



VTI1E2 – APLIKASI MIKROKONTROLER dan ANTARMUKA[©] SEMESTER GANJIL – KURIKULUM 2020

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VTI2D3

Aplikasi Mikrokontroler dan Antarmuka

Materi ke-3: Pemrograman Dasar Mikrokontroler I (Assembly, C, Processing)

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Bagaimana kita membuat Aplikasi Mikrokontroler?

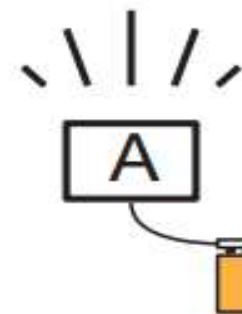
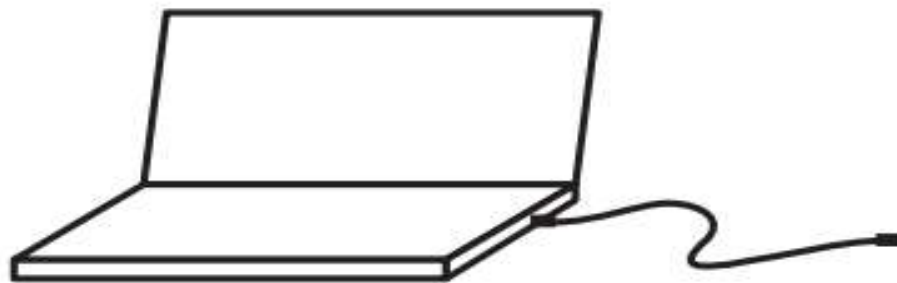
1. Mengetahui type/jenis mikrokontrolernya -> ATmega328? ESP8266? ESP32? dll -> cek datasheet
2. Mengetahui antarmuka yang akan digunakan -> Digital? Analog? Serial? Paralel? SPI? I2C? Dll -> cek datasheet
3. Mengetahui sistem minimum mikrokontrolernya (untuk prototyping) -> Arduino Uno? Modul ESP8266? Modul ESP32? Dll -> cek manual guide
4. Mengetahui komponen elektronika utama dan tambahan (untuk implementasi) -> pengukuran (sensor)? Kendali (aktuator)? AI? dll -> cek kebutuhan sistem
5. Mengetahui bahasa pemrograman yang bisa digunakan -> Assembly? C/C++? C Arduino? Micropython? Lua? Processing? dll
6. Mengetahui tools dan/atau IDE yang sesuai -> Compiler? Linker? Visual Studio? Arduino IDE? Thonny IDE? uPyCraft? dll

ESP32






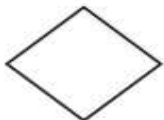


Running Code Stand-Alone

Run Arduino in stand alone mode



Arduino interacts with its environment and runs on battery power

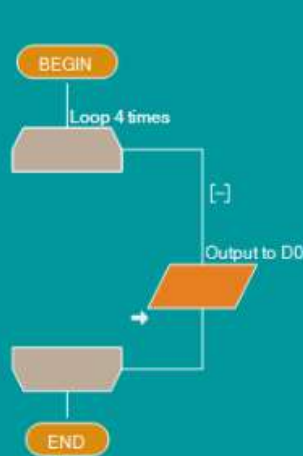
Flow chart symbols

| | | |
|---|-----------------------|---|
|  | Terminator | Start or stop a sequence. May contain module name. |
|  | Process | A step in the process or computational algorithm |
|  | Data input | Information from outside of the algorithm or process |
|  | Decision | Choose a flow path for continuing the algorithm or process |
|  | Flow indicators | Connect other elements |
|  | Connector or Junction | Optional joint where flow indicators merge |

