

## DAFTAR PUSTAKA

- Abdul Rahman. (2019). Perancangan Aplikasi Pengamanan File Pada Memory Card Handphone Menggunakan Algoritma Kunci Asimetris Elgamal. *Jurnal Riset Komputer (JURIKOM)*, Vol. 6, No. 5, Oktober 2019.
- Alfatihah Ainayah., Husain Latuconsina., & Hamdani Dwi Prasetyo. (2023). Pertumbuhan Tanaman Kangkung (*Ipomoea reptans Poir*) dan Pakcoy (*Brassica rapa Linnaeus*) pada Sistem Budidaya Akuaponik. (*JRPK*) *Jurnal Riset Perikanan dan Kelautan* 5 (2), Juli 2023.
- Alfia Risma., (2021). Sistem Monitoring Kualitas Air Pada Sistem Akuaponik Berbasis Iot. *Jurnal Teknik Elektro*. Volume 10. No 3, Tahun 2021, Halaman 707-714.
- Andi Adriansyah, Mirzanu Rizky GM, Yuliza (2014). Rancang bangun dan analisa CCTV online berbasis Raspberry IP. Universitas Mercu Buana. Jakarta.
- Aponso, M., Adhikari, B., & Khanal, S. K. (2018). Ammonia in aquaponics: a review. *Journal of Environmental Management*, 219, 189-199.
- Badan Pusat Statistik. (2019). Pengeluaran untuk Konsumsi Penduduk Indonesia; Berdasarkan Hasil Survei Susenas Maret Akromo Bakterioli, 16 Farida, N.F., Ab 2019. Jakarta: Badan Pusat Statistik.
- Bittsanszky, A., Uzinger, N., Gyulai, L., & Halasz, G. (2016). Monitoring and control in aquaponics systems—A review. *Aquacultural Engineering*, 75, 1-18.
- Cahyo, Saparinto., & Rini Susiana. (2014). Panduan Lengkap Budidaya Ikan dan Sayuran dengan Sistem Akuaponik, Yogyakarta: Lily Publisher.
- Dauhan, R. E. S., Efendi, E., & Suparmono (2014). Efektivitas Sistem Akuaponik Dalam Mereduksi Konsentrasi Amonia Pada Sistem Budidaya Ikan. *Jurnal Rekayasa Dan Teknologi Budidaya Perairan*. Vol. 3 (1): 297-301.
- Dewi Rosanti., (2013). Morfologi Tumbuhan. Jakarta: Erlangga.
- Efendy Yessy Pristika., Dendrit Yahya Qadlizaka, Raka Rizky Raihanfalaach, & Nurul Azizah (2022). Penerapan Teknologi Budidaya Akuaponik Sebagai Bentuk Pemanfaatan Lahan Sempit di Kelurahan Jambangan, Surabaya. *KARYA UNGGUL : Jurnal Pengabdian Kepada Masyarakat*. Volume 1 |

Nomor 2 | Juni 2022.

- Endut, A., Jusoh, A., Ali, N., Wan Nik, W. B., & Wan Daud, W. M. (2012). A study on the optimal growth condition of water spinach (*Ipomoea aquatica*) in aquaponic system. *International Journal of the Physical Sciences*, 7(11), 1699-1704.
- Farida, N.F., Abdullah S.H., & Priyati A. (2017). Analisis kualitas air pada sistem pengairan akuaponik. *Jurnal Ilmiah Rekayasa Pertanian dan Biosistem*, 5 (2): 385-394.
- Gelvan, Laurens Tuapetel., & Alphin Stephanus. (2019). Rancang bangun sistem akuaponik berbasis mikrokontroler dan android. *Jurnal Simetrik Vol.9, No.2, Desember 2019*.
- Hasan, Zaidah., Y. Andriani., Y. Dhahiyat., A. Sahidin., & M. R. Rubiansyah. (2017). Pertumbuhan tiga jenis ikan dan kangkung darat (*Ipomoea reptans* Poir) yang dipelihara dengan sistem akuaponik. *Jurnal Iktiologi Indonesia* 17(2): 175-184.
- Husdi H. (2018). Monitoring kelembaban tanah pertanian menggunakan soil moisture sensor fc-28 dan arduino uno. *ILKOM Jurnal Ilmiah*, vol. 10, no. 2, pp. 237-243.
- Laksanawati H. Dibyantoro Anna, (1996). *Rampai - Rampai Kangkung*. (Balai Penelitian Tanaman Sayuran Pusat Penelitian Dan Pengembangan Hortikultura Badan Penelitian Dan Pengembangan Pertanian, Bandung).
- Lingga Pinus, (1999) *Hidroponik: Bercocok Tanam Tanpa Tanah*, Jakarta: Penebar Swadaya.
- Lucien M., and L. Amanda. (2016). Analisa Kualitas Air Alkalinitas Dan Kesadahan (Hardness) Pada Pembesaran Udang Putih (*Litopenaeus Vannamei*) Di Laboratorium Animal Health Service Binaan Pt. Central Proteina Prima Tbk. Medan. Sekolah Tinggi Perikanan Sibolga.
- Maulidatun Nisa, Ahmad Mustofa, Ibrahim Saiful Millah & Fadlilatin Nailah. (2023). Rancang Bangun Smart Green House Pada Budidaya Tanaman Kangkung Berbasis IoT ( Internet of Things), *Jurnal Techno Bahari Vol. 10, No. 2, October 2023*, pp. 11 - 17.
- Mulkan Iskandar Nasution, Lailatul Husna Lubis, Wahyu Utama Akbar Ritonga. (2023). Implementasi Mikrokontroler Berbasis IoT Untuk Optimalisasi Kinerja Sistem Akuaponik, *Phi: Jurnal Pendidikan Fisika dan Terapan* 9 (1),

7-14.

- Nasaruddin, (2000). *Kisaran Derajat Ph Tanah Lahan Pertanian*. Universitas Yokyakarta.
- Nofiandi Riawan., (2016). *Step by Step Membuat Instalasi Akuaponik Portable 1 m<sup>2</sup> Hingga Memanen*. Jakarta: AgroMedia Pustaka.
- Nugraheni Widyawati, (2013). *Urban Farming Gaya Bertani Spesifik Kota*. Yogyakarta: Lily Publisher.
- Nugroho, R.A., Pambudi, L.T., Chilmawati, D. & Haditomo, A.H.C., (2012). Aplikasi teknologi akuaponik pada budidaya ikan air tawar untuk optimalisasi kapasitas produksi. *Jurnal Saintek Perikanan*, 8(1), 46-50.
- Rahmadhani, L.E., Widuri L.I., & Dewanti P. (2020). Kualitas mutu sayur kasepak (kangkung,selada, dan pakcoy) dengan sistem budidaya akuaponik dan hidroponik. *Jurnal Agroteknologi*, 14 (1): 33-43.
- Rahmanto, Yuri., Arinda Rifaini., S.Samsugi., & Sampurna Dadi Riskiono. (2020). Sistem monitoring ph air pada aquaponik menggunakan mikrokontroler arduino uno. *Jurnal Teknologi dan Sistem Tertanam*, Vol. 01, No. 1, 2020, 23-28.
- Rakocy, J. E., Bailey, D. S., Shultz, R. C., & Thoman, E. S. (2012). Aquaponic production of tilapia and basil: comparing a batch and staggered cropping system. *Acta Horticulturae*, 927, 109-120.
- Rosanti, Dewi., (2013). *Morfologi Tumbuhan*. Jakarta: Erlangga.
- Soni A., & A. Aman. (2018). Distance Measurement of an Object by using Ultrasonic Sensors with Arduino and GSM Module. *International Journal of Science Technology & Engineering*, vol4, no. 11, pp.23-28.
- Suhl, J., Dannehl, D., Kloas, W., Baganz, D., Jobs, S., & Scheibe, G. (2016). Advanced Aquaponics: Evaluation of intensive tomato production in aquaponics vs. conventional hydroponics. *Agricultural Water Management*, 178, 335-344.
- Sukarno, R., & Widodo, T., (2020). Respons Pertumbuhan Kangkung Darat (*Ipomoea reptans*) terhadap Perubahan pH Tanah.
- Sutalaksana, Anggawisastra, Tjakarmajaya. (1979). *Teknik Tata cara Kerja*. Jurusan Teknik Industri Institut Teknologi Bandung. Bandung.
- Syafri Edi., & Julistia Bobihoe, (2010). *Budidaya Tanaman Sayuran* (Jambi: Balai Pengkaji Teknologi)

- Teng, Yang., & Hye-Ji Kim. (2020). Karakterisasi Komposisi dan Konsentrasi Nutrisi pada Sistem Akuaponik dan Hidroponik Berbasis Tomat, Kemangi, dan Selada. *Air 2020*, 12 (5), 1259.
- Wahyu P. (2020). Removal Klorida, Tds Dan Besi Pada Air Payau Melalui Penukar Ion Dan Filtrasi Campuran Zeolit Aktif Dengan Karbon Aktif. Surabaya: Universitas Adi Buana.
- Wardah R. Z., F. Arinie, & others, (2019). Deteksi kadar keasaman media tanah untuk penanaman kembali secara telemonitoring. *Jurnal Jartel: Jurnal Jaringan Telekomunikasi*, vol. 9, no. 4, pp. 488-493.
- Wicaksana, N., Hastuti S., & Arini E. (2015). Performa produksi ikan lele dumbo (*Clarias gariepinus*) yang dipelihara dengan sistem biofilter akuaponik dan konvensional. *Journal of Aquaculture Management and Technology*, 4(4): 109-116.
- Widyastuti, Y. R. (2008). Peningkatan produksi air tawar melalui budidaya ikan sistem akuaponik. In *Prosiding Seminar Nasional Limnologi IV LIPI*. Bogor (Vol. 62, p. 73).
- Wirman, R. P., Wardhana, I., & Isnaini, V. A. (2019). Kajian Tingkat Akurasi Sensor pada Rancang Bangun Alat Ukur Total Dissolved Solids (TDS) dan Tingkat Kekeruhan Air. *Jurnal Fisika*, 9(1), 37-46.
- Yusfi M., Putra, & W., Derisma. (2015) Rancang Bangun Sistem Kontrol Temperatur Untuk Proses Pendinginan Menggunakan Termoelektrik. *Proceedings Bidang Fisika Semirata Bidang Ilmu MIPA BKS-PTN Barat, Universitas Tanjungpura Pontianak*.
- Zidni, I., Iskandar, Rizal, A., Andriani, Y, Ramadan, R. (2019). Efektivitas Sistem Akuaponik Dengan Jenis Tanaman Berbeda Terhadap Kualitas Air Media Budidaya Ikan. *Jurnal Perikanan dan Kelautan*, 9 (1): 81-94

