LAMPIRAN

Perhitungan Analisis Data

1. Rata-rata ($\overline{X}$)

   Dirumuskan sebagai berikut:

   $$\overline{X} = \frac{\sum X(n)}{n}$$

   a. Larutan buffer 4,01

   $$\overline{X} = \frac{4{,}03+4{,}17+4{,}07+4{,}19+4{,}22+4{,}15+4{,}09+4{,}1+4{,}09+4{,}09}{10}$$

   $$= \frac{41{,}2}{10}$$

   $$= 4{,}12$$

   b. Larutan buffer 6,86

   $$\overline{X} = \frac{6{,}89+6{,}80+6{,}83+6{,}75+6{,}70+6{,}77+6{,}75+6{,}81+6{,}86+6{,}89}{10}$$

   $$= 6{,}80$$

   c. Sampel 1

   $$\overline{X} = \frac{6{,}58+6{,}64+6{,}42+6{,}67+6{,}65+6{,}60+6{,}55+6{,}50+6{,}50+6{,}58}{10}$$

   $$= \frac{65{,}6}{10}$$

   $$= 6{,}56$$

   d. Sampel 2

   $$\overline{X} = \frac{5{,}82+5{,}75+5{,}73+5{,}77+5{,}75+5{,}79+5{,}84+5{,}81+5{,}80\_5{,}80}{10}$$

   $$= \frac{57{,}8}{10}$$

   $$= 5{,}78$$

e. Sampel 3

$$\overline{X} = \frac{5,39+5,37+5,45+5,51+5,48+5,45+5,40+5,47+5,56+5,52}{10}$$

$$= \frac{54,6}{10}$$

$$= 5,46$$

f. Sampel 4

$$\overline{X} = \frac{6,89+6,85+6,89+6,95+6,88+6,93+6,97+6,99+7,00+6,95}{10}$$

$$= \frac{69,3}{10}$$

$$= 6,93$$

2. Simpangan

Dirumuskan sebagai berikut:

Simpangan = $Xn - \overline{X}$

a. Larutan buffer 4,01

Simpangan = 4,12-4,09

= 0,03

b. Larutan buffer 6,86

Simpangan = 6,88-6,80

= 0,08

c. Sampel 1

Simpangan = 6,56-6,50

= 0,06

d. Sampel 2

Simpangan = 5,84-5,78

= 0,06

e. Sampel 3

Simpangan = 5,51-5,46

= 0,05

f. Sampel 4

Simpangan = 7,00-6,93

= 0,07

3. Persentase eror (%)

Dirumuskan sebagai berikut:

$$\%\ Error = \frac{Xn - \overline{X}}{Xn} x100\%$$

a. Larutan buffer 4,01

$$\%\ Error = \frac{4,12-4,09}{4,09} \text{x}100\% = 0,73\ \%$$

b. Larutan buffer 6,86

$$\%Error = \frac{6,88-6,80}{6,88} \text{x}100\% = 1,09\ \%$$

c. Sampel 1

$$\%\ Error = \frac{6,56-6,50}{6,50} \text{x}100\% = 1,06\ \%$$

d. Sampel 2

$$\%\ Error = \frac{5,84-5,78}{5,84} \text{x}100\% = 1,02\ \%$$

e. Sampel 3

$$\%\ Error\ = \frac{5{,}51-5{,}46}{5{,}51}\text{x}100\% = 0{,}91\ \%$$

f. Sampel 4

$$\%\ Error\ = \frac{7{,}00-6{,}93}{7{,}00}\text{x}100\% = 1{,}00\ \%$$

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(2, 3, 4, 5, 6, 7);


