LAPORAN AKHIR

FINAL PROJECT SISTEM TERTANAM

Disusun oleh:

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Dosen Pembimbing:

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TEKNIK KOMPUTER

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SURABAYA

2023

I. PENJELASAN TUGAS

Rancanglah sistem untuk menampilkan jam, kalender, suhu dan alarm dengan karakter pada dot matrix LED 8 x 32 (4 buah matrix LED 8x8), dengan input keyboard USB. Suhu diukur dengan menggunakan sensor suhu analog (seperti LM35 atau yang sejenisnya).

Spesifikasi fitur:

a. mode : run, set jam, set tanggal, set alarm.

b. select set : jam, menit, detik / tgl, bln, thn,

c. 3 waktu alarm dengan text (wajib) + buzzer (optional nilai plus):

- alarm 1: Display NRP

- alarm 2: Display NRP + Nama

- alarm 3: Display text yang diinputkan

Waktu aktif untuk alarm 1, 2 dan 3 bisa diset dengan tanggal, jam, menit dan durasinya dalam detik.

d. Tampilan:

- Kecerahan diatur sesuai kecerahan lingkungan dengan sensor cahaya.

- Jam, menit, detik

- Pada setiap detik ke 10 dan 40 tampilkan tgl-bln-thn selama 3 detik

- Pada setiap detik ke 13 dan 43 tampilkan suhu dengan keterangan ^{o}C (derajad Celcius)

- Pada saat waktu tepat sama dengan waktu seting alarm tampilkan text alarm sesuai durasi setingnya.

- Kecepatan geser tampilan text panjang (running text) adalah 0.5 detik per kolom matrix LED.

- Sebagai tambahan nilai : tampilan berkedip saat berada pada mode seting (input dari keyboard).

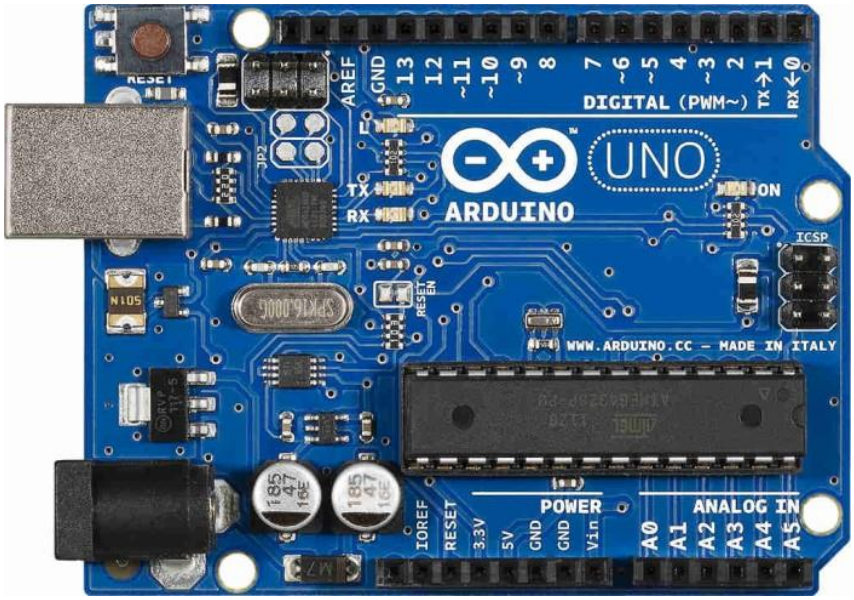
Output:

- 8x32 dot matrix LED

II. ALAT DAN BAHAN

Alat dan bahan yang saya pakai untuk final project ini adalah:

- Arduino UNO

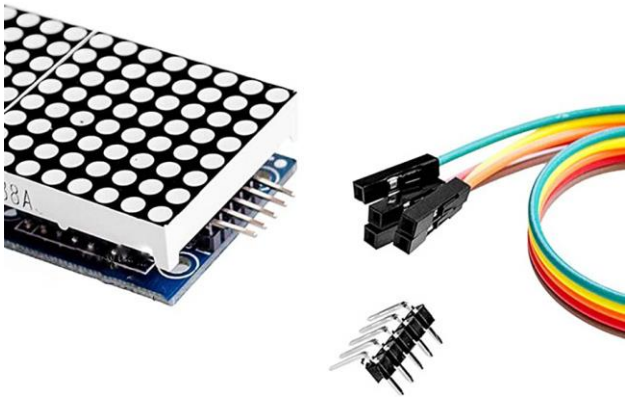


- Keyboard PS/2 Protocol

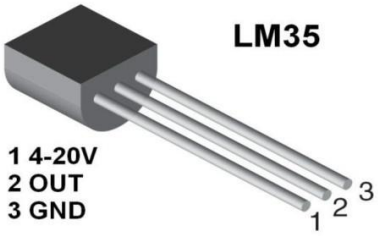
- Female PS/2 Socket

- Active Buzzer

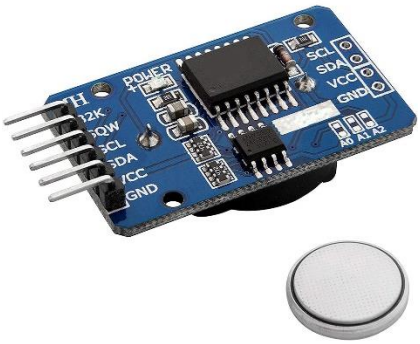
- MAX7219 LED Dot Matrix Module 4-IN-1 32x8



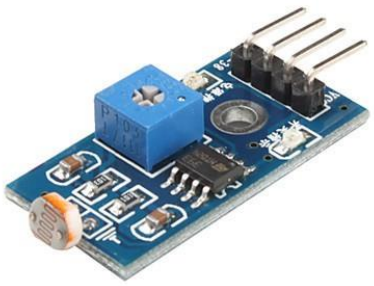
- LM35



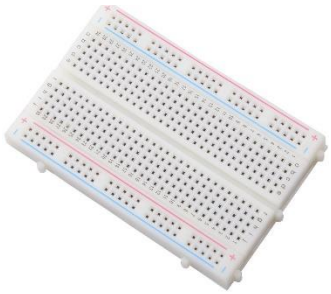
- Real time clock (DS3232)



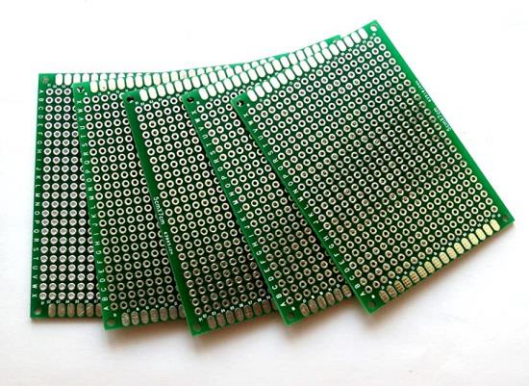
- LDR (Light Sensor Module)



- Breadboard (Untuk bereksperimen)