**LAMPIRAN I**  
**GAMBAR ALAT PENELITIAN**

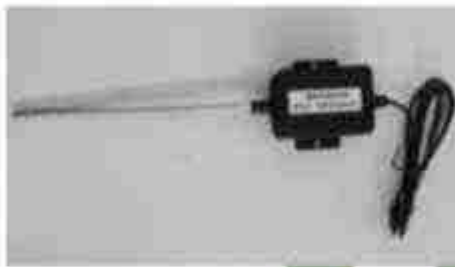
1. Meteran



2. Sensor Ultrasonik tipe HCSR04



3. Sensor pH tanah



4. Pompa Aquarium merk AMARA AA-104



5. Sensor SHT11



6. Sensor kelembaban tanah



7. Memory Card



8. MicroSD Module



UNIVERSITAS ISLAM NEGERI  
IMATERA UTARA MEDAN

9. Kabel 0,75 mm.



10. Selang listrik



11. Tdos



12. Pipa listrik kuning



13. Mesin gerinda tangan



14. Bor tangan



15. Lem tembak



16. Adaptor 12 V



17. Kabel jumper jantan-jantan



18. Kabel jumper jantan-betina



19. Kotak panel hitam



20. LCD 16 x 2



21. RTC



22. Laptop



23. Papan PCB dan papan project board



24. Step down



25. Sprinkle



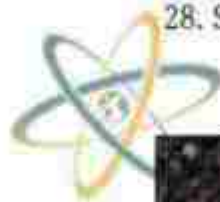
26. Tiang Penyangga



27. Soil moisture meter



28. Soil meter



UNIVERSITAS ISLAM NEGERI  
SUMATERA UTARA MEDAN

29. Temperature





30. Gunting kabel



31. Obeng



32. Solder



33. Timah solder



34. Lem dextone



35. Gunting



36. Palu



37. Klem



38. Ikatan kabel plastik



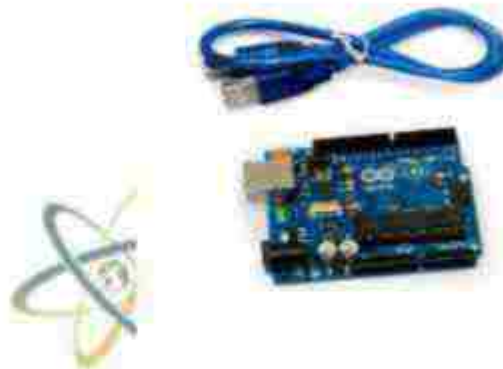
39. Lakban hitam listrik



40. Mikrometer Digital



41. Arduino Uno



UNIVERSITAS ISLAM NEGERI  
SUMATERA UTARA MEDAN

**LAMPIRAN II**  
**GAMBAR BAHAN PENELITIAN**

1. Bibit tumbuhan kangkung



2. Air



3. Tanah atau Lahan tanaman



UNIVERSITAS ISLAM NEGERI  
AL-FALAKHIA UTARA MEDAN

**LAMPIRAN III**  
**GAMBAR DOKUMENTASI PENELITIAN**

1. Pengisian tanah pada lahan tanaman



2. Penanaman bibit kangkung



3. Penyiraman tanaman kangkung



4. Kalibrasi Sensor dan pembuatan bahasa coding



STAN ISLAM NEGERI  
**SUMATERA UTARA MEDAN**

5. Pemasangan sambungan kabel listrik pada sensor



7. Pemasangan pipa listrik untuk kabel sambungan sensor



6. Kalibrasi sensor pH tanah



8. Merangkai alat sensor



9. Pemasangan alat sensor ultrasonik pada tiang penyangga



10. Pemasangan alat sensor pH tanah dan kelembapan tanah



11. Pengambilan data



INSTITUT TEKNIK NEGERI  
SUMATERA UTARA MEDAN

**LAMPIRAN IV**  
**GAMBAR HASIL PENGUJIAN**

1. Pengujian Tegangan Adaptor



2. Pengujian Sensor Kelembapan Tanah



3. Pengujian Sensor pH Tanah



4. Pengujian Sensor Ultrasonic



5. Pengujian sensor suhu



6. Pengujian LCD



**LAMPIRAN V**  
**PERHITUNGAN NILAI RATA-RATA TEGANGAN INPUT DAN OUTPUT**  
**ADAPTOR**

No.	Tegangan Input (Adaptor)	Tegangan Output ( <i>Step Down</i> )
1.	12,31 V	5,00 V
2.	12,31 V	5,00 V
3.	12,31 V	5,00 V
4.	12,31 V	5,00 V
5.	12,31 V	5,00 V

Rumus Nilai Rata-Rata:

$$\begin{aligned} \text{Rata-Rata Input} &= \frac{\text{jumlah input}}{\text{jumlah data input}} \\ &= \frac{61,54 \text{ V}}{5} \\ &= 12,308 \text{ V} \end{aligned}$$

$$\begin{aligned} \text{Rata-Rata Output} &= \frac{\text{jumlah output}}{\text{jumlah data output}} \\ &= \frac{25 \text{ V}}{5} \\ &= 5 \text{ V} \end{aligned}$$





**LAMPIRAN VI**  
**PERHITUNGAN NILAI RATA-RATA DAN *ERROR* SENSOR pH I**

No.	Nilai Sensor pH I	Nilai pH Standar I	Nilai <i>Error</i> Sensor pH I
1.	7,34	6,8	9,8%
2.	7,58	6,8	9,8%
3.	7,56	6,8	9,8%
4.	7,44	6,8	9,8%
5.	7,42	6,8	9,8%

Rumus Nilai Rata-Rata:

$$\text{Rata-Rata Nilai Sensor pH I} = \frac{\text{Jumlah nilai sensor pH I}}{\text{Jumlah data sensor pH I}}$$

$$= \frac{37,34}{5}$$

$$= 7,468$$

$$\text{Rata-Rata Nilai pH Standar I} = \frac{\text{Jumlah nilai sensor pH standar I}}{\text{Jumlah data sensor pH standar I}}$$

$$= \frac{34}{5}$$

$$= 6,8$$

Rumus %Deviasi Sensor pH I:

$$\text{Rumus \%Deviasi} = \frac{\text{Nilai Standar I} - \text{Nilai Sensor I}}{\text{Nilai standar I}} \times 100\%$$

$$= \frac{6,8 - 7,468}{6,8} \times 100\%$$

$$= 0,098 \times 100\%$$

$$= 9,8\%$$

## LAMPIRAN VII

### PERHITUNGAN NILAI RATA-RATA DAN *ERROR* SENSOR pH II

No.	Nilai Sensor pH II	Nilai pH Standar II	Nilai <i>Error</i> Sensor pH II
1.	7,30	7,00	3,8%
2.	7,27	7,00	3,8%
3.	7,28	7,00	3,8%
4.	7,27	7,00	3,8%
5.	7,24	7,00	3,8%

Rumus Nilai Rata-Rata:

$$\begin{aligned} \text{Rata-Rata Nilai Sensor pH II} &= \frac{\text{jumlah nilai sensor pH II}}{\text{jumlah data sensor pH II}} \\ &= \frac{36,16}{5} \\ &= 7,272 \end{aligned}$$

$$\begin{aligned} \text{Rata-Rata Nilai pH Standar II} &= \frac{\text{jumlah nilai sensor pH standar II}}{\text{jumlah data sensor pH standar I}} \\ &= \frac{35}{5} \\ &= 7 \end{aligned}$$

Rumus %Deviasi Sensor pH II:

$$\begin{aligned} \text{Rumus \%Deviasi} &= \frac{\text{Nilai Standar II} - \text{Nilai Sensor II}}{\text{Nilai standar II}} \times 100\% \\ &= \frac{7 - 7,272}{7} \times 100\% \\ &= 0,038 \times 100\% \\ &= 3,8\% \end{aligned}$$

**LAMPIRAN VIII**  
**PERHITUNGAN NILAI RATA-RATA DAN ERROR SENSOR**  
**ULTRASONIC I**

No.	Nilai Sensor Ultrasonic I	Nilai Penggaris I	Nilai Error
1.	3,12 cm	3 cm	3%
2.	5,23 cm	5 cm	4%
3.	8,21 cm	8 cm	2%
4.	9,54 cm	9 cm	5%
5.	10,19 cm	10 cm	1%