Contoh Diagram Alir

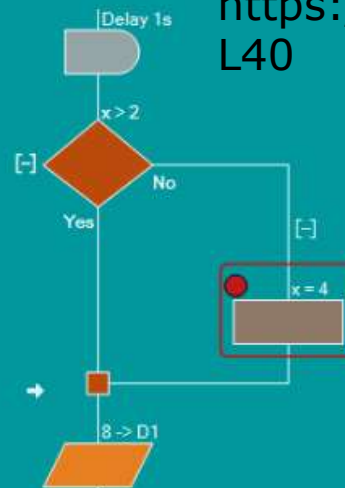
FC FLOWCODE

Arduino Programming



Visual Interfaces

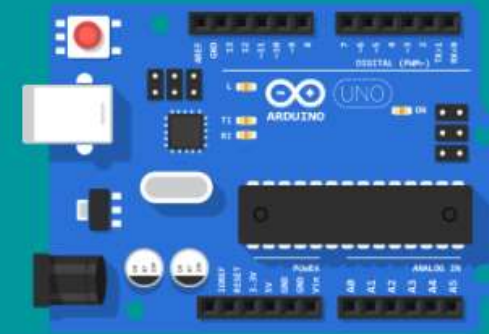
Using Flowcode allows you to program your Arduino with different visual programming interfaces, e.g. flowchart or blocks mode.



Debug your code

Step through your code, view variables in real time, set break points, simulate your hardware. Fully debug your code with Flowcode.

<https://www.matrixsl.com/flowcode/arduino/>
<https://www.youtube.com/watch?v=Jux3didJL40>



Free for Arduino Uno users

Users of the Uno can compile to their device for free, along with many free components to get started with Flowcode.

Assembly Programming via Arduino IDE

led.ino

Both files must have same name & be in same directory

led.S

```

1 //
2 // C Code for Blinking LED
3 //
4 extern "C" //function prototypes external to C sketch
5 {
6   void start();
7   void led(byte);
8 }
9 //
10 void setup()
11 {
12   start();
13 }
14 //
15 void loop()
16 {
17   led(1); delay(500);
18   led(0); delay(500);
19 }
    
```

C code

```

1 ;
2 ; Assembly Code
3 ;
4 #define __SFR_OFFSET 0x00
5 #include "avr/io.h"
6 ;
7 .global start
8 .global led
9 ;
10 start:
11   SBI DDRB,4      ;set DD12 to output
12   RET             ;return to loop() function
13 ;
14 led:
15   CPI R24, 0x00  ;value passed by caller in R24 compared with 0
16   BREQ ledOFF    ;jump (branch) if equal to subroutine ledOFF
17   SBI PORTB, 4   ;set D12 to high
18   RET             ;return to loop() function
19 ;
20 ledOFF:
21   CBI PORTB, 4   ;set D12 to low
22   RET             ;return to loop() function
    
```

