
| Maximum Power (P_{max}) | 20 Wp |
| Maximum Power Current (I_{mp}) | 1.19 A |
| Maximum Power Voltage (V_{mp}) | 16.8 V |
| Shot-Circuit Current (I_{sc}) | 1.21 A |
| Open Circuit Voltage (V_{oc}) | 21,4 V |
| Cell Operating Temperature | 50 °C |
| Efficiency | 10% |



Device **Kontroler** > **Microkontroler** **Arduino**

Arduino adalah **pengendali** mikro single-board yang **bersifat open-source**, diturunkan dari Wiring platform, dirancang untuk memudahkan penggunaan elektronik dalam berbagai bidang.

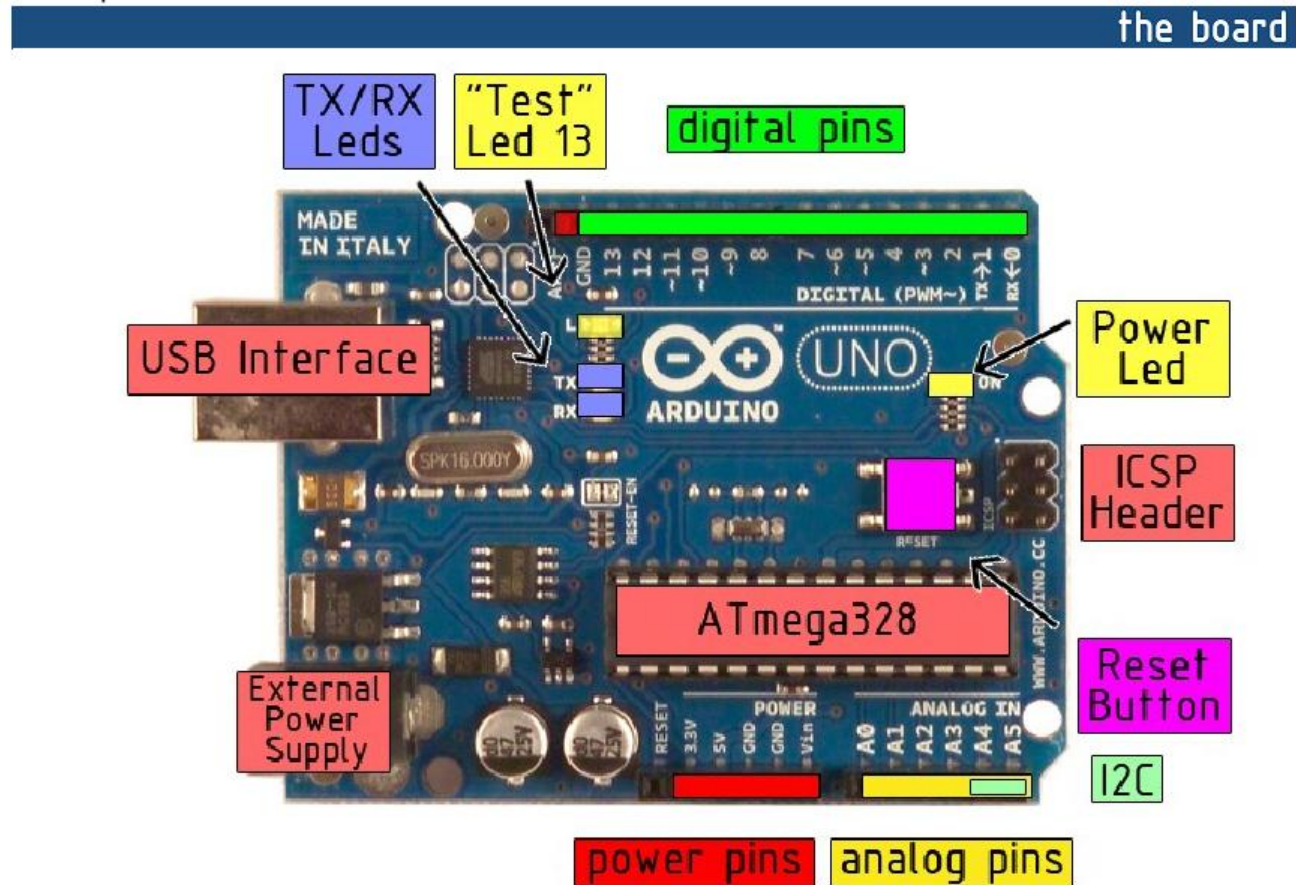
Hardwarenya memiliki prosesor Atmel AVR dan **softwarenya** memiliki bahasa pemrograman sendiri. (Khumaidi, 2019)