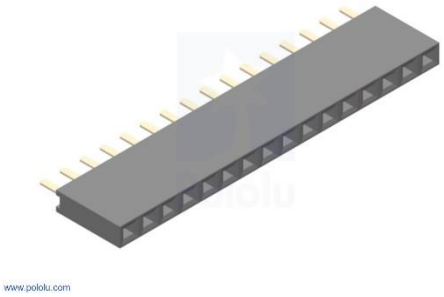
- PCB



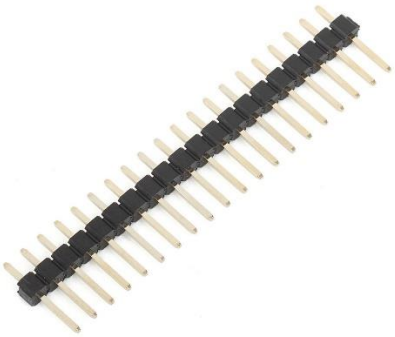
- Solder dan timahnya

- Kaki PCB

- Female to Male Pin Header



- Male to Male Pin Header



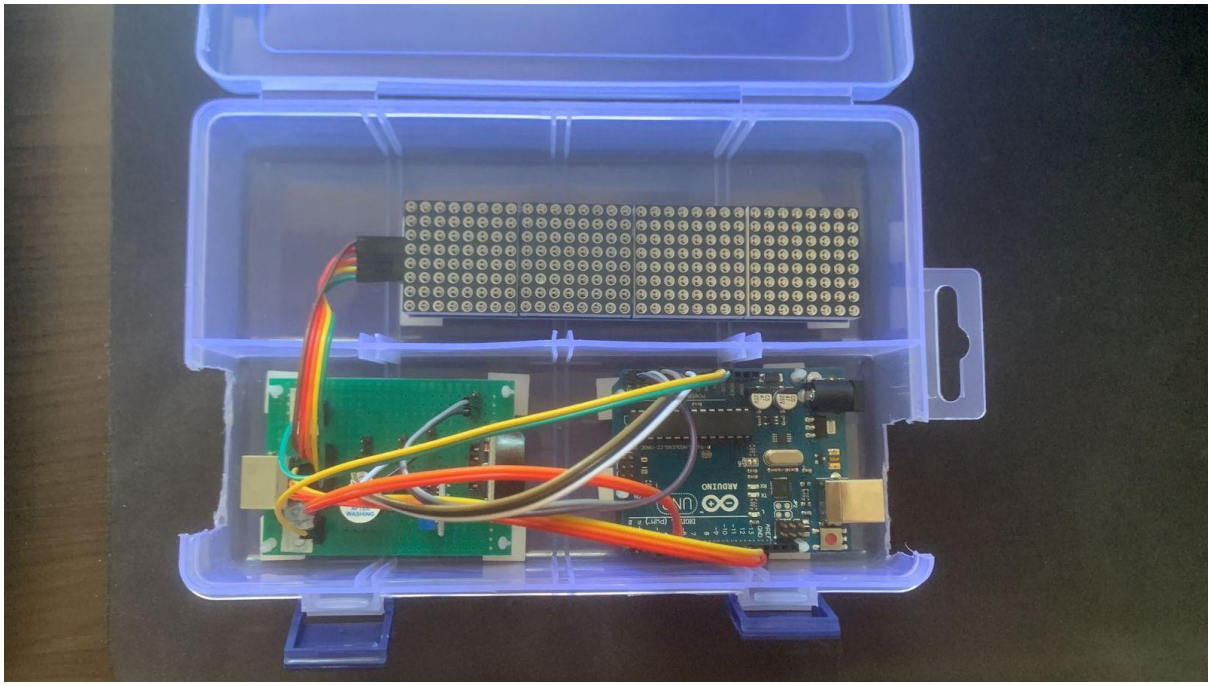
- Kabel
  - Male to female

  - Female to female

- Male to male (untuk bereksperimen)

III. RANGKAIAN

Berikut merupakan rangkaian yang telah saya rancang:

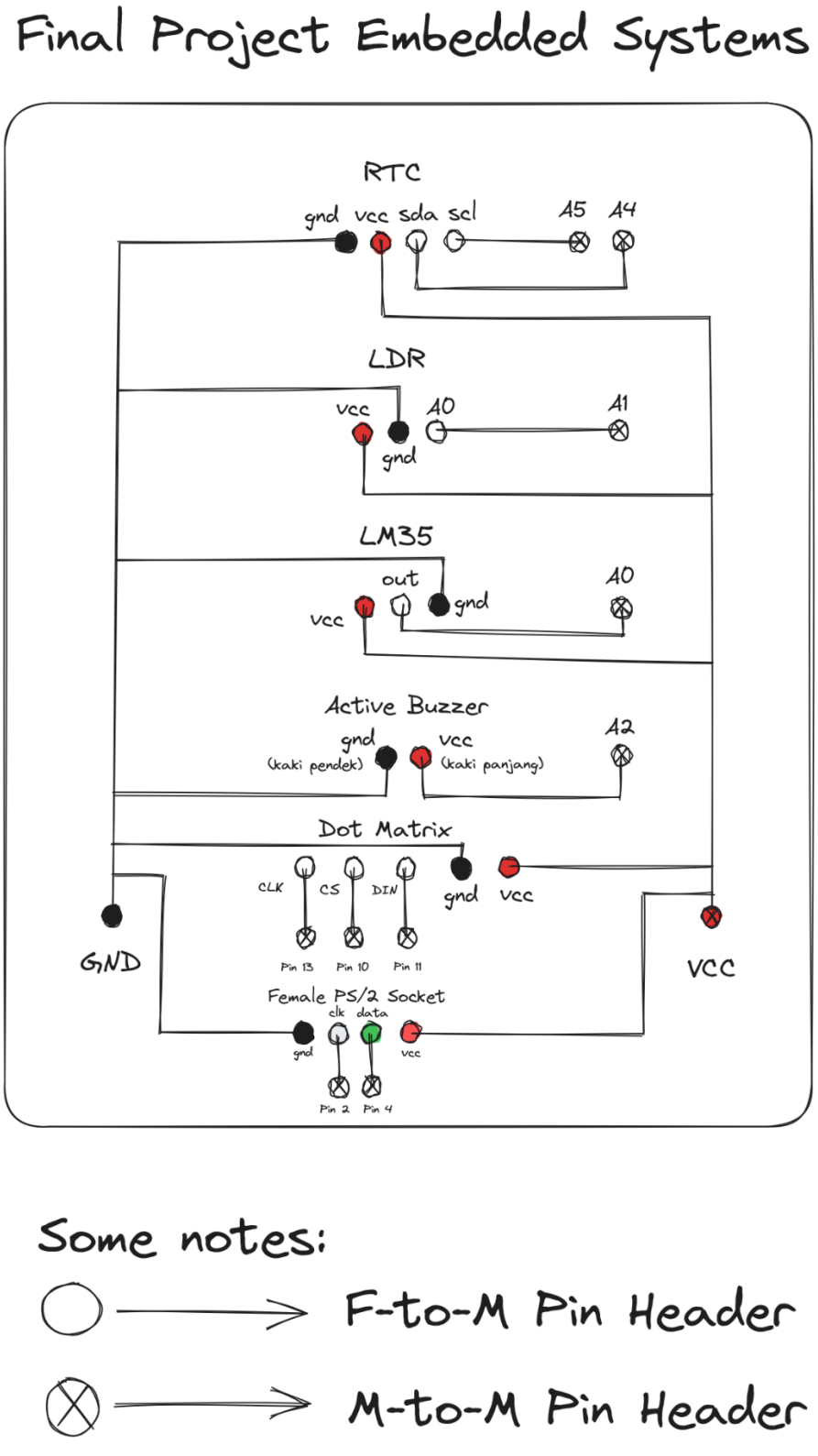


Detail rangkaian:

- Dot matrix
  - VCC disambungkan pada 5v di arduino
  - GND disambungkan pada GND di arduino
  - DIN disambungkan pada pin 11 di arduino
  - CS disambungkan pada pin 10 di arduino
  - CLK disambungkan pada pin 13 di arduino
- LDR
  - VCC disambungkan pada 5v di arduino
  - GND disambungkan pada GND di arduino
  - A0 disambungkan pada A1 di arduino
- Active Buzzer
  - Pin 1 disambungkan pada GND di arduino
  - Pin 2 disambungkan pada 8 di arduino
- RTC
  - VCC disambungkan pada 5v di arduino
  - GND disambungkan pada GND di arduino

    - SDA disambungkan pada A4 di arduino
    - SCL disambungkan pada A5 di arduino
- LM35
    - 4-20V disambungkan pada 5v di arduino
    - GND disambungkan pada GND di arduino
    - OUT disambungkan pada A0 di arduino
- Female PS/2 Socket
    - VCC disambungkan pada VCC di arduino
    - GND disambungkan pada GND di arduino
    - CLK disambungkan pada Pin 2 di arduino
    - DATA disambungkan pada Pin 4 di arduino

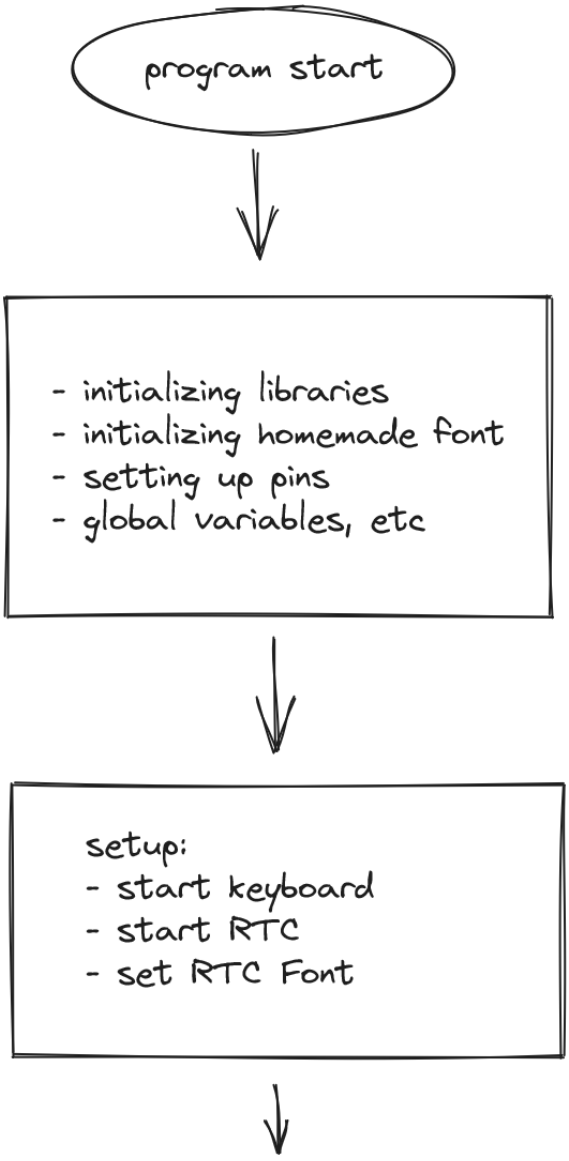
Rancangan pada PCB:



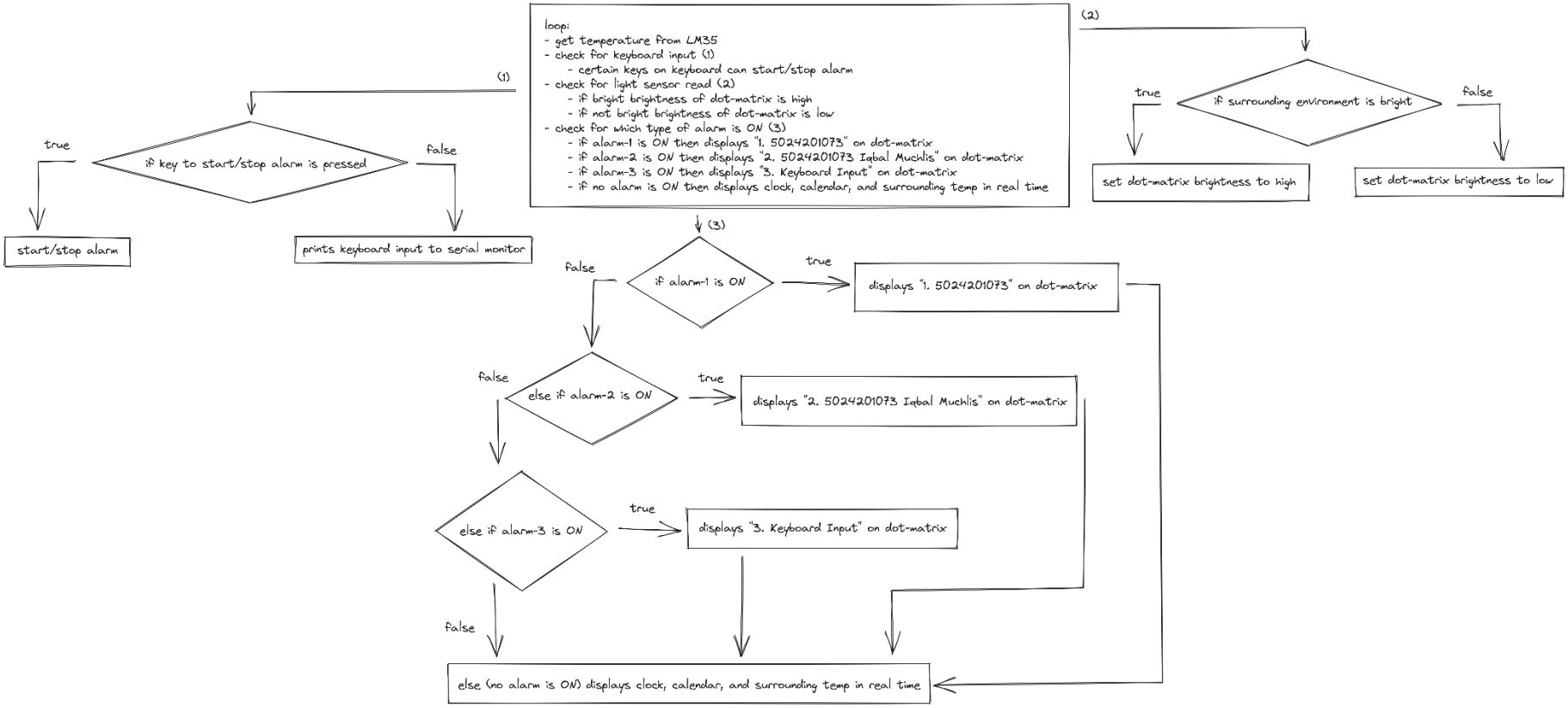
IV. HASIL

- Diagram blok:

  - Part 1:



  - Part 2:


loop:
- get temperature from LM35
- check for keyboard input (1)
  - certain keys on keyboard can start/stop alarm
- check for light sensor read (2)
  - if bright brightness of dot-matrix is high
  - if not bright brightness of dot-matrix is low
- check for which type of alarm is ON (3)
  - if alarm-1 is ON then displays "1. 5024201073" on dot-matrix
  - if alarm-2 is ON then displays "2. 5024201073 Iqbal Muchlis" on dot-matrix
  - if alarm-3 is ON then displays "3. Keyboard Input" on dot-matrix
  - if no alarm is ON then displays clock, calendar, and surrounding temp in real time
(1)
if key to start/stop alarm is pressed
true
false
start/stop alarm
prints keyboard input to serial monitor
(2)
if surrounding environment is bright
true
false
set dot-matrix brightness to high
set dot-matrix brightness to low
(3)
if alarm-1 is ON
true
false
displays "1. 5024201073" on dot-matrix
else if alarm-2 is ON
true
false
displays "2. 5024201073 Iqbal Muchlis" on dot-matrix
else if alarm-3 is ON
true
false
displays "3. Keyboard Input" on dot-matrix
else (no alarm is ON) displays clock, calendar, and surrounding temp in real time

- Dengan menggunakan library:
    - MD_MAX72XX (https://github.com/MajicDesigns/MD_MAX72XX)
        - untuk mengatur display dot matrix
    - MD_Parola (https://github.com/MajicDesigns/MD_Parola)
        - untuk mengatur, memunculkan tampilan, scrolling text, dll pada display dot matrix
    - Streaming (https://github.com/janelia-arduino/Streaming)
        - sehingga dapat melakukan cout << variable << endl seperti pada c++
        - dilakukan dengan cara Serial << variable << endl
    - TimeLib (https://github.com/PaulStoffregen/Time)
        - untuk mendapatkan time
    - DS3232RTC (https://github.com/JChristensen/DS3232RTC)
        - untuk mengatur real time clock
    - LM35 (https://github.com/wilmouths/LM35)
        - untuk mengatur sensor temperature agar lebih mudah
    - PS2Keyboard.h (https://github.com/PaulStoffregen/PS2Keyboard)
        - untuk memproses input keyboard
- Hasil:
    - dapat melakukan semua yang diminta dari detail tugas kecuali:
      - setting alarm dengan input keyboard
      - untuk alarm-3 (memasukkan input keyboard dan menampilkannya pada dot-matrix) juga belum dapat saya selesaikan

- Code:

```
// dot matrix
#include <MD_Parola.h>   //
https://github.com/MajicDesigns/MD_Parola
#include <MD_MAX72xx.h>  //
https://github.com/MajicDesigns/MD_MAX72XX)
#include <SPI.h>
#define HARDWARE_TYPE MD_MAX72XX::FC16_HW
#define MAX_DEVICES 4
#define CLK_PIN 13
#define DATA_PIN 11
#define CS_PIN 10
MD_Parola P = MD_Parola(HARDWARE_TYPE, CS_PIN, MAX_DEVICES);
// real time clock
```

```
#include <Streaming.h>  // https://github.com/janelia-
arduino/Streaming
#include <TimeLib.h>    // https://github.com/PaulStoffregen/Time
#include <DS3232RTC.h>  // https://github.com/JChristensen/DS3232RTC
DS3232RTC myRTC;
// temp sensor
#include <LM35.h>  // https://github.com/wilmouths/LM35
LM35 lm35(A0);
// light sensor
#define LIGHT_SENSOR A1
// buzzer
#define BUZZER A2
// keyboard
#include <PS2Keyboard.h>
#define DATAPIN 4
#define IRQPIN 2
PS2Keyboard keyboard;

// for snprintf
char buffer[60];

// new font
MD_MAX72XX::fontType_t newFont[] PROGMEM = {
  0,                                  // 0
  0,                                  // 1
  0,                                  // 2
  0,                                  // 3
  0,                                  // 4
  0,                                  // 5
  0,                                  // 6
  0,                                  // 7
  0,                                  // 8
  0,                                  // 9
  0,                                  // 10
  0,                                  // 11
  0,                                  // 12
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  0,                                  // 18
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  0,                                  // 24
```