Rumus %Deviasi Sensor Ultrasonic I:

$$\begin{aligned} \%Deviasi\ 1 &= \frac{\text{Nilai Sensor} - \text{Nilai penggaris}}{\text{Nilai Sensor}} \times 100\% \\ &= \frac{3,12\text{ cm} - 3\text{ cm}}{3,12\text{ cm}} \times 100\% \\ &= 0,03 \times 100\% \\ &= 3\% \end{aligned}$$

$$\begin{aligned} \%Deviasi\ 2 &= \frac{\text{Nilai Sensor} - \text{Nilai penggaris}}{\text{Nilai Sensor}} \times 100\% \\ &= \frac{5,23\text{ cm} - 5\text{ cm}}{5,23\text{ cm}} \times 100\% \\ &= 0,04 \times 100\% \\ &= 4\% \end{aligned}$$

$$\begin{aligned} \%Deviasi\ 3 &= \frac{\text{Nilai Sensor} - \text{Nilai penggaris}}{\text{Nilai Sensor}} \times 100\% \\ &= \frac{8,21\text{ cm} - 8\text{ cm}}{8,21\text{ cm}} \times 100\% \\ &= 0,02 \times 100\% \\ &= 2\% \end{aligned}$$

$$\begin{aligned} \%Deviasi\ 4 &= \frac{\text{Nilai Sensor} - \text{Nilai penggaris}}{\text{Nilai Sensor}} \times 100\% \\ &= \frac{9,54\text{ cm} - 9\text{ cm}}{9,54\text{ cm}} \times 100\% \end{aligned}$$

$$= 0,05 \times 100\%$$

$$= 5\%$$

$$\% \text{Deviasi } S = \frac{\text{Nilai Sensor} - \text{Nilai penggaris}}{\text{Nilai Sensor}} \times 100\%$$

$$= \frac{10,19 \text{ cm} - 10 \text{ cm}}{10,19 \text{ cm}} \times 100\%$$

$$= 0,01 \times 100\%$$

$$= 1\%$$



UNIVERSITAS ISLAM NEGERI  
SUMATERA UTARA MEDAN

**LAMPIRAN IX**  
**PERHITUNGAN NILAI RATA-RATA DAN ERROR SENSOR**  
**ULTRASONIC II**

No.	Nilai Sensor Ultrasonic II	Nilai Penggaris II	Nilai Error
1.	3,21 cm	3 cm	6%
2.	5,21 cm	5 cm	4%
3.	6,72 cm	6 cm	10%
4.	8,31 cm	8 cm	3%
5.	9,31 cm	9 cm	3%

Rumus %Deviasi Sensor Ultrasonic II:

$$\begin{aligned} \%Deviasi\ 1 &= \frac{\text{Nilai Sensor} - \text{Nilai penggaris}}{\text{Nilai Sensor}} \times 100\% \\ &= \frac{3,21\text{ cm} - 3\text{ cm}}{3,21\text{ cm}} \times 100\% \\ &= 0,06 \times 100\% \\ &= 6\% \end{aligned}$$

$$\begin{aligned} \%Deviasi\ 2 &= \frac{\text{Nilai Sensor} - \text{Nilai penggaris}}{\text{Nilai Sensor}} \times 100\% \\ &= \frac{5,21\text{ cm} - 5\text{ cm}}{5,21\text{ cm}} \times 100\% \\ &= 0,04 \times 100\% \\ &= 4\% \end{aligned}$$

$$\begin{aligned} \%Deviasi\ 3 &= \frac{\text{Nilai Sensor} - \text{Nilai penggaris}}{\text{Nilai Sensor}} \times 100\% \\ &= \frac{6,72\text{ cm} - 6\text{ cm}}{6,72\text{ cm}} \times 100\% \\ &= 0,10 \times 100\% \\ &= 10\% \end{aligned}$$

$$\begin{aligned} \%Deviasi\ 4 &= \frac{\text{Nilai Sensor} - \text{Nilai penggaris}}{\text{Nilai Sensor}} \times 100\% \\ &= \frac{8,31\text{ cm} - 8\text{ cm}}{8,31\text{ cm}} \times 100\% \end{aligned}$$

$$= 0,03 \times 100\%$$

$$= 3\%$$

$$\% \text{Deviasi } 5 = \frac{\text{Nilai Sensor} - \text{Nilai penggaris}}{\text{Nilai Sensor}} \times 100\%$$

$$= \frac{9,31 \text{ cm} - 9 \text{ cm}}{9,31 \text{ cm}} \times 100\%$$

$$= 0,03 \times 100\%$$

$$= 3\%$$



UNIVERSITAS ISLAM NEGERI  
SUMATERA UTARA MEDAN

## LAMPIRAN X

### PERHITUNGAN NILAI RATA-RATA DAN *ERROR* SENSOR SUHU

No.	Hari/Jam	Nilai Sensor Suhu	Nilai Sensor Standar	Nilai <i>Error</i>
1.	Selasa,25 Juli 2024/ 14.14 WIB	37,80° C	34,7° C	8%
2.	Selasa,25 Juli 2024/ 14.18 WIB	38,00° C	35,3° C	7%
3.	Selasa,25 Juli 2024/ 14.22 WIB	38,10° C	35,4° C	7%
4.	Selasa,25 Juli 2024/ 14.26 WIB	38,20° C	35,7° C	6%
5.	Selasa,25 Juli 2024/ 14.30 WIB	38,20° C	35,8° C	6%

Rumus %Deviasi Sensor Suhu:

$$\begin{aligned}\% \text{Deviasi 1} &= \frac{\text{Nilai Sensor} - \text{Nilai sensor standar}}{\text{Nilai Sensor}} \times 100\% \\ &= \frac{37,80^{\circ} \text{C} - 34,7^{\circ} \text{C}}{37,80^{\circ} \text{C}} \times 100\% \\ &= 0,08 \times 100\% \\ &= 8\%\end{aligned}$$

$$\begin{aligned}\% \text{Deviasi 2} &= \frac{\text{Nilai Sensor} - \text{Nilai sensor standar}}{\text{Nilai Sensor}} \times 100\% \\ &= \frac{38,00^{\circ} \text{C} - 35,3^{\circ} \text{C}}{38,00^{\circ} \text{C}} \times 100\% \\ &= 0,07 \times 100\% \\ &= 7\%\end{aligned}$$

$$\begin{aligned}\% \text{Deviasi 3} &= \frac{\text{Nilai Sensor} - \text{Nilai sensor standar}}{\text{Nilai Sensor}} \times 100\% \\ &= \frac{38,10^{\circ} \text{C} - 35,4^{\circ} \text{C}}{38,10^{\circ} \text{C}} \times 100\% \\ &= 0,07 \times 100\%\end{aligned}$$

$$= 7\%$$

$$\begin{aligned} \% \text{Deviasi 4} &= \frac{\text{Nilai Sensor} - \text{Nilai sensor standar}}{\text{Nilai Sensor}} \times 100\% \\ &= \frac{38,20^\circ \text{C} - 35,7^\circ \text{C}}{38,20^\circ \text{C}} \times 100\% \\ &= 0,06 \times 100\% \\ &= 6\% \end{aligned}$$

$$\begin{aligned} \% \text{Deviasi 5} &= \frac{\text{Nilai Sensor} - \text{Nilai sensor standar}}{\text{Nilai Sensor}} \times 100\% \\ &= \frac{38,20^\circ \text{C} - 35,8^\circ \text{C}}{38,20^\circ \text{C}} \times 100\% \\ &= 0,06 \times 100\% \\ &= 6\% \end{aligned}$$



UNIVERSITAS ISLAM NEGERI  
SUMATERA UTARA MEDAN



**LAMPIRAN XI**  
**HASIL CODINGAN SISTEM MONITORING PADA APLIKASI ARDUINO**  
**IDE**

```

#include <Wire.h>
#include <LiquidCrystal_I2C.h>
#include <SD.h>
#include <SPI.h>
#include <RTClib.h>
#include <DHT.h>

// Define pin connections
#define TRIG_PIN1 2
#define ECHO_PIN1 3
#define TRIG_PIN2 4
#define ECHO_PIN2 5
#define DHT_PIN 6
#define RELAY_PIN 7
#define SOIL_PIN1 A0
#define SOIL_PIN2 A1
#define PH_PIN1 A2
#define PH_PIN2 A3
#define SD_CS_PIN 10

// Initialize the sensors
DHT dht(DHT_PIN, DHT11);
RTC_DS3231 rtc;
LiquidCrystal_I2C lcd(0x27, 16, 2); // Adjust this to your I2C address

// Variables for storing sensor data
float distance1, distance2;
float temperature, humidity;
float soilMoisture1, soilMoisture2;
float pHValue1, pHValue2;

```



UNIVERSITAS ISLAM NEGERI  
**SUMATERA UTARA MEDAN**

```

// EWMA variables
float alpha = 0.2; // Smoothing factor
float ewmaSoilMoisture1 = 0;
float ewmaSoilMoisture2 = 0;
float ewmaPH1 = 0;
float ewmaPH2 = 0;

// Timers and counters
unsigned long lastSaveTime = 0;
unsigned long lastSensorReadTime = 0;
const unsigned long saveInterval = 1800000; // 30 minutes in milliseconds
const unsigned long sensorReadInterval = 1000; // 1 second in milliseconds
const unsigned long displayInterval = 2000; // 2 seconds in milliseconds

// Variables for LCD display timing
unsigned long lastDisplayTime = 0;
int displayState = 0;

// Function to measure distance with HC-SR04
float measureDistance(int trigPin, int echoPin) {
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  long duration = pulseIn(echoPin, HIGH);
  return (duration * 0.034 / 2);
}

// Function to read pH sensor
float readPH() {
  int sensorValue = analogRead(A2);
  float voltage = sensorValue * (5.0 / 1023.0);
  return (3.5 * voltage);
}