Jenis Arduino



Hardware Arduino

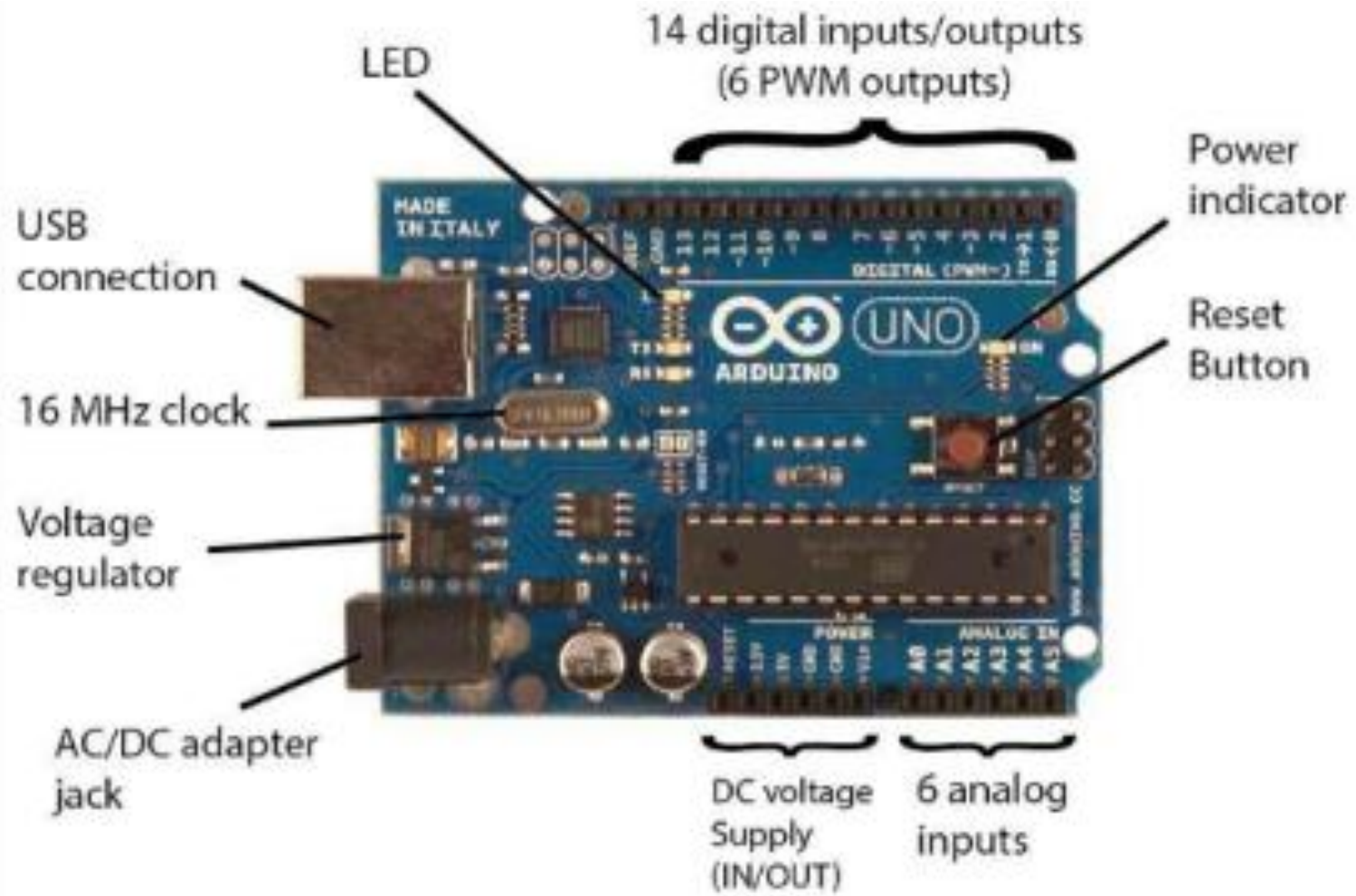


Spesifikasi Teknis Arduino Uno

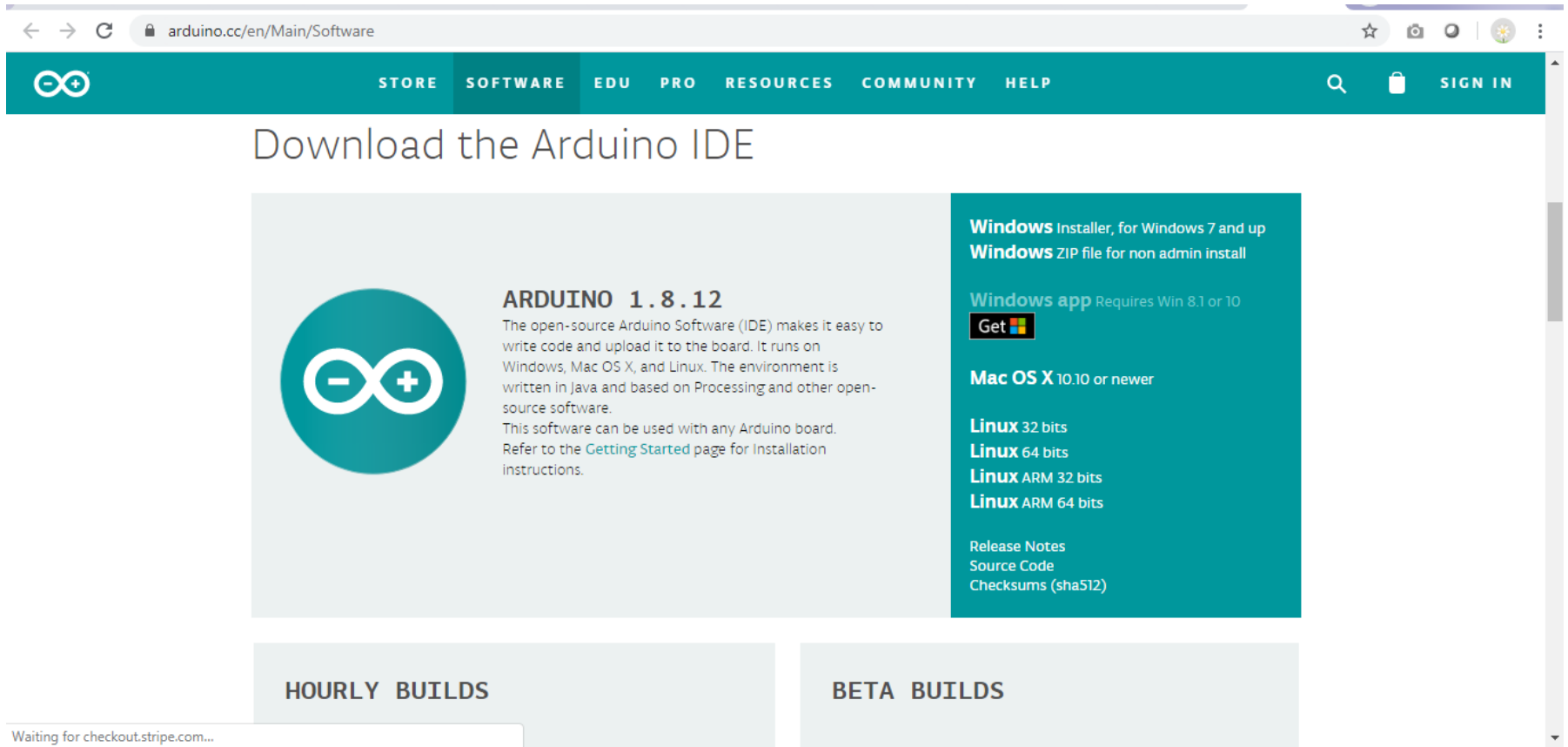
Summary

| | |
|-----------------------------|---|
| Microcontroller | ATmega328 |
| Operating Voltage | 5V |
| Input Voltage (recommended) | 7-12V |
| Input Voltage (limits) | 6-20V |
| Digital I/O Pins | 14 (of which 6 provide PWM output) |
| Analog Input Pins | 6 |
| DC Current per I/O Pin | 40 mA |
| DC Current for 3.3V Pin | 50 mA |
| Flash Memory | 32 KB of which 0.5 KB used by bootloader |
| SRAM | 2 KB |
| EEPROM | 1 KB |
| Clock Speed | 16 MHz |

Input/Output Arduino



Software **Arduino**




The screenshot shows the Arduino website's software page. The browser address bar displays 'arduino.cc/en/Main/Software'. The navigation menu includes 'STORE', 'SOFTWARE', 'EDU', 'PRO', 'RESOURCES', 'COMMUNITY', and 'HELP'. The main heading is 'Download the Arduino IDE'. The central content area features the Arduino logo and the text 'ARDUINO 1.8.12'. Below this, it describes the IDE as open-source software that runs on Windows, Mac OS X, and Linux. To the right, there are download options for Windows (installer and ZIP file), Windows app, Mac OS X, and Linux (32-bit and 64-bit). At the bottom, there are sections for 'HOURLY BUILDS' and 'BETA BUILDS'. A small notification at the bottom left says 'Waiting for checkout.stripe.com...'.