#define SensorPin A0            //pH meter Analog output
to Arduino Analog Input 0
#define startpin  8
#define LED 13
#define samplingInterval 20
#define printInterval 800
#define ArrayLenth  40    //times of collection
int pHArray[ArrayLenth];   //Store the average value of
the sensor feedback
int pHArrayIndex=0;
int codestart=0;
void setup(void)
{
  lcd.begin(16, 2);
  pinMode(LED,OUTPUT);
  pinMode(startpin,INPUT_PULLUP);
  Serial.begin(9600);
  Serial.println("pH meter experiment!");    //Test the
serial monitor
}
```

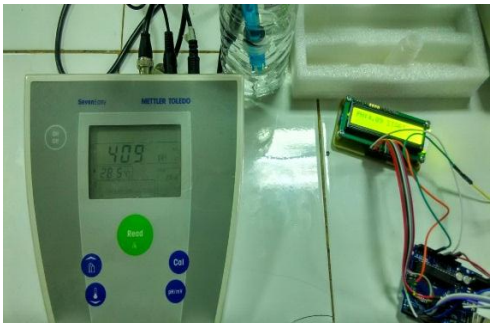
```
void loop(void)
{
  static unsigned long samplingTime = millis();
  static unsigned long printTime = millis();
  static float pHValue,voltage,PHLCD;
  if(millis()-samplingTime > samplingInterval)
  {
      pHArray[pHArrayIndex++]=analogRead(SensorPin);
      if(pHArrayIndex==ArrayLenth)pHArrayIndex=0;
      voltage        =        map(avergearray(pHArray,
ArrayLenth),0,1023,1023,0)*5.0/1024;
      pHValue = (1.5*voltage)*voltage;
      samplingTime=millis();
  }
  if(millis() - printTime > printInterval)    //Every
800 milliseconds, print a numerical, convert the state
of the LED indicator
  {
     Serial.print("Voltage:");
        Serial.print(voltage,2);
        Serial.print("    pH value: ");
     Serial.println(pHValue,2);
        digitalWrite(LED,digitalRead(LED)^1);
        printTime=millis();
```

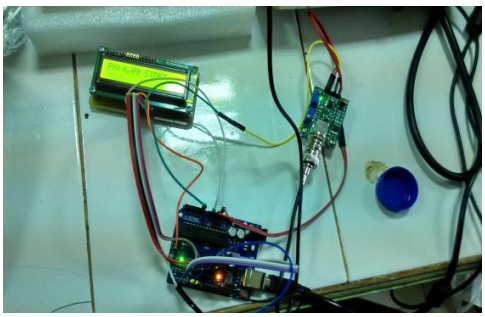
```
        if(codestart==1)PHLCD=pHValue;
        lcd.clear();
  }