```

```

// Function to read pH sensor
float readPH20 {
  int sensorValue = analogRead(A3);
  float voltage = sensorValue * (5.0 / 1023.0);
  return (3.5 * voltage);
}

// EWMA function
float ewma(float current, float previous, float alpha) {
  return (alpha * current) + ((1 - alpha) * previous);
}

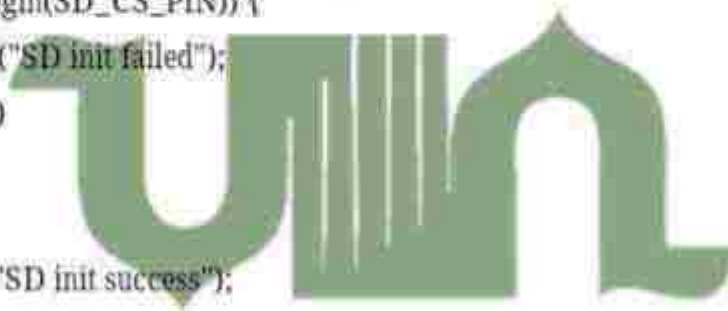
// Function to initialize SD card
void initSD() {
  if (!SD.begin(SD_CS_PIN)) {
    lcd.print("SD init failed");
    while (1)
      ;
  }
  lcd.print("SD init success");
}

void setup() {
  // Initialize serial communication
  Serial.begin(9600);

  // Initialize pins
  pinMode(TRIG_PIN1, OUTPUT);
  pinMode(ECHO_PIN1, INPUT);
  pinMode(TRIG_PIN2, OUTPUT);
  pinMode(ECHO_PIN2, INPUT);

  // Inisialisasi pin untuk relay
  pinMode(RELAY_PIN, OUTPUT);

```



UNIVERSITAS ISLAM NEGERI

SUMATERA UTARA MEDAN

```

digitalWrite(RELAY_PIN, HIGH);

// Initialize sensors
dht.begin();

// Initialize RTC
if (!rtc.begin()) {
  Serial.println("Couldn't find RTC");
  lcd.setCursor(0, 0);
  lcd.print("RTC init failed");
  while (1)
    ;
}
rtc.adjust(DateTime(F(__DATE__), F(__TIME__)));

// Initialize LCD
lcd.init();
lcd.backlight();
lcd.setCursor(0, 0);
lcd.print("LCD init success");

// Initialize SD card
initSD();
}

void loop() {
  DateTime now = rtc.now();

  // Read ultrasonic sensors
  distance1 = measureDistance(TRIG_PIN1, ECHO_PIN1);
  distance2 = measureDistance(TRIG_PIN2, ECHO_PIN2);

  // Read other sensors at a different interval
  if (millis() - lastSensorReadTime > sensorReadInterval) {
    lastSensorReadTime = millis();

```



UNIVERSITAS ISLAM NEGERI  
SUMATERA UTARA MEDAN

```

temperature = dht.readTemperature();
humidity = dht.readHumidity();
soilMoisture1 = analogRead(SOIL_PIN1);
soilMoisture2 = analogRead(SOIL_PIN2);
phValue1 = (readPH0 + 3.5);
phValue2 = (readPH2() + 3.5);

// Apply EWMA
ewmaSoilMoisture1 = ewma(soilMoisture1, ewmaSoilMoisture1, alpha);
ewmaSoilMoisture2 = ewma(soilMoisture2, ewmaSoilMoisture2, alpha);
ewmaPH1 = ewma(phValue1, ewmaPH1, alpha);
ewmaPH2 = ewma(phValue2, ewmaPH2, alpha);
}

// Update LCD display at a different interval
if (millis() - lastDisplayTime > displayInterval) {
  lastDisplayTime = millis();
  lcd.clear();
  switch (displayState) {

  case 0:
    lcd.setCursor(0, 0);
    lcd.print("Jarak1: ");
    lcd.print(57-distance1);
    lcd.print(" cm");
    lcd.setCursor(0, 1);
    lcd.print("Jarak2: ");
    lcd.print(56-distance2);
    lcd.print(" cm");
    break;

  case 1:
    lcd.setCursor(0, 0);
    lcd.print("Temp: ");
    lcd.print(temperature);

```

```

lcd.print(" C");
lcd.setCursor(0, 1);
lcd.print("Hum: ");
lcd.print(humidity);
lcd.print(" %");
break;

case 2:
  lcd.setCursor(0, 0);
  lcd.print("Soil1: ");
  lcd.print(ewmaSoilMoisture1);
  lcd.setCursor(0, 1);
  lcd.print("Soil2: ");
  lcd.print(ewmaSoilMoisture2);
  break;

case 3:
  lcd.setCursor(0, 0);
  lcd.print("pH1: ");
  lcd.print(ewmaPH1);
  lcd.setCursor(0, 1);
  lcd.print("pH2: ");
  lcd.print(ewmaPH2);
  break;
}

displayState = (displayState + 1) % 4;
}

// Print data to Serial Monitor
Serial.print("Time: ");
Serial.print(now.timestamp(DateTime::TIMESTAMP_FULL));
Serial.print(" Dist1: ");
Serial.print(distance1);
Serial.print(" cm Dist2: ");
Serial.print(distance2);

```

```

Serial.print(" cm Temp: ");
Serial.print(temperature);
Serial.printf(" C Hum: ");
Serial.print(humidity);
Serial.print(" % Soil1: ");
Serial.print(ewmaSoilMoisture1);
Serial.print(" Soil2: ");
Serial.print(ewmaSoilMoisture2);
Serial.print(" pH1: ");
Serial.print(ewmaPH1);
Serial.print(" pH2: ");
Serial.println(ewmaPH2);

// Save data to SD card every 30 minutes
if (millis() - lastSaveTime > saveInterval) {
  lastSaveTime = millis();

  // Save other sensor data
  File sensorFile = SD.open("sensors.txt", FILE_WRITE);
  if (sensorFile) {
    sensorFile.print(now.timestamp(DateTime::TIMESTAMP_FULL));
    sensorFile.print(",");
    sensorFile.print(distance1);
    sensorFile.print(",");
    sensorFile.print(distance2);
    sensorFile.print(",");
    sensorFile.print(temperature);
    sensorFile.print(",");
    sensorFile.print(humidity);
    sensorFile.print(",");
    sensorFile.print(ewmaSoilMoisture1);
    sensorFile.print(",");
    sensorFile.print(ewmaSoilMoisture2);
    sensorFile.print(",");
  }
}

```

```

    sensorFile.print(ewmaPH1);
    sensorFile.print(",");
    sensorFile.print(ewmaPH2);
    sensorFile.println();
    sensorFile.close();
} else {
    Serial.println("Error opening sensors file");
}
}

// Kontrol relay untuk mengontrol pompa
static unsigned long relayStartMillis = 0;
bool pumpOn = false;
if (now.hour() == 7 && now.minute() == 0 || now.hour() == 17 && now.minute()
    == 0) {
    if (!pumpOn) {
        digitalWrite(RELAY_PIN, LOW);
        pumpOn = true;
    }
}

// Matikan relay setelah 1 jam
if (now.hour() == 7 && now.minute() == 5 || now.hour() == 17 && now.minute()
    == 5) {
    if (!pumpOn) {
        digitalWrite(RELAY_PIN, HIGH);
        relayStartMillis = millis();
        pumpOn = true;
    }
}
}
}

```



**LAMPIRAN XII**  
**HASIL DATA PADA KARTU MEMORI**

Tanggal	D1	D2	Suhu	Soil 1	Soil 2	ph1	PH2
2024-07-26 18:46:03	41.48	56.20	34.20	370.48	413.73	7.39	6.99
2024-07-26 19:16:06	48.82	57.51	34.20	365.99	410.02	7.33	7.10
2024-07-26 19:46:09	48.79	49.05	34.10	365.47	406.42	7.29	7.04
2024-07-26 20:16:12	35.53	44.59	33.80	363.49	406.12	7.47	7.01
2024-07-26 20:46:15	48.48	46.61	33.60	360.80	406.15	7.38	7.07
2024-07-26 21:16:18	35.53	46.97	33.30	358.32	403.78	7.32	7.13
2024-07-26 21:46:21	35.53	48.23	33.30	355.81	402.32	7.51	7.30
2024-07-26 22:16:23	35.45	48.18	33.00	355.06	400.03	7.45	7.02
2024-07-26 22:46:26	35.55	47.79	33.00	349.55	398.69	7.37	7.10
2024-07-26 23:16:29	35.99	46.10	32.60	347.48	398.67	7.45	7.31
2024-07-26 23:46:32	35.55	46.58	32.30	345.30	396.90	7.15	7.06
2024-07-27 00:16:35	35.55	47.04	31.80	342.79	395.78	7.38	6.58
2024-07-27 00:46:38	35.55	47.84	31.80	344.33	394.71	7.22	7.03
2024-07-27 01:16:41	36.02	49.27	31.80	345.74	394.28	7.24	7.32
2024-07-27 01:46:44	48.99	47.86	31.40	342.84	393.45	7.11	7.09
2024-07-27 02:16:47	48.99	47.55	31.40	341.96	393.41	7.09	7.16
2024-07-27 02:46:50	48.99	47.09	31.30	341.12	390.43	7.19	6.58
2024-07-27 03:16:53	36.48	47.04	31.30	338.36	390.04	7.36	7.31
2024-07-27 03:46:56	48.65	46.29	31.30	339.29	389.21	7.42	7.29
2024-07-27 04:16:59	48.23	46.70	31.10	337.69	388.57	7.41	7.30
2024-07-27 04:47:02	48.67	46.39	30.80	338.11	389.14	7.38	7.18
2024-07-27 05:17:05	48.67	47.23	30.20	336.88	388.98	7.42	7.31