← → ↻ arduino.cc/en/Main/Software ☆ 📷 🔍 | 🌟 ⋮

∞ STORE SOFTWARE **EDU PRO RESOURCES COMMUNITY HELP** 🔍 📦 SIGN IN

Download the Arduino IDE



ARDUINO 1.8.12

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and other open-source software.

This software can be used with any Arduino board. Refer to the [Getting Started](#) page for Installation instructions.

Windows Installer, for Windows 7 and up
Windows ZIP file for non admin install

Windows app Requires Win 8.1 or 10
Get 🇺🇸

Mac OS X 10.10 or newer

Linux 32 bits
Linux 64 bits
Linux ARM 32 bits
Linux ARM 64 bits

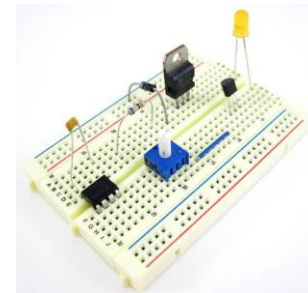
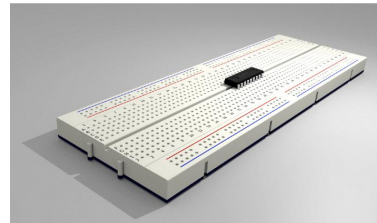
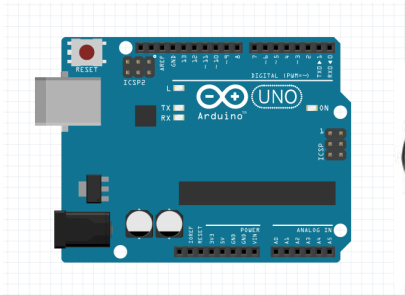
[Release Notes](#)
[Source Code](#)
[Checksums \(sha512\)](#)

HOURLY BUILDS **BETA BUILDS**

Waiting for checkout.stripe.com...

Menggunakan **Arduino (1)**

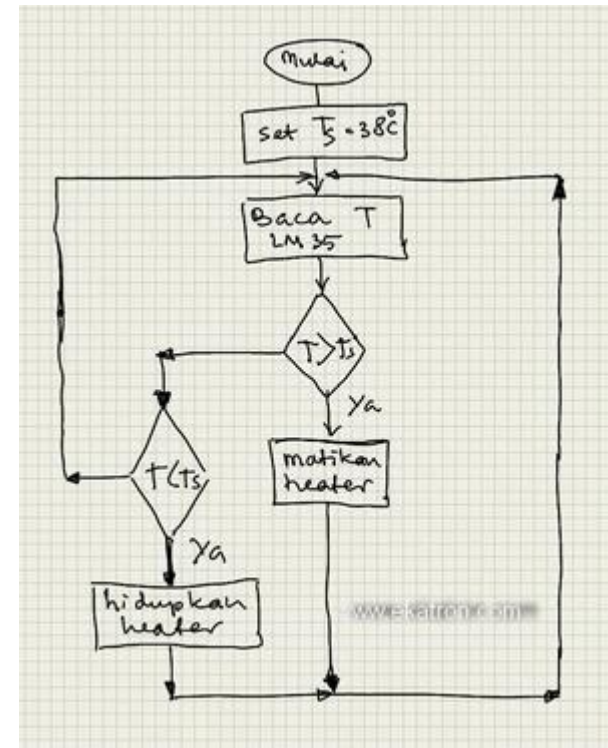
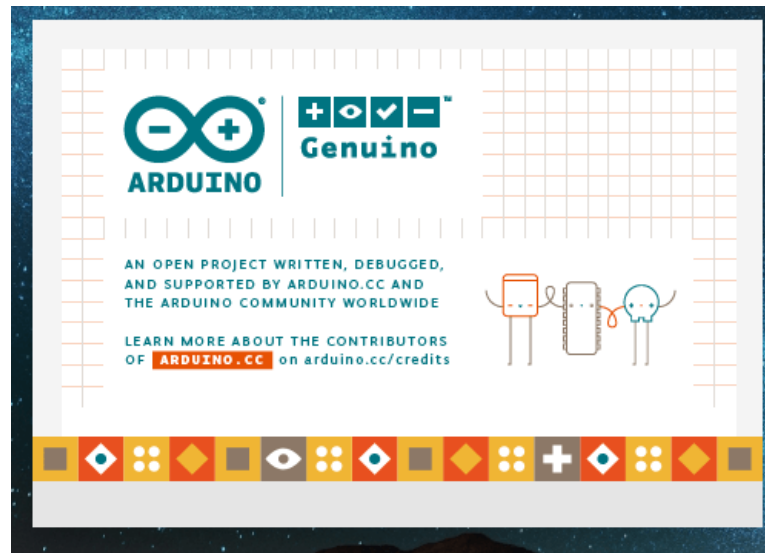
- **Hardware:** Board Arduino, kabel usb, breadboard, kabel jumper, dan beberapa komponen elektronika dasar.



Note: Hardware tersebut sangat mudah didapatkan terlebih **mencari di toko online.**

Menggunakan Arduino (1)

- **Software:** Arduino IDE / program lain

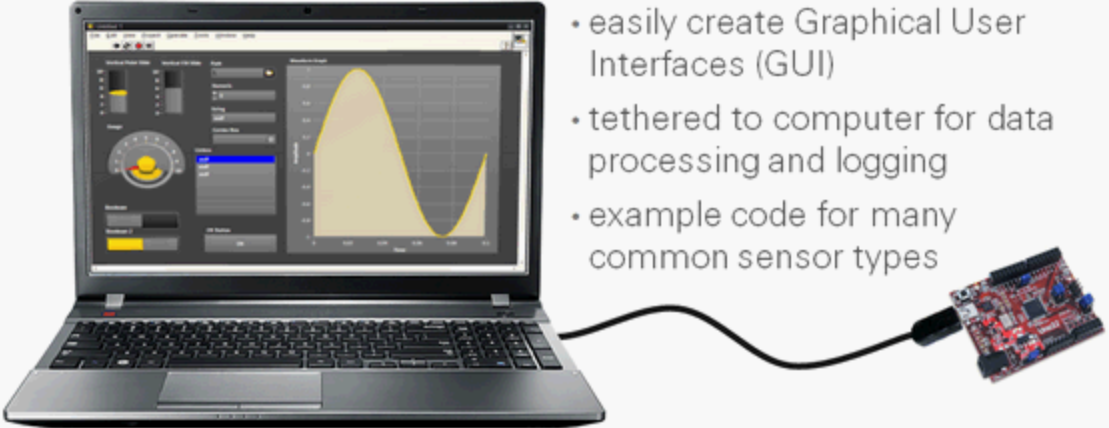


Contoh Project (Arduino + labview)