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  0,                                  // 25
  0,                                  // 26
  0,                                  // 27
  0,                                  // 28
  0,                                  // 29
  0,                                  // 30
  0,                                  // 31
  1, 0,                               //
32                                    - space
  1, 92,                              // 33
  3, 12, 0, 12,                       // 34
  5, 40, 124, 40, 124, 40,            // 35
  4, 76, 146, 255, 100,               // 36
  4, 36, 16, 8, 36,                   // 37
  4, 108, 82, 42, 84,                 // 38
  1, 6,                               // 39
  2, 60, 66,                          // 40
  2, 66, 60,                          // 41
  3, 4, 14, 4,                        // 42
  5, 16, 16, 124, 16, 16,             // 43
  2, 64, 32,                          // 44
  2, 16, 16,                          // 45
  1, 32,                              // 46
  5, 64, 32, 16, 8, 4,                // 47
  4, 56, 68, 68, 56,                  // 48                    - 0
  2, 8, 124,                          // 49                          -
1
  4, 72, 100, 84, 72,                 // 50                    - 2
  3, 84, 84, 124,                     // 51                       - 3
  3, 16, 24, 124,                     // 52                        - 4
  3, 92, 84, 116,                     // 53                       - 5
  3, 124, 84, 116,                    // 54                      - 6
  3, 4, 4, 124,                       // 55                          - 7
  3, 124, 84, 124,                    // 56                      - 8
  3, 92, 84, 124,                     // 57                       - 9
  1, 36,                              //
58                                    - :
  2, 64, 36,                          // 59
  3, 16, 40, 68,                      // 60
  3, 40, 40, 40,                      // 61
  3, 68, 40, 16,                      // 62
  4, 2, 89, 9, 6,                     // 63
  7, 28, 34, 89, 85, 93, 46, 20,      // 64
  3, 120, 20, 120,                    // 65
  3, 124, 84, 40,                     // 66
  3, 56, 68, 68,                      // 67
  3, 124, 68, 56,                     // 68
  3, 124, 84, 84,                     // 69
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  3, 124, 20, 20,                 // 70
  4, 56, 68, 84, 116,             // 71
  4, 124, 16, 16, 124,            // 72
  1, 124,                         // 73
  3, 64, 64, 124,                 // 74
  3, 124, 40, 68,                 // 75
  3, 124, 64, 64,                 // 76
  5, 124, 8, 16, 8, 124,          // 77
  5, 124, 8, 16, 32, 124,         // 78
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  4, 126, 18, 18, 12,             // 80
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  2, 34, 62,                      // 93
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  3, 88, 88, 120,                 // 103
  3, 120, 16, 112,                // 104
  1, 116,                         // 105
  2, 64, 56,                      // 106
  3, 120, 16, 104,                // 107
  1, 124,                         // 108
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  3, 96, 16, 96,                  // 110
  4, 48, 72, 72, 48,              // 111
  3, 120, 24, 24,                 // 112
  3, 24, 24, 120,                 // 113
  3, 120, 8, 8,                   // 114
  3, 72, 84, 36,                  // 115
  3, 16, 120, 80,                 // 116
  3, 112, 64, 112,                // 117
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  3, 48, 64, 48,                    // 118
  5, 48, 64, 112, 64, 48,           // 119
  4, 72, 48, 48, 72,                // 120
  3, 16, 96, 16,                    // 121
  4, 72, 104, 88, 72,               // 122
  4, 16, 124, 130, 130,             // 123
  1, 255,                           // 124
  4, 130, 130, 124, 16,             // 125
  7, 16, 8, 8, 16, 32, 32, 16,      // 126
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  0,                                  // 255
};

char c = keyboard.read();
bool firstAlarm = false;
bool secondAlarm = false;
bool thirdAlarm = false;
```

```
bool noAlarm = false;

// unsigned long startTime;
// const unsigned long duration = 5000;

#define PS2_F1 49
#define PS2_F2 50
#define PS2_F3 51
#define PS2_F4 52
#define PS2_F5 53
#define PS2_F6 54

void setup() {
  Serial.begin(9600);
  // startTime = millis();
  keyboard.begin(DATAPIN, IRQPIN);
  pinMode(BUZZER, OUTPUT);
  myRTC.begin();
  P.begin();
  P.setFont(newFont);


  // Parameters

  //   alarmType: A value from the ALARM_TYPES_t enumeration, above.
(ALARM_TYPES_t)
  //   seconds: The seconds value to set the alarm to. (uint8_t)
  //   minutes: The minutes value to set the alarm to. (uint8_t)
  //   hours: The hours value to set the alarm to. (uint8_t)
  //   dayOrDate: The day of the week or the date of the month. For
day of the week,
  //   use a value from the Time library timeDayOfWeek_t
enumeration,
  //   i.e. dowSunday, dowMonday, dowTuesday, dowWednesday,
dowThursday, dowFriday, dowSaturday. (uint8_t)

  // Values for Alarm 1

  //   ALM1_EVERY_SECOND -- causes an alarm once per second.
  //   ALM1_MATCH_SECONDS -- causes an alarm when the seconds match
(i.e. once per minute).
  //   ALM1_MATCH_MINUTES -- causes an alarm when the minutes and
seconds match.
  //   ALM1_MATCH_HOURS -- causes an alarm when the hours and
minutes and seconds match.
  //   ALM1_MATCH_DATE -- causes an alarm when the date of the month
and hours and minutes and seconds match.
  //   ALM1_MATCH_DAY -- causes an alarm when the day of the week
and hours and minutes and seconds match.
```

```
  // Syntax
  //   myRTC.setAlarm(alarmType, seconds, minutes, hours,
dayOrDate);

  // // second
  // myRTC.setAlarm(DS3232RTC::ALM1_EVERY_SECOND, 0, 0, 0, 1);
  // // seconds
  // myRTC.setAlarm(DS3232RTC::ALM1_MATCH_SECONDS, 3, 0, 0, 1);
  // // minutes
  // myRTC.setAlarm(DS3232RTC::ALM1_MATCH_MINUTES, 5, 30, 0, 1);
  // // hours
  // myRTC.setAlarm(DS3232RTC::ALM1_MATCH_HOURS, 3, 3, 3, 1);
  // // date
  // myRTC.setAlarm(DS3232RTC::ALM1_MATCH_DATE, 3, 3, 3, 3);
  // // day
  // myRTC.setAlarm(DS3232RTC::ALM1_MATCH_DAY, 3, 3, 3,
dowWednesday);


  // // set alarm by seconds every minute
  // // set Alarm 1 to occur at 5 seconds after every minute
  // myRTC.setAlarm(DS3232RTC::ALM1_MATCH_SECONDS, 3, 0, 0, 1);


  // clear the alarm flag
  // myRTC.alarm(DS3232RTC::ALARM_1);

  // setSyncProvider() causes the Time library to synchronize with
the
  // external RTC by calling RTC.get() every five minutes by
default.
  setSyncProvider(myRTC.get);
  // Serial << F("RTC Sync");
  // if (timeStatus() != timeSet)
  //   Serial << F(" FAIL!");
  // Serial << endl;

  P.displayClear();
}

void loop() {
  // change time_t (uint32_t) to uint16_t if need to free more
memory
  static time_t tLast;
  time_t t;
  tmElements_t tm;

  // keyboard input
```

```
  if (keyboard.available()) {
    char c = keyboard.read();
    // check for some of the special keys
    if (c == PS2_ENTER) {
      Serial.println();
    } else if (c == PS2_TAB) {
      Serial.print("Tab");
    } else if (c == PS2_ESC) {
      Serial.print("ESC");
    } else if (c == PS2_PAGEDOWN) {
      Serial.print("PgDn");
    } else if (c == PS2_PAGEUP) {
      Serial.print("PgUp");
    } else if (c == PS2_LEFTARROW) {
      Serial.print("Left");
    } else if (c == PS2_RIGHTARROW) {
      Serial.print("Right");
    } else if (c == PS2_UPARROW) {
      Serial.print("Up");
    } else if (c == PS2_DOWNARROW) {
      Serial.print("Down");
    } else if (c == PS2_DELETE) {
      Serial.print("Del");
    } else if (c == 33) {  // !
      // second
      myRTC.setAlarm(DS3232RTC::ALM1_EVERY_SECOND, 0, 0, 0, 1);
      Serial << "set alarm 1";
      firstAlarm = true;
      secondAlarm = false;
      thirdAlarm = false;
      noAlarm = false;
    } else if (c == 64) {  // @
      // seconds
      myRTC.setAlarm(DS3232RTC::ALM1_MATCH_SECONDS, 3, 0, 0, 1);
      Serial << "set alarm 2";
      firstAlarm = false;
      secondAlarm = true;
      thirdAlarm = false;
      noAlarm = false;
    } else if (c == 35) {  // #
      // minutes
      myRTC.setAlarm(DS3232RTC::ALM1_MATCH_MINUTES, 5, 30, 0, 1);
      Serial << "set alarm 3";
      firstAlarm = false;
      secondAlarm = false;
      thirdAlarm = true;
      noAlarm = false;
    } else if (c == 36) {  // enables alarm with "$" in keyboard
```