2024-07-27 05:47:08	31.11	46.22	30.20	341.40	388.30	7.36	7.04
2024-07-27 06:17:11	31.11	46.58	29.80	337.73	387.40	7.19	7.32
2024-07-27 07:49:22	32.10	47.16	31.30	317.96	321.61	7.27	7.27
2024-07-27 09:15:30	33.02	47.16	37.00	342.90	335.39	6.20	6.19
2024-07-27 09:15:30	33.02	47.16	36.70	337.66	332.09	6.47	6.11
2024-07-27 12:04:15	45.60	48.30	38.00	344.89	356.58	6.26	6.26
2024-07-27 12:04:15	45.60	48.30	37.90	350.81	363.83	6.16	6.06
2024-07-27 12:04:15	45.60	47.02	38.50	340.38	334.30	4.54	5.03
2024-07-27 12:04:15	46.75	46.43	36.40	367.65	445.50	5.31	5.29
2024-07-27 17:24:37	48.45	45.14	35.20	365.93	356.52	6.17	6.13
2024-07-27 18:48:09	48.33	38.17	34.60	390.36	564.90	4.54	4.01
2024-07-27 18:48:09	48.45	47.09	34.00	393.04	362.12	5.23	5.38
2024-07-27 19:18:12	47.69	47.41	33.80	401.69	361.38	4.48	4.47
2024-07-27 19:18:12	47.94	37.66	34.70	397.98	541.84	4.49	5.56
2024-07-27 19:48:15	47.69	45.83	33.30	401.49	360.93	4.49	6.12
2024-07-27 19:48:15	49.39	46.08	33.40	126.91	519.17	4.41	6.21
2024-07-27 20:18:18	52.04	46.60	33.60	408.81	362.81	4.57	7.33
2024-07-27 20:48:21	51.19	47.99	33.60	389.60	362.93	4.55	7.25
2024-07-27 21:18:24	44.83	46.80	33.70	396.12	362.16	4.44	6.56
2024-07-27 21:48:27	42.65	46.44	33.30	396.26	362.73	4.49	6.32
2024-07-27 22:18:30	42.55	46.34	32.80	397.27	363.91	4.43	5.10
2024-07-27 22:48:33	42.67	46.80	33.30	396.36	362.54	4.31	5.33
2024-07-27 23:18:35	46.51	46.85	32.90	396.76	367.62	3.51	5.21
2024-07-27 23:48:38	48.98	47.69	32.80	397.64	367.78	3.50	5.00
2024-07-28 00:18:41	48.64	47.24	32.80	396.99	366.87	3.50	5.11

2024-07-28 00:48:44	48.30	44.90	32.30	394.00	366.99	3.52	5.15
2024-07-28 01:18:47	46.53	44.34	32.30	386.14	353.41	3.56	5.07
2024-07-28 01:48:49	46.12	47.38	32.30	386.18	350.77	4.06	5.09
2024-07-28 02:18:52	46.51	47.75	32.00	386.82	350.66	4.03	5.05
2024-07-28 02:48:55	44.46	48.35	31.80	386.10	348.43	4.34	5.06
2024-07-28 03:18:59	46.53	47.74	31.80	384.65	348.23	3.59	5.10
2024-07-28 03:49:02	42.19	47.33	31.80	382.77	348.64	3.56	5.18
2024-07-28 04:19:05	42.28	48.25	31.80	382.54	347.84	3.53	5.16
2024-07-28 04:49:08	41.80	47.79	31.80	381.93	347.77	3.58	5.28
2024-07-28 05:19:11	41.80	46.58	31.30	381.19	346.54	3.55	5.38
2024-07-28 05:49:14	43.20	46.63	30.30	382.33	349.35	3.53	5.45
2024-07-28 06:19:17	42.79	47.11	30.20	380.75	350.94	3.56	5.51
2024-07-28 06:49:20	43.28	47.96	30.30	379.42	352.55	3.55	5.26
2024-07-28 07:19:23	42.79	47.45	30.80	329.97	312.21	3.58	5.00
2024-07-28 07:49:26	56.61	45.83	31.30	352.43	315.97	3.58	5.32
2024-07-28 08:19:29	47.69	45.12	32.30	368.02	318.03	3.59	5.01
2024-07-28 08:49:32	48.77	44.86	33.80	374.65	318.83	3.59	4.56
2024-07-28 09:19:35	47.92	54.86	35.20	374.20	321.25	4.10	4.32
2024-07-28 09:49:37	47.40	44.06	36.60	370.47	320.00	4.23	4.46
2024-07-28 10:19:40	46.22	50.32	37.30	366.39	318.28	4.28	4.30
2024-07-28 10:49:43	48.77	47.02	35.60	365.01	321.25	4.33	6.01
2024-07-28 11:19:46	46.67	47.80	35.60	362.59	322.90	4.38	6.04
2024-07-28 11:49:49	47.84	46.43	35.60	361.50	324.71	4.29	7.06
2024-07-28 12:19:52	48.87	47.40	37.60	355.19	324.71	4.25	6.48
2024-07-28 12:49:55	48.71	47.42	38.20	352.77	326.82	4.18	7.24

2024-07-28 13:19:58	48.88	48.10	38.50	352.86	329.98	4.07	5.22
2024-07-28 13:50:01	41.97	48.39	39.10	352.83	335.48	4.11	5.40
2024-07-28 14:20:04	48.55	49.22	38.10	353.83	345.80	4.28	4.51
2024-07-28 14:50:07	48.59	48.55	37.30	357.24	349.60	4.37	3.58
2024-07-28 15:20:10	48.59	47.98	37.40	354.47	354.79	4.57	3.57
2024-07-28 15:50:13	47.84	48.21	37.00	357.39	357.50	4.58	4.08
2024-07-28 16:20:16	47.16	46.37	35.90	355.81	358.03	4.56	4.01
2024-07-28 16:50:19	46.67	44.35	35.60	360.32	357.55	4.53	3.50
2024-07-28 17:20:22	52.26	43.30	34.70	319.13	314.73	4.21	5.21
2024-07-28 17:50:25	48.08	42.55	34.20	329.04	321.85	4.25	5.59
2024-07-28 18:20:28	43.74	48.03	33.90	340.75	327.22	4.39	5.25
2024-07-28 18:50:30	46.82	56.92	33.90	336.15	329.93	4.39	5.25
2024-07-28 19:20:33	48.48	45.70	33.80	335.96	332.72	4.41	5.40
2024-07-28 19:50:36	50.86	54.45	33.80	341.80	336.82	4.45	6.00
2024-07-28 20:20:39	43.52	47.87	33.30	346.71	340.48	04.49	06.04
2024-07-28 20:50:42	46.75	47.87	31.80	351.75	347.86	04.47	06.23
2024-07-28 21:20:45	46.75	44.25	31.30	356.39	351.99	04.37	05.27
2024-07-28 21:50:48	46.38	49.66	30.80	353.98	354.33	04.48	05.33
2024-07-28 22:20:51	47.77	51.36	30.80	327.48	342.35	04.45	05.40
2024-07-28 22:50:53	47.75	45.41	28.50	323.76	334.77	04.27	05.45
2024-07-28 23:20:56	45.59	45.66	28.90	328.06	340.60	04.54	06.00
2024-07-28 23:50:59	45.61	46.87	28.80	334.75	346.42	04.40	06.44
2024-07-29 00:21:02	45.99	44.74	28.50	333.68	349.71	04.38	05.00
2024-07-29 00:51:05	45.99	45.14	28.00	335.67	355.82	04.58	04.55
2024-07-29 01:21:08	46.00	51.82	28.00	338.94	358.84	04.58	04.43

2024-07-29 01:51:10	46.38	45.70	28.50	335.07	360.67	04.59	05.21
2024-07-29 02:21:13	47.87	45.71	28.00	343.66	365.96	05.00	05.22
2024-07-29 02:51:16	46.39	48.06	28.00	346.41	367.05	05.12	05.12
2024-07-29 03:21:19	46.38	48.82	28.00	346.60	368.08	05.33	05.44
2024-07-29 03:51:22	47.74	49.22	27.50	348.70	368.25	05.44	04.00
2024-07-29 04:21:25	46.10	46.41	27.70	346.27	368.16	05.35	04.55
2024-07-29 04:51:27	42.14	32.05	27.60	346.25	367.64	05.40	05.44
2024-07-29 05:21:30	48.26	31.91	27.60	343.69	371.84	05.32	05.44
2024-07-29 05:51:33	42.53	47.84	28.00	345.08	371.62	04.45	05.23
2024-07-29 06:21:36	42.14	32.15	27.60	345.31	373.98	05.56	06.11
2024-07-29 06:51:39	43.26	38.54	28.00	348.39	374.65	04.22	06.14
2024-07-29 07:21:42	42.01	40.32	28.50	352.91	346.44	04.35	06.23
2024-07-29 07:51:45	46.34	41.02	28.50	356.56	354.98	05.32	06.25
2024-07-29 08:21:48	47.12	49.98	29.80	364.53	359.52	05.44	06.30
2024-07-29 08:51:51	46.53	50.01	30.80	364.34	359.94	05.33	04.45
2024-07-29 09:21:54	46.51	40.14	31.30	370.40	361.82	05.10	05.10
2024-07-29 09:51:57	46.51	32.09	31.40	370.48	363.56	05.44	05.12
2024-07-29 10:21:59	48.98	31.28	31.80	372.42	365.08	05.21	06.45
2024-07-29 10:52:02	45.49	31.52	32.80	373.25	364.60	04.41	05.53
2024-07-29 11:22:05	45.83	32.40	34.70	370.25	361.17	04.30	05.21
2024-07-29 11:52:08	48.40	28.97	34.20	371.35	366.15	04.31	05.44
2024-07-29 12:22:11	42.91	44.21	34.40	373.32	368.15	04.46	05.56
2024-07-29 12:52:14	45.49	45.52	34.70	371.63	368.12	04.45	06.34
2024-07-29 13:22:17	48.71	43.12	35.60	378.24	370.41	04.55	07.06
2024-07-29 13:52:20	48.06	45.41	34.20	373.53	374.95	04.10	07.11