- <https://www.youtube.com/watch?v=nom25sX4N-4>



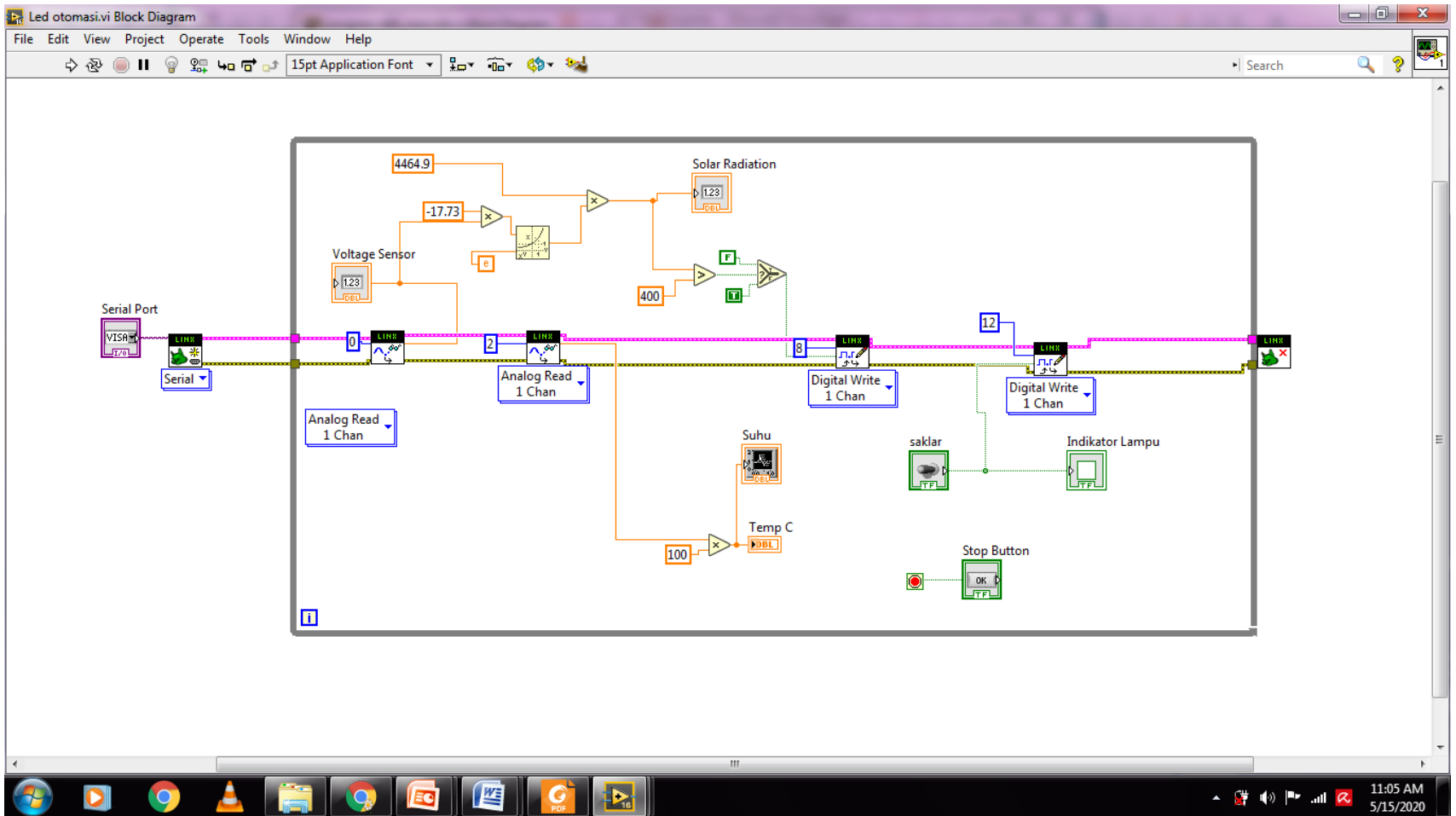
LabVIEW Interface for chipKIT™



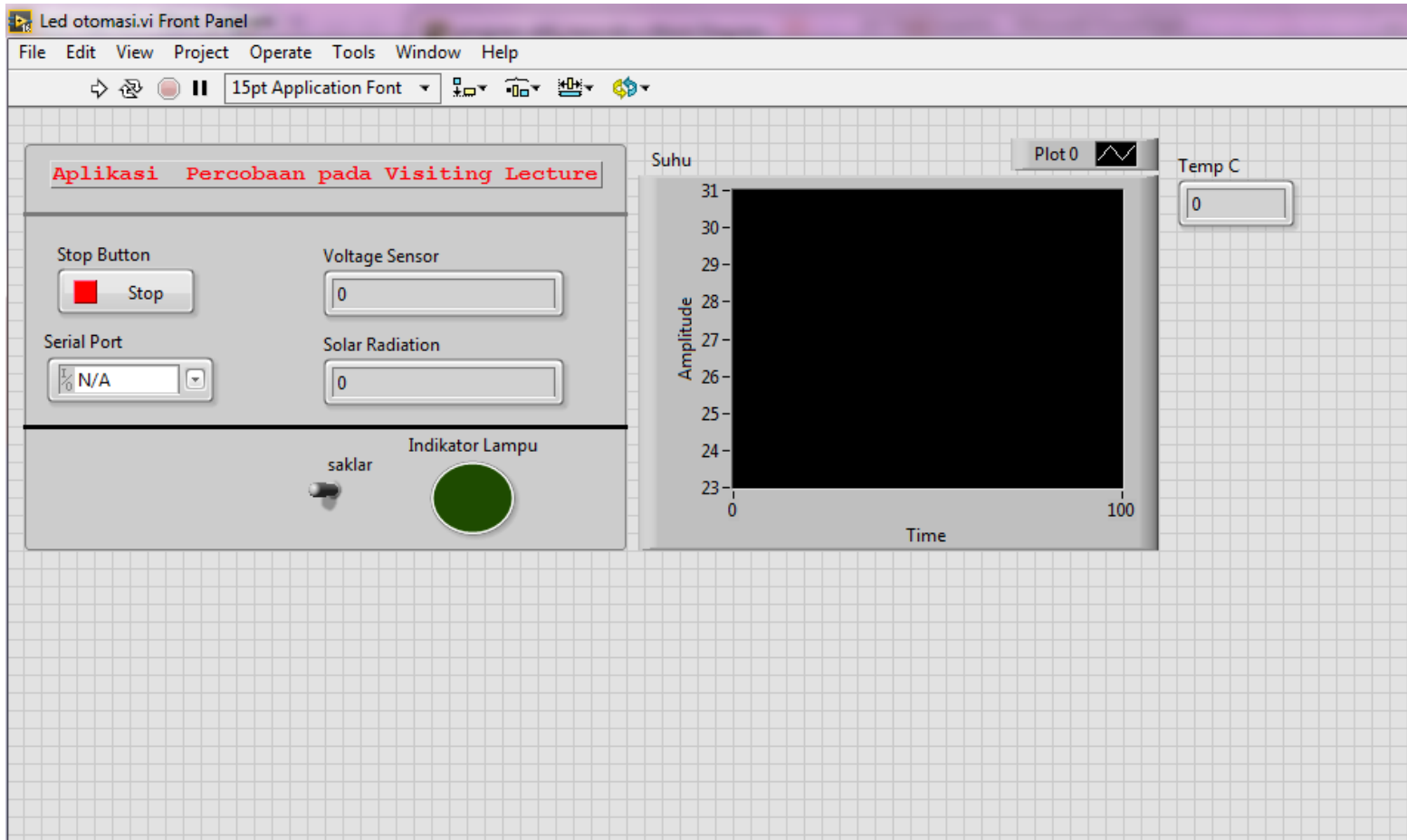
The image shows a laptop screen displaying the LabVIEW software interface. The interface includes a control panel on the left with a dial and several buttons, and a main plot area on the right showing a yellow sine wave. A black cable connects the laptop to a red and black chipKIT development board.