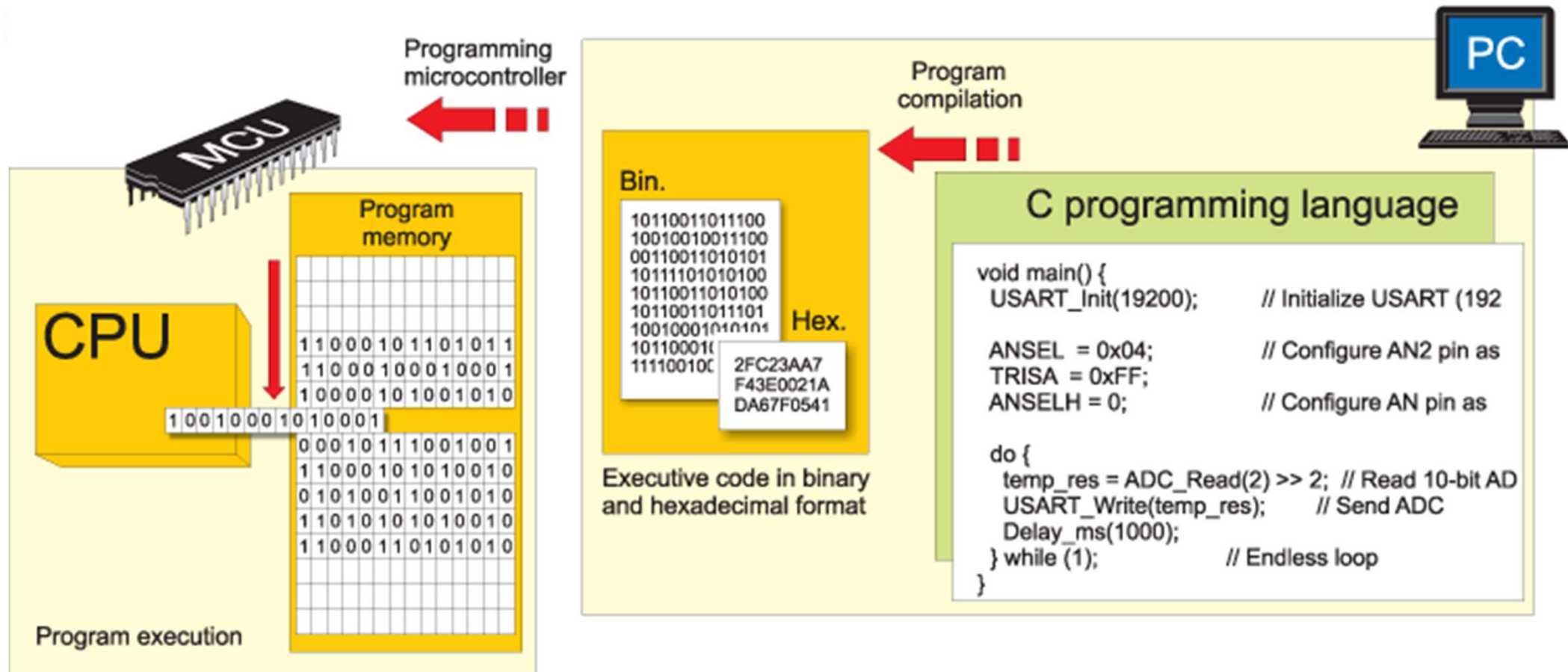
Assembly code

Contoh program assembly

```
> .include "C:\Appnotes\m8535def.inc"
> //-----
> .org 0x0000
> // Code for Blinking LED
> //-----
> rjmp main
> extern "C"
> {
> void start();
> main:
> void led(byte);
> ldi r16, low(RAMEND)
> out SPL, r16
> void setup()
> ldi r16, high(RAMEND)
> out SPH, r16
> //-----
> void loop()
> ldi r16, 0xff
> out PORTA, r16
> led(1);
> led(0);
> }
> cbi PORTA, 0
> cbi PORTA, 1
```

```
The .S file:
>
> ;-----
> ; Assembly Code
> ;-----
> #define __SFR_OFFSET 0x00
> #include "avr/io.h"
> ;-----
> .global start
> .global led
> ;-----
> start:
> SBI DDRB, 4 ;set PB4 (D12) as o/p
> RET ;return to setup() function
> ;-----
> led:
> CPI R24, 0x00 ;value in R24 passed by caller compared with 0
> BREQ ledOFF ;jump (branch) if equal to subroutine ledOFF
> SBI PORTB, 4 ;set D12 to high
> RCALL myDelay
> RET ;return to loop() function
> ;-----
> ledOFF:
> CBI PORTB, 4 ;set D12 to low
> RCALL myDelay
> RET ;return to loop() function
> ;-----
> .equ delayVal, 10000 ;initial count value for inner loop
> ;-----
```

```
The .S file:
>
> myDelay:
> LDI R20, 100 ;initial count
> value for outer loop
> outerLoop:
> LDI R30, lo8(delayVal) ;low byte of
> delayVal in R30
> LDI R31, hi8(delayVal) ;high byte of
> delayVal in R31
> innerLoop:
> SBIW R30, 1 ;subtract 1
> from 16-bit value in R31, R30
> BRNE innerLoop ;jump if
> countVal not equal to 0
> ;-----
> SUBI R20, 1 ;subtract 1
> from R20
> BRNE outerLoop ;jump if R20
> not equal to 0
> RET
> ;-----
```