2024-07-29 14:22:23	43.03	44.55	34.30	374.98	382.57	04.16	07.04
2024-07-29 14:52:25	46.77	46.51	34.70	379.09	387.85	04.16	07.03
2024-07-29 15:22:28	46.67	29.50	34.70	382.47	392.99	04.22	07.01
2024-07-29 15:52:31	45.88	29.22	34.50	381.95	398.77	04.42	07.12
2024-07-29 16:22:34	45.51	28.36	34.20	381.83	400.88	04.48	07.22
2024-07-29 16:52:37	45.20	29.68	33.80	381.93	400.68	04.43	07.09
2024-07-29 17:22:40	47.29	32.25	33.30	350.04	363.12	04.25	05.02
2024-07-29 17:52:43	44.34	33.45	33.30	362.91	372.47	04.33	05.06
2024-07-29 18:22:46	46.51	42.79	32.80	370.55	380.77	04.42	05.30
2024-07-29 18:52:49	42.19	42.42	32.30	369.54	382.07	04.50	05.34
2024-07-29 19:22:51	44.14	46.60	32.60	375.54	385.62	04.55	05.43
2024-07-29 19:52:54	44.68	45.23	30.80	376.84	385.16	04.57	05.27
2024-07-29 20:22:57	46.36	46.28	30.20	374.68	391.95	04.38	05.34
2024-07-29 20:53:00	46.36	45.87	30.21	374.69	396.98	04.31	05.36
2024-07-29 21:23:03	46.36	45.97	30.22	374.70	396.99	04.08	05.42
2024-07-29 21:53:06	46.48	46.78	30.23	381.64	401.88	04.52	05.39
2024-07-29 22:23:09	46.05	47.29	29.80	381.65	403.65	04.51	05.47
2024-07-29 22:53:12	46.48	47.53	29.80	383.71	403.66	05.51	05.41
2024-07-29 23:23:14	46.38	47.16	29.80	383.72	403.67	06.51	05.49
2024-07-29 23:53:17	46.04	47.99	29.70	383.73	403.68	07.51	05.57
2024-07-30 00:23:20	46.38	48.69	29.60	383.74	403.69	08.51	06.57
2024-07-30 00:53:23	46.36	47.41	29.80	386.98	403.70	09.51	07.57
2024-07-30 01:23:26	43.91	47.72	29.81	386.99	403.71	05.03	08.57
2024-07-30 01:53:29	45.99	48.45	28.90	386.10	403.72	03.58	09.57
2024-07-30 02:23:32	44.22	47.97	28.90	386.22	403.73	04.58	10.57

2024-07-30 02:53:35	45.99	48.86	28.90	431.35	403.74	06.01	06.54
2024-07-30 03:23:37	43.93	48.40	28.70	431.36	443.91	06.06	06.51
2024-07-30 03:53:40	43.81	48.48	28.70	431.37	443.25	06.22	06.45
2024-07-30 04:23:43	45.00	49.16	28.80	431.38	444.28	05.59	06.42
2024-07-30 04:53:46	45.02	48.31	28.50	431.39	446.67	06.43	06.53
2024-07-30 05:23:49	45.41	47.45	28.51	431.40	450.67	05.22	06.45
2024-07-30 05:53:52	47.91	46.04	28.52	431.41	453.89	05.11	07.45
2024-07-30 06:23:55	45.01	39.93	28.53	431.42	453.90	06.34	06.56
2024-07-30 06:53:58	47.01	32.30	28.54	431.43	453.91	06.54	06.34
2024-07-30 07:24:00	48.55	35.36	28.50	431.44	453.92	06.12	05.45
2024-07-30 07:54:03	46.87	47.11	28.90	431.45	453.93	05.11	06.45
2024-07-30 08:24:06	48.71	47.50	28.91	431.46	453.94	05.05	07.45
2024-07-30 08:54:09	54.96	37.83	28.92	431.47	453.95	06.05	08.45
2024-07-30 09:24:12	42.98	39.37	34.70	431.48	453.96	07.05	07.45
2024-07-30 09:54:15	43.37	39.22	35.70	431.49	453.97	07.22	07.42
2024-07-30 10:24:18	48.74	39.54	35.90	431.50	453.98	06.05	08.42
2024-07-30 10:54:21	43.25	43.25	35.40	431.51	453.99	07.05	06.42
2024-07-30 11:24:24	41.94	42.12	35.90	431.52	453.52	07.47	05.22
2024-07-30 11:54:27	55.15	42.23	35.90	431.53	444.88	08.09	07.11
2024-07-30 12:24:30	46.70	39.22	35.91	372.91	444.89	07.03	06.24
2024-07-30 12:54:33	47.24	38.99	35.90	373.63	444.90	07.21	07.24
2024-07-30 13:24:36	47.53	39.20	35.91	373.64	444.91	05.38	08.24
2024-07-30 13:54:39	45.43	39.12	35.92	373.65	444.92	04.22	07.23
2024-07-30 14:24:42	49.10	38.21	35.93	373.66	444.93	06.46	07.22
2024-07-30 14:54:45	48.37	38.24	35.90	373.67	449.61	06.06	05.35

2024-07-30 15:24:48	41.94	39.53	35.91	373.68	500.65	08.53	04.24
2024-07-30 15:54:51	43.54	38.52	35.92	373.69	500.66	07.12	05.52
2024-07-30 16:24:53	48.81	40.46	35.93	373.70	500.67	03.22	06.06
2024-07-30 16:54:56	46.06	37.35	35.94	373.71	500.68	04.22	06.04
2024-07-31 15:48:45	48.35	39.54	35.95	373.72	500.69	05.22	06.24
2024-07-31 16:18:47	47.87	46.72	35.96	373.73	500.70	05.22	06.26
2024-07-31 16:48:50	40.05	40.77	35.97	373.74	500.71	05.18	06.26
2024-07-31 17:18:53	40.31	40.34	35.98	373.75	500.72	06.18	04.01
2024-07-31 17:48:56	49.66	37.75	35.99	373.76	500.73	05.05	04.31
2024-07-31 18:18:59	41.89	37.76	32.90	373.77	500.74	05.05	04.15
2024-07-31 18:49:02	45.83	34.68	31.56	387.61	482.90	05.02	05.18
2024-07-31 19:19:05	45.84	35.71	31.56	387.62	482.91	05.11	06.18
2024-07-31 19:49:08	45.85	35.72	31.57	387.63	482.92	05.09	07.18
2024-07-31 20:19:11	48.69	35.73	31.58	387.64	486.71	05.18	08.18
2024-07-31 20:49:14	48.79	35.74	31.59	404.91	486.72	05.21	06.18
2024-07-31 21:19:17	45.75	35.75	31.60	404.92	486.73	05.19	07.18
2024-07-31 21:49:20	41.91	31.68	30.44	404.98	486.74	05.22	08.18
2024-07-31 22:19:23	45.75	31.70	30.85	404.94	486.75	05.23	07.27
2024-07-31 22:49:26	45.85	31.71	30.86	404.95	502.70	05.19	05.22
2024-07-31 23:19:29	48.69	37.88	30.87	404.96	502.71	05.22	06.18
2024-07-31 23:49:32	48.70	41.73	30.88	404.97	524.96	05.34	03.18
2024-08-01 00:19:35	48.71	41.74	30.89	404.98	527.65	05.20	04.18
2024-08-01 00:49:38	48.72	41.75	30.90	404.99	530.89	05.30	05.18
2024-08-01 01:19:41	48.73	41.76	30.80	404.100	536.62	05.01	06.18
2024-08-01 01:49:44	47.67	41.77	30.80	416.85	536.63	05.21	07.18



2024-08-01 02:19:47	43.13	48.76	29.60	419.72	547.70	05.21	04.07
2024-08-01 02:49:50	43.14	48.77	29.61	419.96	545.93	05.18	05.07
2024-08-01 03:19:53	43.15	48.78	29.62	420.89	545.94	05.28	06.07
2024-08-01 03:49:56	43.16	48.79	29.63	430.81	545.95	05.38	07.07
2024-08-01 04:19:59	43.17	48.80	29.64	430.82	545.96	05.40	08.07
2024-08-01 04:50:01	43.18	48.81	29.65	430.83	551.71	05.39	07.21
2024-08-01 05:20:04	48.89	48.82	29.66	430.84	551.72	05.36	06.43
2024-08-01 05:50:07	48.90	48.83	29.67	430.85	551.73	05.41	06.10
2024-08-01 06:20:10	48.91	48.84	29.68	430.86	551.74	05.43	08.43
2024-08-01 06:50:13	41.94	48.85	29.69	430.87	561.68	05.48	03.54
2024-08-01 07:20:16	41.95	48.86	29.70	430.88	505.60	05.20	03.50
2024-08-01 07:50:19	41.96	48.87	30.60	375.82	523.77	05.21	03.53
2024-08-01 08:20:22	41.97	46.61	31.80	375.83	523.78	05.18	03.50
2024-08-01 08:50:25	39.83	46.62	31.81	375.84	523.79	06.18	03.50
2024-08-01 09:20:28	41.70	46.63	31.82	375.85	564.87	05.05	05.12
2024-08-01 09:50:31	48.92	46.64	31.83	375.86	566.64	05.01	06.12
2024-08-01 10:20:34	48.93	46.65	31.84	387.68	566.65	03.59	07.12
2024-08-01 10:50:37	48.94	46.66	31.85	389.74	566.66	04.59	08.12
2024-08-01 11:20:39	48.95	46.67	31.86	394.62	567.75	05.59	07.53
2024-08-01 11:50:42	48.96	46.68	31.87	394.63	607.80	06.59	07.59
2024-08-01 12:20:45	48.97	46.69	37.60	394.64	635.88	07.59	08.59
2024-08-01 12:50:48	48.98	46.70	37.60	394.65	648.99	08.59	08.21
2024-08-01 13:20:51	48.99	46.71	36.90	394.66	652.78	05.46	07.24
2024-08-01 13:50:54	48.77	46.72	34.72	394.67	664.96	07.08	05.34
2024-08-01 14:20:57	48.78	46.73	34.73	410.74	664.97	08.12	04.56