- easily create Graphical User Interfaces (GUI)
- tethered to computer for data processing and logging
- example code for many common sensor types

Contoh Blok Diagram

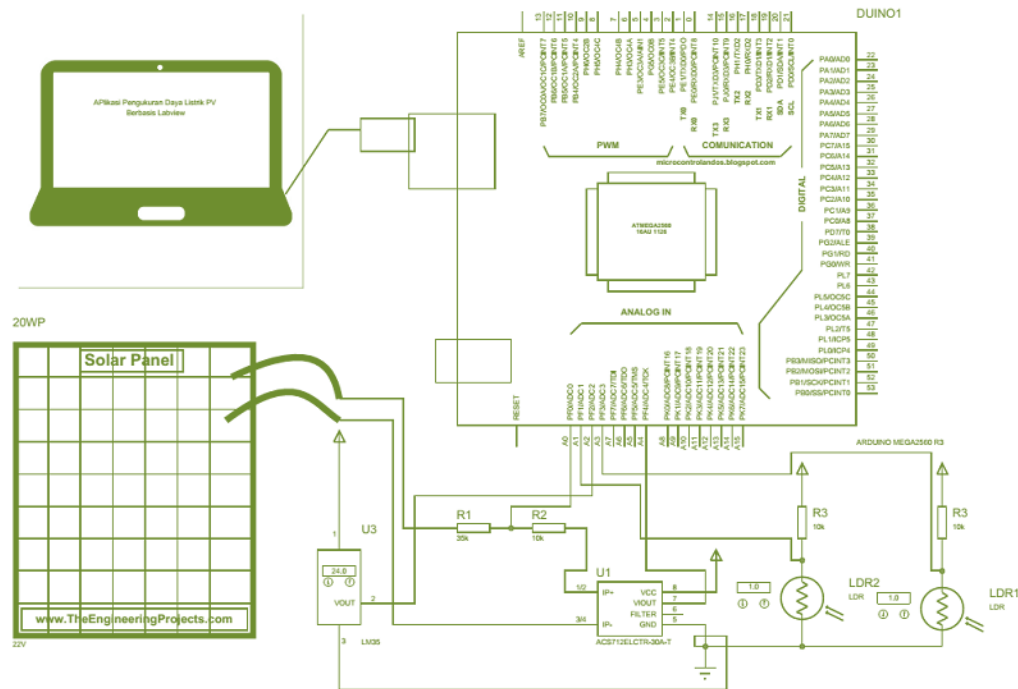


Contoh Blok Diagram



Contoh project :

Aplikasi Pengukuran Daya Listrik dari Solar Sel Berbasis Labview



Gambar 1. Sistem Kerja Aplikasi

Diskripsi **Project Ardunio**

- Aplikasi ini **dikembangkan berbasis Labview dan Arduino Mega** yang digunakan untuk mengukur daya listrik yang berasal dari sel surya.
- Daya listrik di dapatkan dari **pengukuran arus dan tegangan**. Selan itu pengukuran juga dilakukan pada kondisi lingkungan yaitu **suhu, solar radiation dan intersitas cahaya (Lux)**.

Diskripsi **Project Arduino**

- **LabVIEW** merupakan singkatan dari Laboratory Virtual Instrument Engineering Workbench. LabVIEW adalah Software yang di kembangkan oleh National Instrument, merupakan sebuah software untuk membuat aplikasi yang berbasis grafis (**graphical programming**).
- Berbeda dengan bahasa pemrograman lainnya yang biasa nya menggunakan structured text language (Bahasa pemrograman berbasis text) LabVIEW hadir dengan **bahasa pemrograman berbasis Block Diagram**.