```
      // hours
      myRTC.setAlarm(DS3232RTC::ALM1_MATCH_HOURS, 3, 3, 3, 1);
      digitalWrite(BUZZER, HIGH);
    } else if (c == 37) {  // enables alarm with "%" in keyboard
      // date
      myRTC.setAlarm(DS3232RTC::ALM1_MATCH_DATE, 3, 3, 3, 3);
      digitalWrite(BUZZER, HIGH);
    } else if (c == 94) {  // enables alarm with "^" in keyboard
      // day
      myRTC.setAlarm(DS3232RTC::ALM1_MATCH_DAY, 3, 3, 3,
dowWednesday);
      digitalWrite(BUZZER, HIGH);
    } else if (c == 49 && firstAlarm == true) {  // disables alarm
with "1" in keyboard
      digitalWrite(BUZZER, LOW);
      firstAlarm = false;
      noAlarm = true;
      myRTC.alarm(DS3232RTC::ALARM_1);
      myRTC.clearAlarm(DS3232RTC::ALARM_1);
    } else if (c == 50 && secondAlarm == true) {  // disables alarm
with "2" in keyboard
      digitalWrite(BUZZER, LOW);
      secondAlarm = false;
      noAlarm = true;
      myRTC.alarm(DS3232RTC::ALARM_1);
      myRTC.clearAlarm(DS3232RTC::ALARM_1);
    } else if (c == 51 && thirdAlarm == true) {  // disables alarm
with "3" in keyboard
      digitalWrite(BUZZER, LOW);
      thirdAlarm = false;
      noAlarm = true;
      myRTC.alarm(DS3232RTC::ALARM_1);
      myRTC.clearAlarm(DS3232RTC::ALARM_1);
    } else if (c == 38) {
      firstAlarm = false;
      secondAlarm = false;
      thirdAlarm = false;
      noAlarm = true;
      myRTC.alarm(DS3232RTC::ALARM_1);
      myRTC.clearAlarm(DS3232RTC::ALARM_1);
      digitalWrite(BUZZER, LOW);
    } else {
      // otherwise, just print all normal characters
      Serial.print(c);
    }
  }
```

```
  // check for input to set the RTC, minimum length is 12, i.e.
yy,m,d,h,m,s
  if (Serial.available() >= 12) {
    // note that the tmElements_t Year member is an offset from
1970,
    // but the RTC wants the last two digits of the calendar year.
    // use the convenience macros from the Time Library to do the
conversions.

    int y = Serial.parseInt();
    if (y >= 100 && y < 1000)
      Serial << F("Error: Year must be two digits or four digits!")
<< endl;
    else {
      if (y >= 1000)
        tm.Year = CalendarYrToTm(y);
      else  // (y < 100)
        tm.Year = y2kYearToTm(y);
      tm.Month = Serial.parseInt();
      tm.Day = Serial.parseInt();
      tm.Hour = Serial.parseInt();
      tm.Minute = Serial.parseInt();
      tm.Second = Serial.parseInt();
      t = makeTime(tm);
      myRTC.set(t);  // use the time_t value to ensure correct
weekday is set
      setTime(t);
      Serial << F("RTC set to: ");
      // printDateTime(t);

      Serial << endl;
      // dump any extraneous input
      while (Serial.available() > 0)
        Serial.read();
    }
  }

  t = now();

  if (t != tLast) {
    tLast = t;

    // P.setIntensity(0);
    // changes brightness according to light sensor
    if (analogRead(LIGHT_SENSOR) < 100) {
      // terang banget
      P.setIntensity(10);
    } else if (analogRead(LIGHT_SENSOR) < 200) {
```

```
      // terang
      P.setIntensity(8);
    } else if (analogRead(LIGHT_SENSOR) < 500) {
      // normal
      P.setIntensity(5);
    } else if (analogRead(LIGHT_SENSOR) < 800) {
      // gelap
      P.setIntensity(3);
    } else {
      // gelap banget
      P.setIntensity(0);
    }

    // // prints calendar and clock
    // printDateTime(t);
    // // prints LM35, RTC Temp, and LDR, current display on dot
matrix
    // Serial << "LM35: " << lm35.getTemp(CELCIUS) << " "
    //        << "RTC: " << myRTC.temperature() / 4.0 << " LDR:" <<
analogRead(LIGHT_SENSOR) << " " << buffer;
    uint16_t celciusTemp = lm35.getTemp(CELCIUS);

    Serial << buffer << " " << celciusTemp;


    if (firstAlarm == true && myRTC.checkAlarm(DS3232RTC::ALARM_1))
{
      Serial << " ALARM 1";
      snprintf(buffer, sizeof(buffer), "1. 5024201073");
      digitalWrite(BUZZER, HIGH);
    } else if (secondAlarm == true &&
myRTC.checkAlarm(DS3232RTC::ALARM_1)) {
      Serial << " ALARM 2";
      snprintf(buffer, sizeof(buffer), "2. 5024201073 Iqbal
Muchlis");
      digitalWrite(BUZZER, HIGH);

    } else if (thirdAlarm == true &&
myRTC.checkAlarm(DS3232RTC::ALARM_1)) {
      Serial << " ALARM 3";
      snprintf(buffer, sizeof(buffer), "3. Keyboard Input");
      digitalWrite(BUZZER, HIGH);
    } else if (noAlarm == true) {
      // snprintf(buffer, sizeof(buffer), " ");
      if (second(t) == 9 || second(t) == 39 || second(t) == 14 ||
second(t) == 44) {
        // myRTC.clearAlarm(DS3232RTC::ALARM_1);
        snprintf(buffer, sizeof(buffer), " ");
```

```
      } else if ((second(t) >= 10 && second(t) <= 13) || (second(t)
>= 40 && second(t) <= 43)) {
        // displays calendar for 3 seconds
        digitalWrite(BUZZER, LOW);
        snprintf(buffer, sizeof(buffer), "%d.%s.%d", day(t),
monthShortStr(month(t)), _DEC(year(t)));
        Serial << " CALENDAR";
      } else if ((second(t) >= 14 && second(t) <= 17) || (second(t)
>= 44 && second(t) <= 46)) {
        // displays temperature for 3 seconds
        digitalWrite(BUZZER, LOW);
        snprintf(buffer, sizeof(buffer), "%d °C", celciusTemp);
        Serial << " TEMP";
      } else {
        // displays clock as a default
        digitalWrite(BUZZER, LOW);
        snprintf(buffer, sizeof(buffer), "%d.%d.%d", hour(t),
minute(t), second(t));
      }
    }