Contoh Program Sederhana

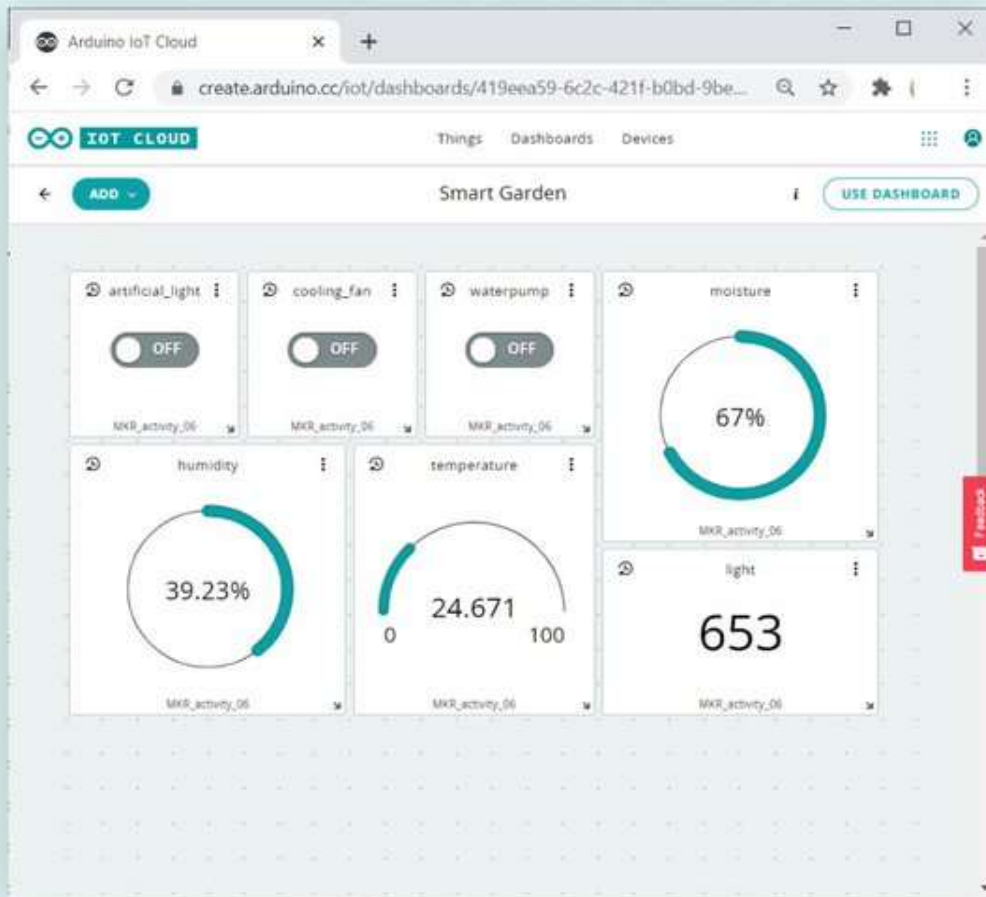
```
➤ #include <avr/io.h>
➤ int main(void)
➤ {unsigned char i=0x01;
➤
➤     for(;;)
➤     {
➤         PORTB=i;
➤         i=(i<<1)|(i>>7);
➤
➤     }
➤
➤     return(0);
➤ }
```