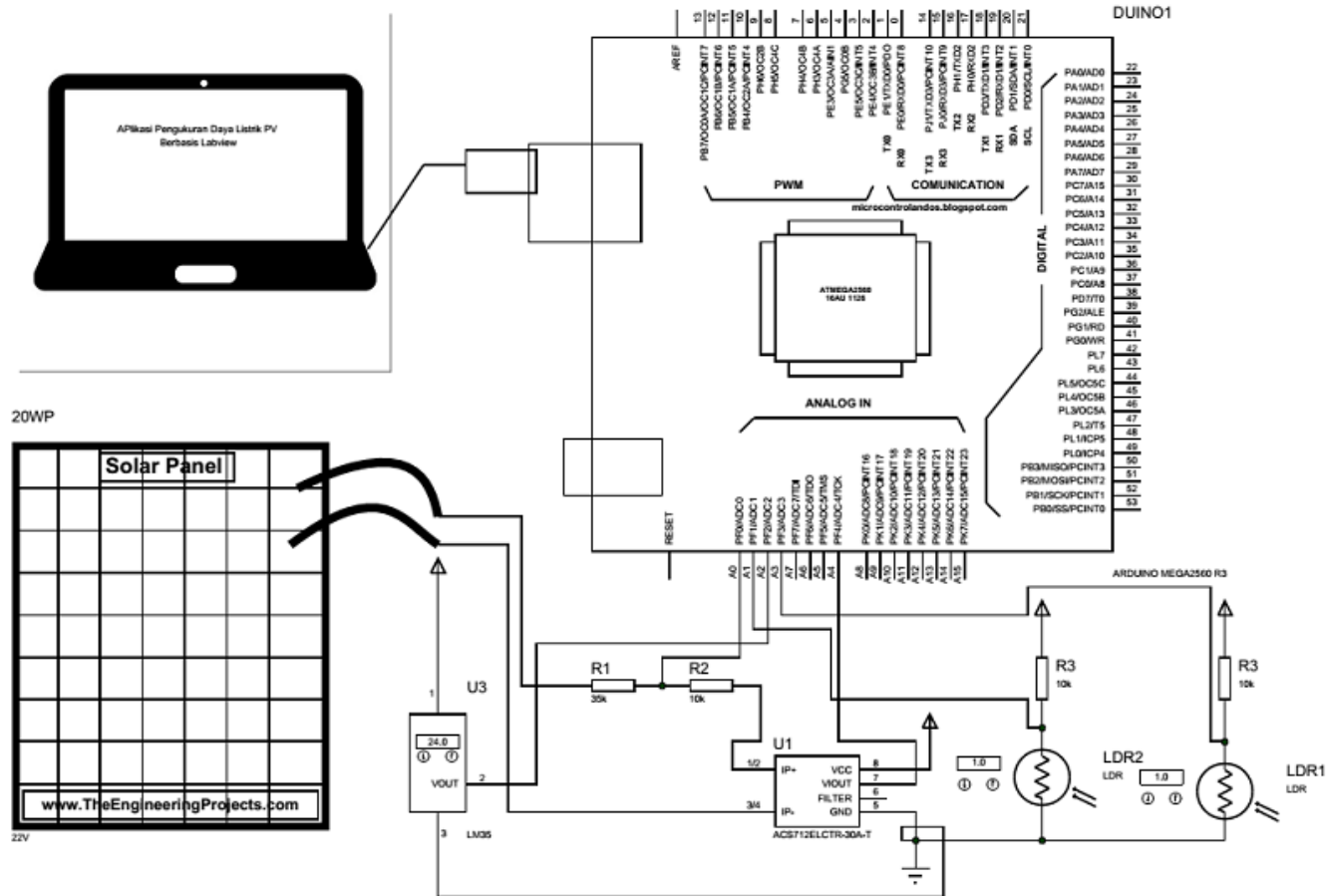
Sistem Kerja **Project Arduinio**

- Sistem kerja aplikasi seperti pada Gambar 1, Input aplikasi Berasal sensor Arus Acs 712 30 A, Sensor Suhu LM 35, Sensor LDR, yang terhubung ke computer **melalui Arduino Mega 2560**. Spesifikasi Solar Panel yang digunakan disajikan pada tabel 1.

Table 1. Spesifikasi Solar Panel

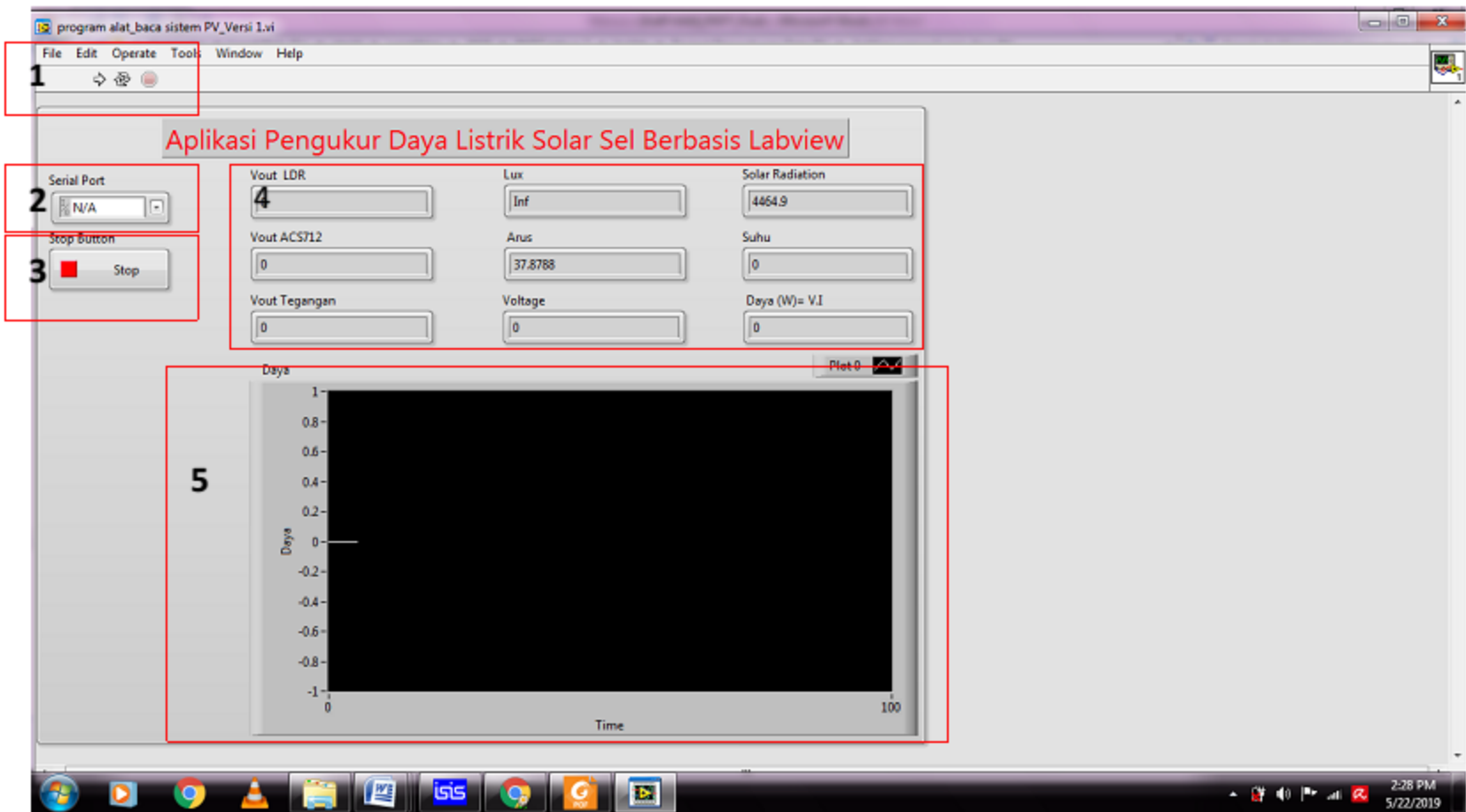
| | |
|-----------------------------|---------------|
| Maximum Power (Pmax) | 20 W |
| Maximum Power Voltage (Vmp) | 18.5 V |
| Maximum Power Current (Imp) | 1.08 A |
| Open Circuit Voltage (Voc) | 22.14 V |
| Short Circuit Current (Isc) | 1.16 A |
| Maximum System Voltage | 1000 VDC |
| Dimention | 485x360x25 mm |
| Efficiency | 15 % |