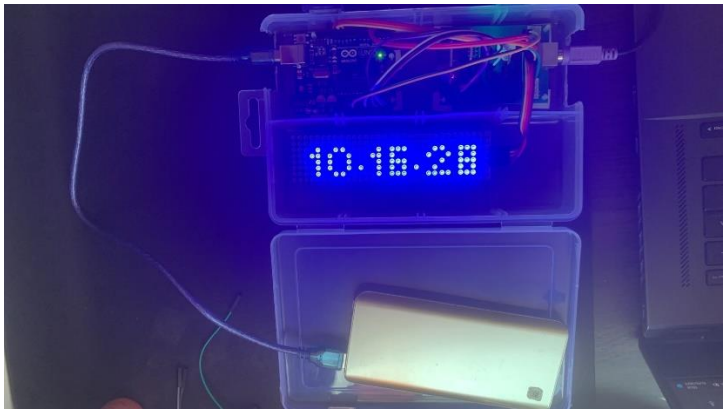
    Serial << endl;
  }

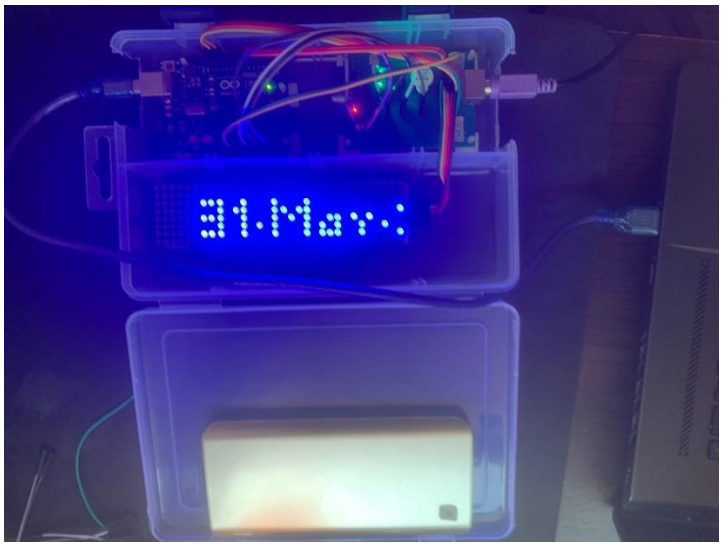
  if (P.displayAnimate()) {
    if (firstAlarm == true || secondAlarm == true || thirdAlarm ==
true || noAlarm == false) {
      P.displayText(buffer, PA_RIGHT, 60, 60, PA_SCROLL_LEFT,
PA_SCROLL_LEFT);
    }
    if (second(t) == 9 || second(t) == 39 || second(t) == 14 ||
second(t) == 44) {
      // dont change PA_OPENING, it fixes weird calendar + temp
scrolling
      P.displayText(buffer, PA_CENTER, 60, 60, PA_OPENING,
PA_OPENING);
    } else if (((second(t) >= 10 && second(t) <= 13) || (second(t)
>= 40 && second(t) <= 43)) || ((second(t) >= 14 && second(t) <= 16)
|| (second(t) >= 44 && second(t) <= 45))) {
      P.displayText(buffer, PA_RIGHT, 60, 60, PA_SCROLL_LEFT,
PA_SCROLL_LEFT);
    } else {
      P.displayText(buffer, PA_CENTER, 60, 60, PA_NO_EFFECT,
PA_NO_EFFECT);
    }
    P.displayReset();
  }
}
```

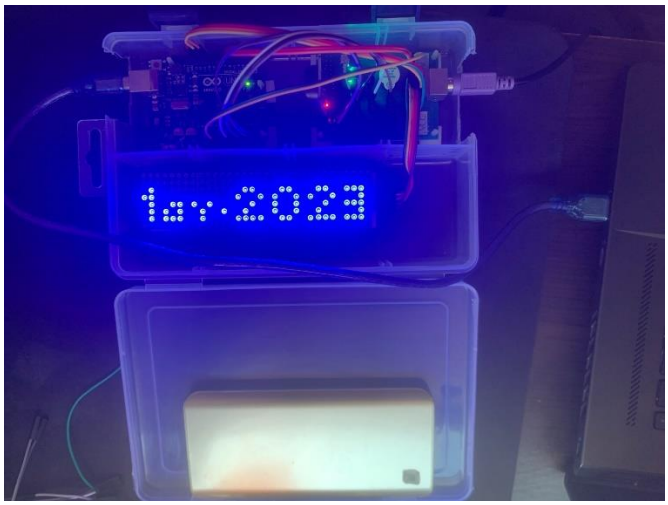
```
  Serial << _DEC(val);
  if (delim > 0) Serial << delim;
  return;
}
```

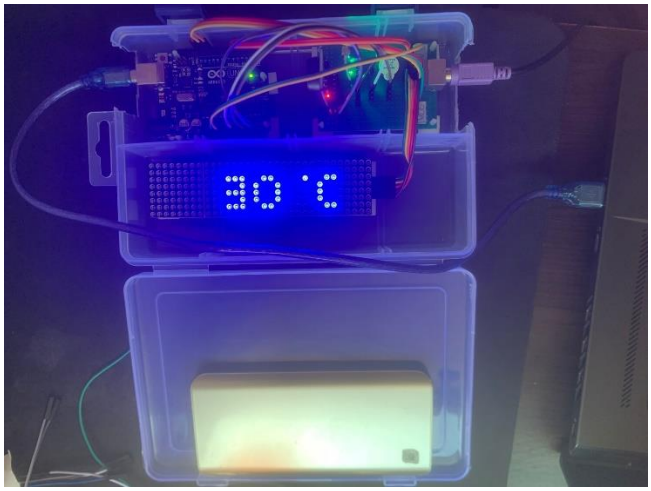