if(digitalRead(startpin)==0){
  codestart++;
  if(codestart>2)codestart=0;
  lcd.clear();
  delay(200);
}
if(codestart==0) PHLCD=0;
lcd.setCursor(0,0);
lcd.print("PH:");
lcd.print(PHLCD);
if(codestart==0)lcd.print(" STOP");
if(codestart==1)lcd.print(" START");
if(codestart==2)lcd.print(" HOLD");
lcd.setCursor(0,1);
if(codestart==2){
if(PHLCD<5.5)lcd.print("ASIDOSIS");
if(PHLCD>=5.5&&PHLCD<=7)lcd.print("NORMAL");
if(PHLCD>7)lcd.print("ALKALIOSIS");
}
delay(10);
```

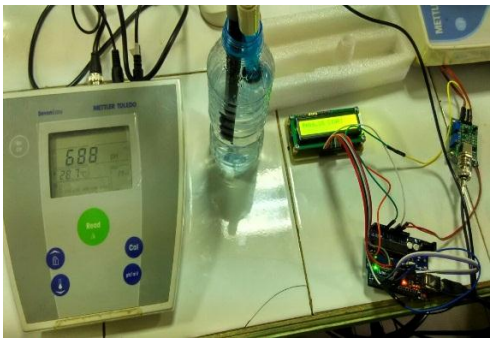
```
}
double avergearray(int* arr, int number){
  int i;
  int max,min;
  double avg;
  long amount=0;
  if(number<=0){
    Serial.println("Error  number  for  the  array  to
avraging!/n");
    return 0;
  }
  if(number<5){    //less than 5, calculated directly
statistics
    for(i=0;i<number;i++){
      amount+=arr[i];
    }
    avg = amount/number;
    return avg;
  }else{
    if(arr[0]<arr[1]){
      min = arr[0];max=arr[1];
    }
    else{
      min=arr[1];max=arr[0];
```

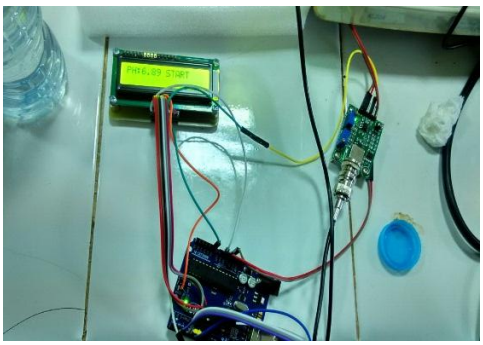
```
    }
    for(i=2;i<number;i++){
      if(arr[i]<min){
        amount+=min;         //arr<min
        min=arr[i];
      }else {
        if(arr[i]>max){
          amount+=max;    //arr>max
          max=arr[i];
        }else{
          amount+=arr[i]; //min<=arr<=max
        }
      }//if
    }//for
    avg = (double)amount/(number-2);
  }//if
  return avg;
}
```

Pengujian Alat





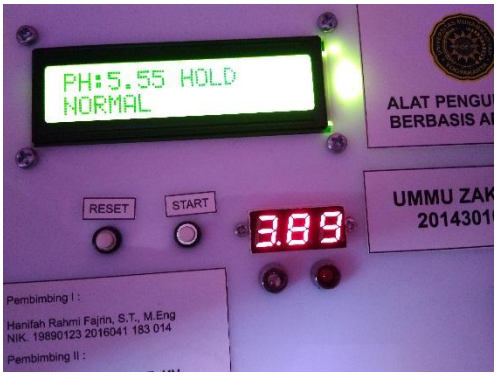


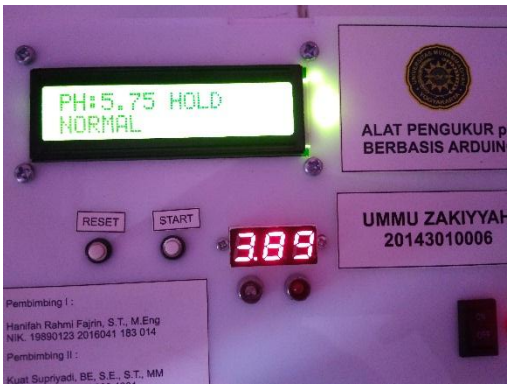



PH:6.92 HOLD
NORMAL
RESET
START
3.87
UMMU ZAKIY
Pembimbing I :
Hanifah Rahmi Fajrin, S.T., M.Eng
NIK. 19890123 2016041 183 014


PH:6.99 HOLD
NORMAL
RESET
START
3.89
ALAT PENG
BERBASIS
UMMU ZA
2014301
Hanifah Rahmi Fajrin, S.T., M.Eng
19890123 2016041 183 014


PH:5.52 HOLD
NORMAL
RESET
START
3.89
ALAT PENG
BERBASIS
UMMU ZA
20143
Pembimbing I :
anifah Rahmi Fajrin, S.T., M.Eng
IK. 19890123 2016041 183 014


PH:5.55 HOLD
NORMAL
RESET
START
3.89
ALAT PENGU
BERBASIS A
UMMU ZAK
2014301
Pembimbing I :
Hanifah Rahmi Fajrin, S.T., M.Eng
NIK. 19890123 2016041 183 014
Pembimbing II :


PH:5.75 HOLD
NORMAL
RESET
START
3.89
ALAT PENGUKUR p
BERBASIS ARDUIN
UMMU ZAKIYYAH
20143010006
Pembimbing I :
Hanifah Rahmi Fajrin, S.T., M.Eng
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Pembimbing II :
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PH:5.84 HOLD
NORMAL
RESET
START
3.89
ALAT PENGUKUR pH
BERBASIS ARDUINO
UMMU ZAKIYYAH
20143010006
Pembimbing I :
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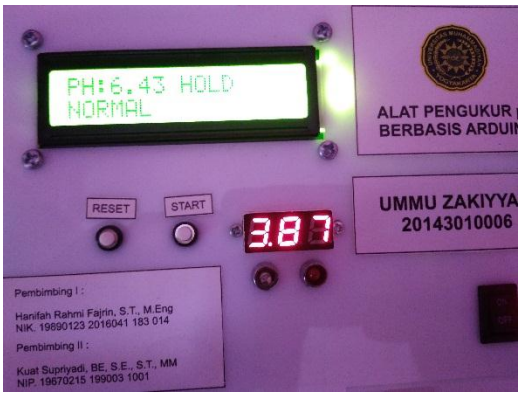
Pembimbing II :
Kuat Supriyadi, BE, S.E., S.T., MM


PH:6.43 HOLD
NORMAL
ALAT PENGUKUR
BERBASIS ARDUI
RESET
START
3.87
UMMU ZAKIYYA
20143010006
Pembimbing I :
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Pembimbing II :
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PH:6.58 HOLD
NORMAL
ALAT PENGUKUR pH
BERBASIS ARDUINO
RESET
START
3.89
UMMU ZAKIYYAH
20143010006
Pembimbing I :
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