Sistem Kerja Project Arduino

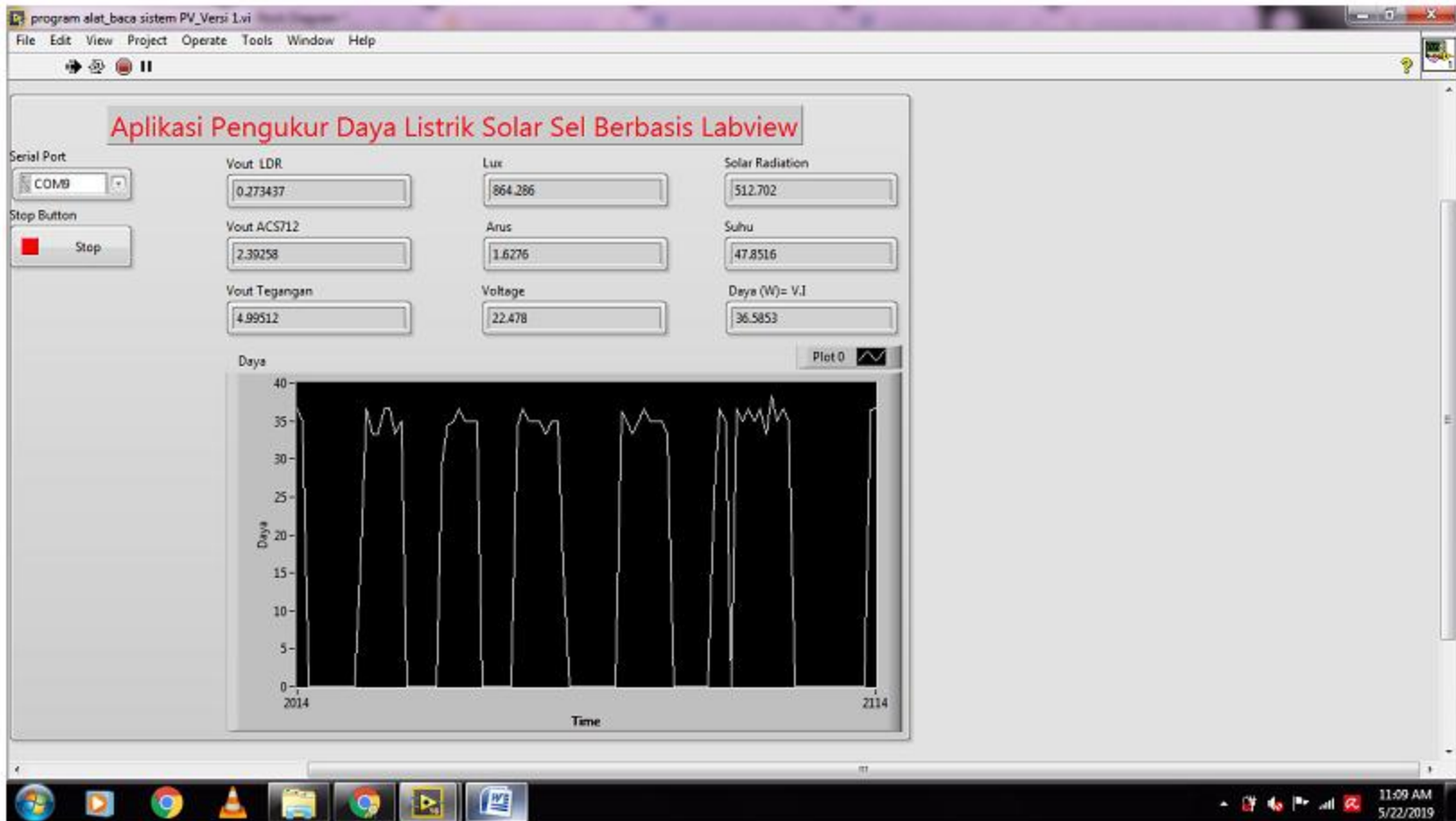


Gambar 1. Sistem Kerja Aplikasi

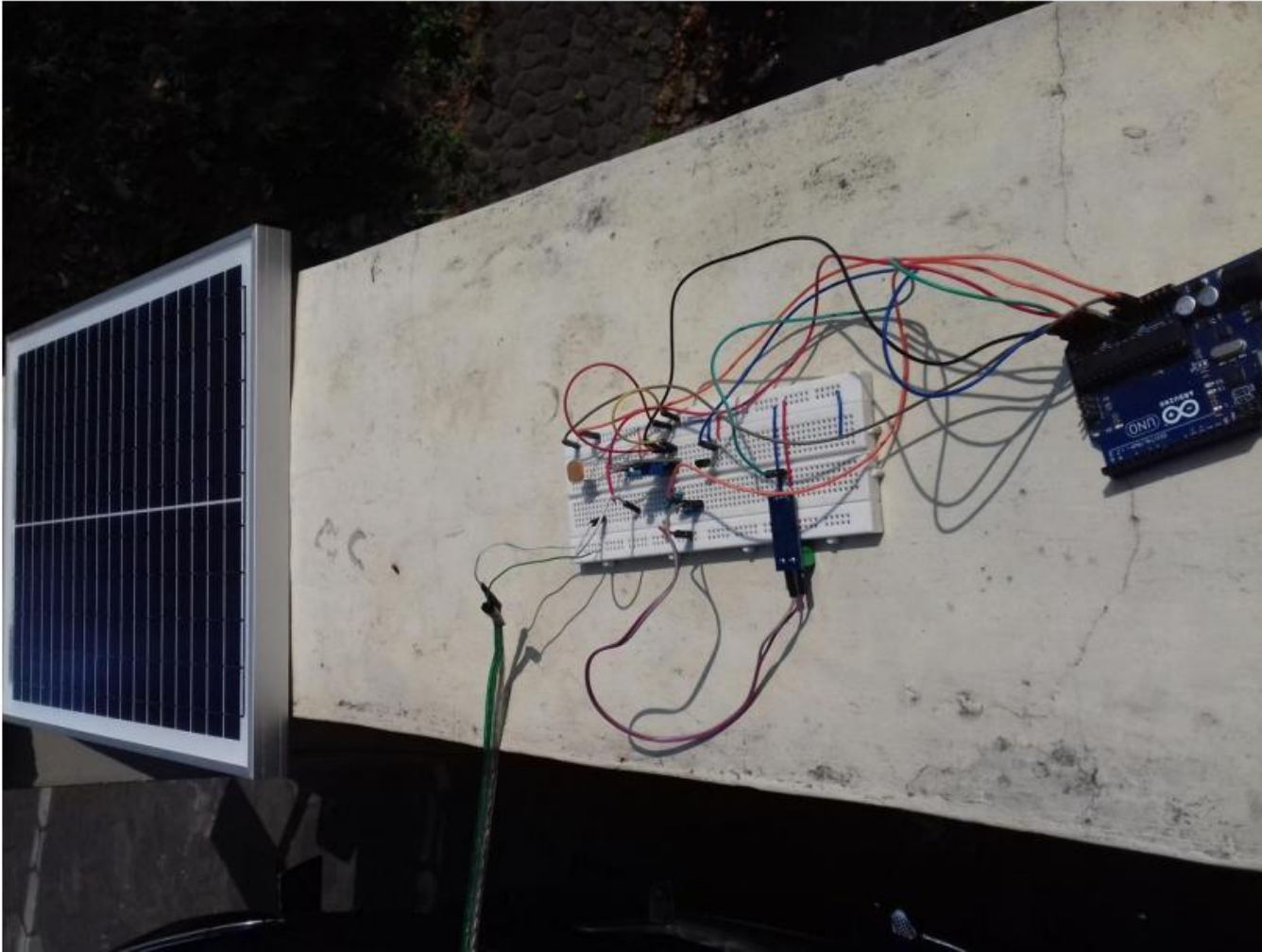
Tampilan Interface



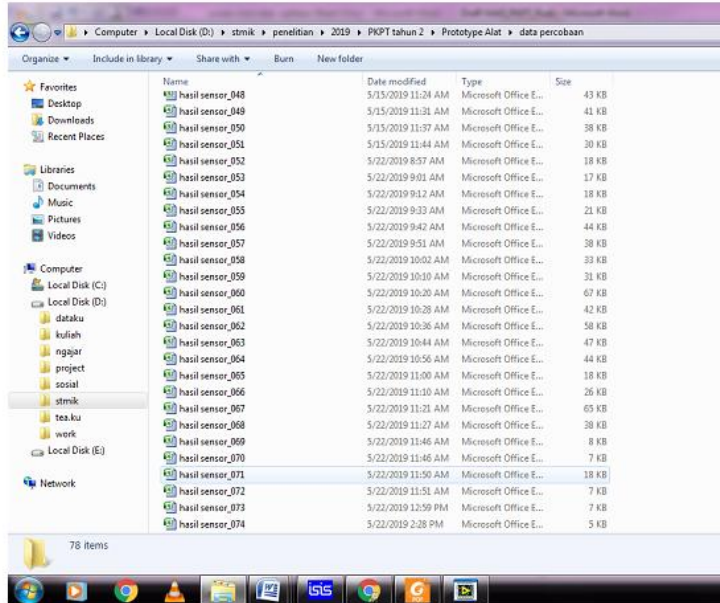
Tampilan output



Penerapan Hardware



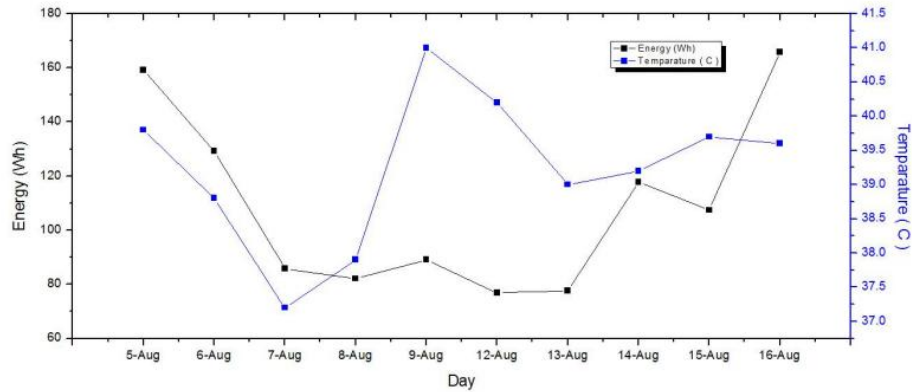
Output Aplikasi



| Time | Tegangan | Lux | Arus | Daya | Suhu | Solar Radiation |
|------------------------|-----------|------------|----------|----------|----------|-----------------|
| 5/22/2019 11:24:34.667 | 0.043945 | 880.909091 | 1.923532 | 0.08453 | 62.98828 | 559.066105 |
| 5/22/2019 11:24:35.667 | 2.460937 | 880.909091 | 1.997514 | 4.915758 | 45.41016 | 559.066105 |
| 5/22/2019 11:24:36.667 | 4.921875 | 880.909091 | 1.84955 | 9.103255 | 54.19922 | 559.066105 |
| 5/22/2019 11:24:37.667 | 8.041992 | 880.909091 | 1.923532 | 15.46903 | 42.96875 | 559.066105 |
| 5/22/2019 11:24:38.667 | 8.151855 | 880.909091 | 1.997514 | 16.28345 | 62.5 | 559.066105 |
| 5/22/2019 11:24:39.668 | 22.478027 | 880.909091 | 2.071496 | 46.56315 | 42.96875 | 559.066105 |
| 5/22/2019 11:24:40.667 | 3.186035 | 880.909091 | 1.997514 | 6.36415 | 43.94531 | 559.066105 |