- Hasil display

    - clock, yang dimana pada saat detik 10, 13 dan 40, 43 akan tampil kalender dan suhu

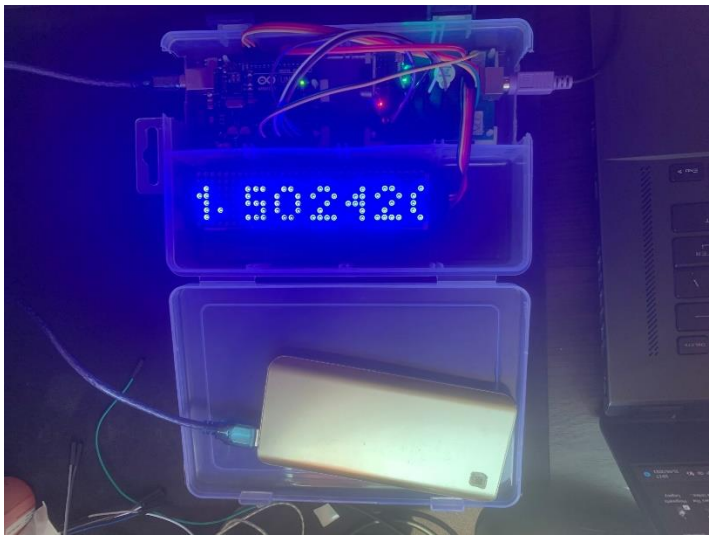




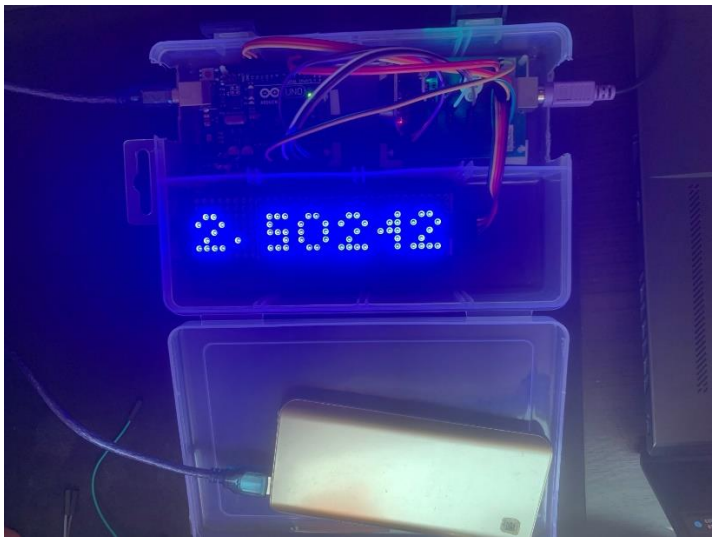


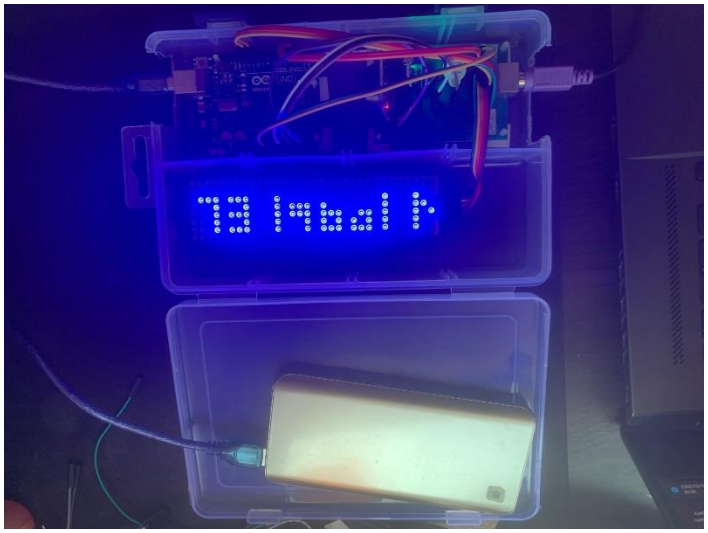


- display pada saat alarm 1 bernyala

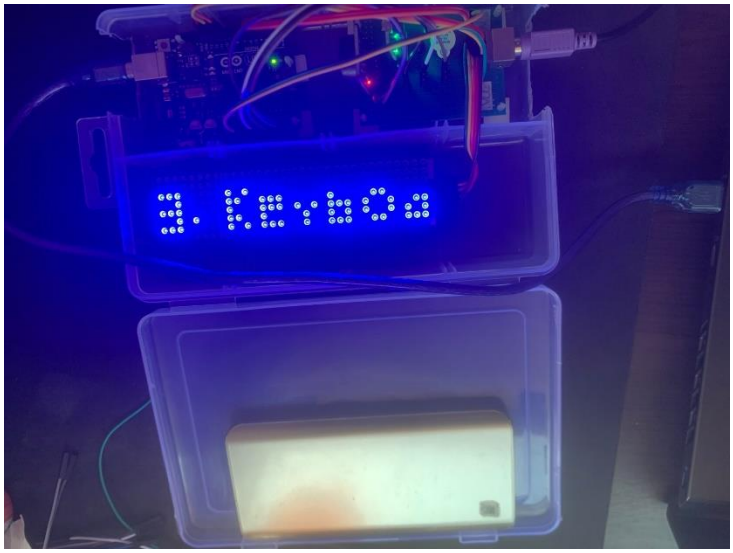


- display pada saat alarm 2 bernyala





- display pada saat alarm 3 bernyala



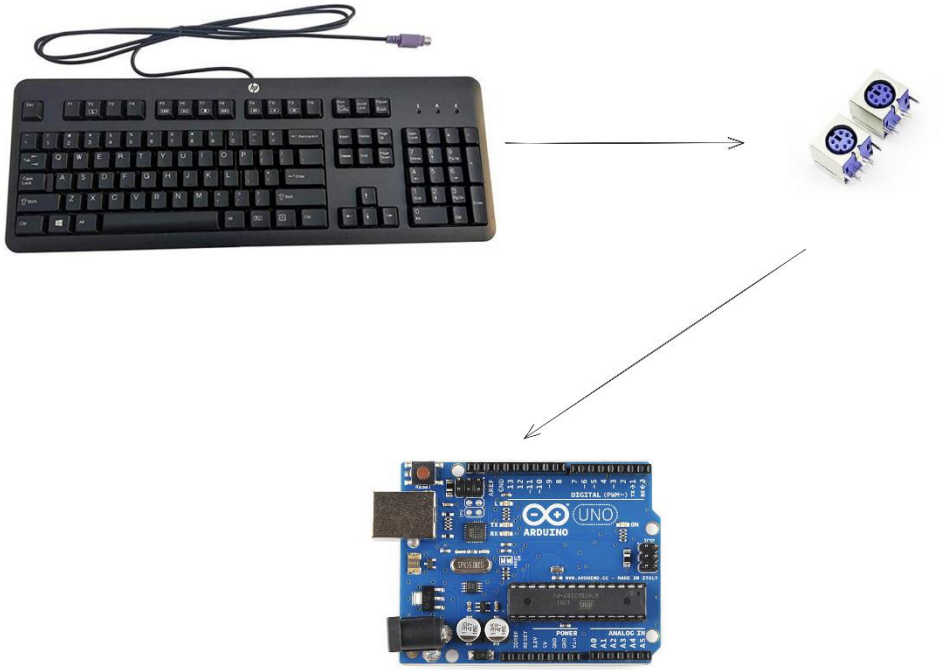
V. KESIMPULAN

Kode saya memiliki kekurangan yaitu tidak dapat:

- tidak dapat setting detail alarm (contoh: durasi alarmnya) dengan keyboard.

- hanya bisa menampilkan satu per satu karakter (contoh: saat tekan 1 pada keyboard akan tampil 1 tapi saat tekan 2 yang seharusnya menampilkan 12 tetapi hanya 2 saja) pada dot-matrix dengan keyboard.

Detail rancangan input keyboard:



Dengan menggunakan ps/2 keyboard, saya dapat memakai female ps/2 socket sehingga dapat digunakannya pada arduino. Untuk implementasinya kodingannya, saya memakai sebuah library untuk mengubah scan code dari ps/2 menjadi ascii character.