Blink.ino

```
➤ // the setup function runs once when you press
➤ // reset or power the board
➤ void setup() {
➤     // initialize digital pin LED_BUILTIN as an
➤     // output.
➤     pinMode(LED_BUILTIN, OUTPUT);
➤ }
➤
➤ // the loop function runs over and over again
➤ // forever
➤ void loop() {
➤     digitalWrite(LED_BUILTIN, HIGH); // turn
➤     // the LED on (HIGH is the voltage level)
➤     delay(1000); // wait for a
➤     // second
➤     digitalWrite(LED_BUILTIN, LOW); // turn
➤     // the LED off by making the voltage LOW
➤     delay(1000); // wait for a
➤     // second
➤ }
```

ButtonAndLed.ino

```
➤ #define PIN_LED 2
➤ #define PIN_BUTTON 13
➤ // the setup function runs once when you
➤ // press reset or power the board
➤ void setup() {
➤     // initialize digital pin PIN_LED as an
➤     // output.
➤     pinMode(PIN_LED, OUTPUT);
➤     pinMode(PIN_BUTTON, INPUT);
➤ }
➤
➤ // the loop function runs over and over
➤ // again forever
➤ void loop() {
➤     if (digitalRead(PIN_BUTTON) == LOW) {
➤         digitalWrite(PIN_LED,HIGH);
➤     }else{
➤         digitalWrite(PIN_LED,LOW);
➤     }
➤ }
```



Arduino Editor

create.arduino.cc/editor/ArduinoEdu/9eac7ff4-7205-444f-8cdb-7...

OPLA_PROJECT_06

Arduino MKR WIFI 1010 at C GO TO IOT CLOUD

OPLA_PROJECT_06.ino ReadMe.adoc thingProperties.h Secret

```

62 void loop() {
63   //Update the Cloud
64   ArduinoCloud.update();
65
66   //read temperature and humidity
67   temperature = carrier.Env.readTemperature();
68   humidity = carrier.Env.readHumidity();
69
70   //read raw moisture value
71   int raw_moisture = analogRead(moistPin);
72
73   //map raw moisture to a scale of 0 - 100
74   moisture = map(raw_moisture, 0, 1023, 0, 100);
75
76   //read ambient light
77   while (!carrier.Light.colorAvailable()) {
78     delay(5);
79   }
80   int none; //We dont need RGB colors
81   carrier.Light.readColor(none, none, none, light);
82
83   delay(100);
--

```


K3 Pada pemrograman mikrokontroler menggunakan Arduino:

- ▶ Periksa apakah papan/modul yang digunakan dikenali oleh PC?
 - Jika tidak daftarkan/cari pada Board Manager di Arduino IDE
- ▶ Periksa apakah port serial pada papan/modul/downloader dikenali oleh PC melalui port COMx
- ▶ Lakukan pemrograman “blink.ino” untuk mencoba apakah papan/modul mikrokontroler masih bekerja dengan baik pada tahap awal

1. Steven F. Barrett and Daniel J. Pack, "Microcontrollers Fundamentals for Engineers and Scientists", 2006, Morgan & Claypool
2. <https://akuzechie.blogspot.com/2021/09/assembly-programming-via-arduino-uno.html>
3. https://www.youtube.com/playlist?list=PL09ZAP7_T_LmIX5vctZV4PFfZwMNzjX1F
4. <https://www.youtube.com/watch?v=Jux3didJL40>
5. <https://www.youtube.com/playlist?list=PLGs0VKk2DiYw-L-RibttcvK-WBZm8WLEP>

Ada pertanyaan?

1. Buatlah contoh program sederhana menggunakan papan/modul Arduino Uno/ESP32-Wrover/Wemos-d1-mini menggunakan bahasa C (arduino) dan Assembly selain "blink.ino" beserta dari diagram alirnya untuk masing-masing kelompok dan buatlah slide presentasi untuk menerangkannya!

Note: Disarankan mencoba dari program contoh (example) yang ada di Arduino IDE

**Semoga Bermanfaat dan
Terima Kasih atas Perhatiannya**