| 5/22/2019 11:24:41.667 | 2.263184 | 864.285714 | 1.47964 | 3.348697 | 52.73438 | 559.066105 |
| 5/22/2019 11:24:42.667 | 0.197754 | 864.285714 | 1.47964 | 0.292605 | 42.96875 | 559.066105 |
| 5/22/2019 11:25:36.668 | 17.050781 | 880.909091 | 1.405658 | 23.96757 | 55.66406 | 609.622545 |
| 5/22/2019 11:25:37.668 | 3.164062 | 880.909091 | 1.405658 | 4.44759 | 55.66406 | 609.622545 |
| 5/22/2019 11:25:57.669 | 1.032715 | 864.285714 | 1.47964 | 1.528046 | 45.41016 | 559.066105 |
| 5/22/2019 11:25:58.669 | 22.478027 | 864.285714 | 1.331676 | 29.93345 | 44.43359 | 559.066105 |
| 5/22/2019 11:25:59.669 | 22.478027 | 864.285714 | 1.405658 | 31.59642 | 58.59375 | 559.066105 |
| 5/22/2019 11:26:00.669 | 22.478027 | 864.285714 | 1.405658 | 31.59642 | 44.92188 | 559.066105 |
| 5/22/2019 11:26:01.670 | 22.478027 | 864.285714 | 1.405658 | 31.59642 | 55.17578 | 559.066105 |
| 5/22/2019 11:26:02.670 | 22.478027 | 864.285714 | 1.331676 | 29.93345 | 53.71094 | 559.066105 |

Analisis Data

Hasil penelitian energy vs temperature



Referensi

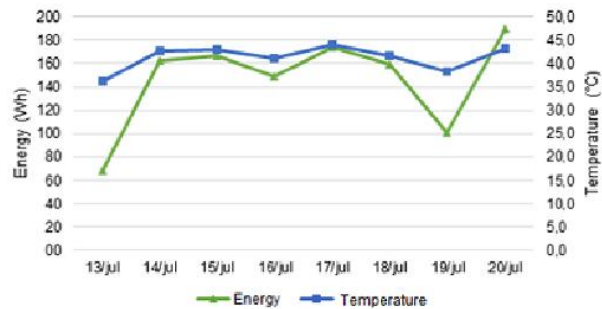


Fig. 7. Generated energy performance and temperature for the static system.

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Terima kasih