2024-08-01 14:51:00	48.79	46.74	34.74	410.75	664.98	06.49	07.54
2024-08-01 15:21:03	48.80	46.75	34.75	410.76	664.99	08.25	08.54
2024-08-01 15:51:06	48.81	46.76	34.76	410.77	664.100	05.49	08.23
2024-08-01 16:21:09	48.82	46.77	34.77	410.78	691.95	06.49	08.55
2024-08-01 16:51:12	48.83	34.97	34.78	410.79	697.70	07.49	05.23
2024-08-01 17:21:15	48.84	34.98	34.79	410.80	697.71	08.49	06.23
2024-08-01 17:51:18	48.85	34.99	34.80	410.81	697.72	08.00	07.23
2024-08-01 18:21:21	48.86	34.34	34.81	410.82	697.73	05.36	08.23
2024-08-01 18:51:23	42.97	35.65	32.80	414.98	707.86	05.33	07.23
2024-08-01 19:21:26	42.98	31.74	32.80	415.70	707.87	05.35	04.41
2024-08-01 19:51:29	42.99	31.75	32.80	415.71	707.88	05.34	05.41
2024-08-01 20:21:32	46.75	31.76	30.76	416.93	717.90	06.43	06.41
2024-08-01 20:51:35	46.75	31.77	30.77	415.73	724.72	05.48	07.19
2024-08-01 21:21:38	42.56	39.73	30.78	417.98	728.74	05.35	08.18
2024-08-01 21:51:41	42.57	34.70	30.79	417.99	734.68	06.35	09.18
2024-08-01 22:21:43	42.58	34.71	30.80	421.95	633.72	05.19	03.50
2024-08-01 22:51:46	42.59	34.72	30.81	428.69	633.73	06.49	04.50
2024-08-01 23:21:49	42.60	34.73	30.82	428.70	633.74	06.16	05.50
2024-08-01 23:51:52	42.61	34.74	30.83	428.71	633.75	07.10	06.50
2024-08-02 00:21:55	42.62	34.75	29.80	427.60	633.76	07.27	07.48
2024-08-02 00:51:58	47.73	30.58	29.80	428.80	633.77	06.47	07.38
2024-08-02 01:22:01	47.74	30.59	29.80	431.80	633.78	05.41	06.34
2024-08-02 01:52:04	47.75	30.60	29.80	431.81	679.84	06.06	06.27
2024-08-02 02:22:07	47.76	30.61	29.81	431.82	681.72	07.06	06.30
2024-08-02 02:52:10	47.77	30.62	29.82	431.73	670.74	06.21	07.30

2024-08-02 03:22:13	47.78	31.60	29.83	431.74	670.75	07.55	08.30
2024-08-02 03:52:16	46.97	31.61	29.84	431.75	670.76	05.52	05.58
2024-08-02 04:22:19	47.77	31.62	29.85	431.76	670.77	06.52	06.58
2024-08-02 04:52:22	47.78	31.63	29.86	431.77	667.71	07.52	07.01
2024-08-02 05:22:25	47.79	31.64	29.87	431.78	667.72	08.52	07.20
2024-08-02 05:52:28	47.80	31.65	29.88	431.79	667.73	09.52	07.02
2024-08-02 06:22:30	47.81	31.66	29.89	431.80	618.76	03.53	06.00
2024-08-02 06:52:33	47.82	31.67	29.90	431.81	618.77	04.53	07.00
2024-08-02 07:22:36	47.83	32.63	32.77	378.85	618.78	05.53	03.05
2024-08-02 07:52:39	47.84	32.64	32.78	378.86	618.79	06.53	04.05
2024-08-02 08:22:42	36.69	32.65	32.79	393.67	618.80	06.55	05.05
2024-08-02 08:52:45	36.70	32.66	32.80	396.63	616.95	07.57	06.05
2024-08-02 09:22:48	36.71	32.67	32.81	396.98	616.96	07.27	07.05
2024-08-02 09:52:50	36.72	33.55	32.82	401.94	616.97	08.27	08.05
2024-08-02 10:22:53	46.65	33.56	32.83	397.70	602.72	08.36	09.05
2024-08-02 10:52:56	46.60	33.57	36.80	397.71	602.73	09.43	08.39
2024-08-02 11:22:59	48.88	33.58	35.60	397.72	602.74	05.54	07.27
2024-08-02 11:53:02	48.77	33.59	34.63	397.73	598.65	06.54	08.23
2024-08-02 12:23:05	48.78	33.60	34.64	417.78	632.64	07.54	09.23
2024-08-02 12:53:08	48.79	33.61	34.65	417.79	637.82	07.44	06.33
2024-08-02 13:23:11	48.80	29.84	34.66	422.74	637.83	05.54	07.33
2024-08-02 13:53:14	48.79	32.96	34.67	422.93	637.84	06.54	08.33
2024-08-02 14:23:17	45.80	30.84	34.68	426.81	656.97	07.54	09.33
2024-08-02 14:53:20	45.81	30.85	34.69	427.99	656.98	08.49	06.44
2024-08-02 15:23:23	45.82	30.86	34.70	430.83	607.81	07.57	08.44

2024-08-02 16:23:28	45.84	30.88	34.80	386.91	607.83	08.48	06.23
2024-08-02 16:53:31	38.93	30.89	34.81	386.92	607.84	08.52	07.23
2024-08-02 17:23:34	38.94	30.90	34.82	386.93	607.85	07.44	08.23
2024-08-02 17:53:37	38.95	30.91	34.83	386.94	606.63	07.44	04.55
2024-08-02 18:23:40	38.96	30.92	34.84	394.80	606.64	08.44	05.55
2024-08-02 18:53:43	41.66	42.87	32.79	405.76	622.68	03.57	07.14
2024-08-02 19:23:46	41.67	42.88	32.80	405.77	622.69	04.57	08.14
2024-08-02 19:53:49	36.66	42.89	32.60	408.78	622.70	05.57	07.14
2024-08-02 20:23:52	36.67	42.90	32.70	408.79	622.71	05.52	08.14
2024-08-02 20:53:55	36.68	42.91	32.70	453.83	622.72	06.52	09.14
2024-08-02 21:23:58	36.69	30.84	31.77	453.84	622.73	05.15	05.29
2024-08-02 21:54:00	36.70	48.64	31.78	453.85	622.74	05.18	06.29
2024-08-02 22:24:03	41.91	32.94	31.79	453.86	622.75	08.41	07.29
2024-08-02 22:54:06	41.92	32.95	31.80	443.76	622.76	09.17	08.38
2024-08-02 23:24:09	47.92	32.96	30.78	445.62	622.77	07.35	09.38
2024-08-02 23:54:12	47.93	32.97	30.79	448.98	622.78	08.35	08.46
2024-08-03 00:24:15	47.94	32.98	30.80	448.99	622.79	09.35	09.46
2024-08-03 00:54:18	47.94	46.75	30.80	456.71	699.91	04.40	09.39
2024-08-03 01:24:21	47.95	46.76	29.76	456.72	699.92	05.40	09.36
2024-08-03 01:54:24	47.96	46.77	29.77	456.73	699.93	06.40	09.38
2024-08-03 02:24:27	47.97	46.78	29.78	456.74	699.94	07.40	09.15
2024-08-03 02:54:30	40.59	46.79	29.79	456.75	699.95	07.54	09.29
2024-08-03 03:24:33	40.60	46.80	29.80	468.86	699.96	08.54	05.34
2024-08-03 03:54:36	53.79	30.91	29.80	468.87	708.62	07.35	09.00
2024-08-03 04:24:39	42.82	48.89	29.80	468.88	708.63	07.34	02.37

2024-08-03 04:54:41	38.98	47.79	29.80	468.89	708.64	07.40	03.37
2024-08-03 05:24:44	36.95	47.80	29.81	468.90	713.85	07.40	04.37
2024-08-03 05:54:47	36.96	47.81	29.82	468.91	722.66	07.09	05.37
2024-08-03 06:24:50	36.97	47.82	29.83	468.92	711.96	04.37	06.37
2024-08-03 06:54:53	36.98	47.83	29.84	435.97	711.97	05.37	07.37
2024-08-03 07:24:56	37.73	47.84	29.80	394.99	711.98	06.37	08.37
2024-08-03 07:54:59	37.74	33.85	29.80	394.100	720.59	06.54	08.53
2024-08-03 08:25:02	37.75	33.86	29.80	394.101	720.60	07.54	08.52
2024-08-03 08:55:05	37.76	33.87	29.80	394.102	720.61	05.50	03.50
2024-08-03 09:25:07	37.77	33.88	31.58	394.103	720.87	05.47	03.51
2024-08-03 09:55:10	37.78	33.89	31.59	394.104	720.88	05.03	03.52
2024-08-03 10:25:13	37.79	33.90	31.60	446.93	720.89	06.03	03.50
2024-08-03 10:55:16	37.80	29.65	31.61	450.87	720.90	07.03	03.51
2024-08-03 11:25:19	37.81	29.95	31.62	450.88	720.91	08.03	03.54
2024-08-03 11:55:22	45.66	33.83	31.63	450.89	720.92	02.55	03.51
2024-08-03 12:25:25	45.67	34.79	32.80	450.90	720.93	03.55	08.05
2024-08-03 12:55:28	45.68	34.80	32.81	450.91	723.88	04.55	08.59
2024-08-03 13:25:31	45.69	34.81	32.82	450.92	717.63	05.55	03.50
2024-08-03 13:55:34	45.70	34.82	32.83	450.93	776.78	05.44	03.50
2024-08-03 14:25:37	37.73	34.83	32.84	450.94	776.79	05.53	03.50
2024-08-03 14:55:40	37.74	34.84	34.80	450.95	776.80	05.56	03.50
2024-08-03 15:25:42	37.75	34.85	34.81	473.92	776.81	05.56	03.50
2024-08-03 15:55:45	37.76	34.86	34.82	473.93	776.82	03.31	03.50
2024-08-03 16:25:48	37.77	34.87	33.90	473.94	776.83	04.31	03.50
2024-08-03 16:55:51	37.78	34.88	33.91	473.95	776.84	05.31	03.50

2024-08-03 17:25:54	37.79	34.89	33.92	473.96	776.85	05.43	03.50
2024-08-03 17:55:57	37.80	34.90	33.93	473.97	776.88	05.19	03.50
2024-08-03 18:26:00	37.81	30.62	32.80	473.98	780.86	05.47	03.53
2024-08-03 18:56:03	35.79	33.97	31.77	478.61	787.86	05.52	03.56
2024-08-03 19:26:05	35.80	33.98	31.78	478.62	787.87	05.28	03.53
2024-08-03 19:56:08	41.68	33.99	31.79	478.63	787.88	05.37	03.50
2024-08-03 20:26:11	41.69	47.82	31.80	487.63	805.91	05.40	03.50
2024-08-03 20:56:14	48.98	43.65	30.80	487.64	805.92	05.34	03.50
2024-08-03 21:26:17	39.59	43.66	29.80	487.65	784.74	05.35	03.53
2024-08-03 21:56:20	39.60	43.67	27.55	593.73	727.90	03.45	03.50
2024-08-03 22:26:23	39.61	43.68	27.56	593.74	733.62	04.45	04.50
2024-08-03 22:56:26	39.62	43.69	27.57	593.75	719.77	05.45	05.50
2024-08-03 23:26:28	39.63	43.70	27.58	613.71	712.78	04.59	06.50
2024-08-03 23:56:31	48.88	48.58	27.59	613.72	712.79	05.13	07.50
2024-08-04 00:26:34	48.89	48.59	27.60	613.73	712.80	06.13	08.50
2024-08-04 00:56:37	48.90	48.60	27.61	613.74	712.81	07.13	07.02
2024-08-04 01:26:40	48.91	48.61	27.62	613.75	730.74	08.13	08.02
2024-08-04 01:56:43	47.69	30.69	27.63	583.78	730.75	09.13	05.02
2024-08-04 02:26:46	47.70	32.96	27.64	643.72	730.76	05.03	02.26
2024-08-04 02:56:48	35.60	31.79	26.75	643.73	730.77	05.04	03.26
2024-08-04 03:26:51	35.61	32.76	26.76	643.74	730.73	05.34	04.26
2024-08-04 03:56:54	35.62	32.77	26.77	692.90	732.69	05.16	05.26
2024-08-04 04:26:57	35.63	32.78	26.78	692.91	731.66	06.16	04.51
2024-08-04 04:57:00	42.76	32.79	26.79	692.92	731.67	05.12	05.51
2024-08-04 05:27:03	42.77	32.80	26.80	697.60	731.68	05.18	06.51

2024-08-04 05:57:05	42.78	32.81	26.70	699.66	731.69	05.45	03.51
2024-08-04 06:27:08	41.85	32.82	26.70	699.67	740.83	06.45	04.51
2024-08-04 06:57:11	43.62	40.25	26.70	699.68	740.84	05.25	04.21
2024-08-04 07:27:10	39.63	40.26	27.56	593.75	593.76	04.45	07.11
2024-08-04 07:57:11	39.64	40.27	27.57	593.76	593.77	05.45	07.34
2024-08-04 08:27:03	39.65	43.70	27.58	593.77	593.78	06.45	06.07
2024-08-04 08:57:13	39.66	43.71	27.59	593.78	593.79	07.45	04.56
2024-08-04 09:27:04	39.67	43.72	27.60	593.79	593.80	08.45	07.52
2024-08-04 09:57:11	39.68	43.73	27.61	740.83	593.81	07.15	08.21
2024-08-04 10:27:06	39.69	43.74	25.21	740.84	593.82	08.15	03.44
2024-08-04 10:57:02	38.70	43.75	25.22	740.85	593.83	09.15	04.44
2024-08-04 11:27:01	38.71	43.76	29.80	740.86	699.68	04.42	05.44
2024-08-04 11:57:02	38.72	38.71	29.81	740.87	699.69	05.42	06.44
2024-08-04 12:27:02	38.73	38.72	29.82	740.88	699.70	06.42	07.44
2024-08-04 12:57:03	38.74	38.73	32.80	740.89	699.71	07.42	09.12
2024-08-04 13:27:00	42.27	38.74	32.81	740.90	699.72	08.42	04.45
2024-08-04 13:57:01	42.28	38.75	32.82	699.68	699.73	09.12	05.45
2024-08-04 14:27:04	42.29	38.76	32.83	699.69	699.74	06.43	06.45
2024-08-04 14:57:05	42.30	41.85	32.84	699.70	699.75	04.13	07.45
2024-08-04 15:27:02	42.31	41.86	32.85	699.71	699.76	04.45	08.45
2024-08-04 15:57:03	41.10	41.87	32.86	699.72	699.77	07.43	07.42
2024-08-04 16:27:04	41.11	41.88	29.80	699.73	593.78	05.54	08.42
2024-08-04 16:57:05	41.12	41.89	29.81	593.75	593.79	06.54	05.42
2024-08-04 17:27:06	41.83	41.90	29.82	593.76	593.80	07.54	06.42
2024-08-04 17:57:07	41.84	42.29	29.83	593.77	593.81	06.23	07.42

2024-08-04 18:27:08	41.85	42.30	29.84	593.78	593.82	07.23	08.42
2024-08-04 18:57:09	41.86	42.31	29.85	593.79	593.83	08.23	09.42
2024-08-04 18:58:03	41.48	56.20	34.20	370.48	413.73	7.39	6.99
2024-08-04 19:28:04	48.82	57.51	34.20	365.99	410.02	7.33	7.10
2024-08-04 19:58:05	48.79	49.05	34.10	365.47	406.42	7.29	7.04
2024-08-04 20:28:03	35.53	44.59	33.80	363.49	406.12	7.47	7.01
2024-08-04 20:58:04	48.48	46.61	33.60	360.80	406.15	7.38	7.07
2024-08-04 21:28:02	35.53	46.97	33.30	358.32	403.78	7.32	7.13
2024-08-04 21:58:03	35.53	48.23	33.30	355.81	402.32	7.51	7.30
2024-08-04 22:28:00	35.45	48.18	33.00	355.06	400.03	7.45	7.02
2024-08-04 22:58:01	35.55	47.79	33.00	349.55	398.69	7.37	7.10
2024-08-04 23:28:02	35.99	46.10	32.60	347.48	398.67	7.45	7.31
2024-08-04 23:58:03	35.55	46.58	32.30	345.30	396.90	7.15	7.06
2024-08-05 00:28:02	35.55	47.04	31.80	342.79	395.78	7.38	6.58
2024-08-05 00:58:06	35.55	47.84	31.80	344.33	394.71	7.22	7.03
2024-08-05 01:28:01	36.02	49.27	31.80	343.74	394.28	7.24	7.32
2024-08-05 01:58:02	48.99	47.68	31.40	342.84	393.45	7.11	7.09
2024-08-05 02:28:09	48.99	47.55	31.40	341.96	393.41	7.09	7.16
2024-08-05 02:58:10	48.99	47.09	31.30	341.12	390.43	7.19	6.58
2024-08-05 03:28:01	36.48	47.04	31.30	338.36	390.04	7.36	7.31
2024-08-05 03:58:02	48.65	46.29	31.30	339.29	389.21	7.42	7.29
2024-08-05 04:28:03	48.23	46.70	31.10	337.69	388.57	7.41	7.30
2024-08-05 04:58:04	48.67	46.39	30.80	338.11	389.14	7.38	7.18
2024-08-05 05:28:00	48.67	47.23	30.20	336.88	388.98	7.42	7.31
2024-08-05 05:58:01	31.11	46.22	30.20	341.40	388.30	7.36	7.04



2024-08-05 06:28:07	31.11	46.58	29.80	337.73	387.40	7.19	7.32
2024-08-05 06:58:08	32.10	47.16	31.30	317.96	321.61	7.27	7.27
2024-08-05 07:28:04	33.02	47.16	37.00	342.90	335.39	6.20	6.19
2024-08-05 07:58:05	33.02	47.16	36.70	337.66	332.09	6.47	6.11
2024-08-05 08:28:01	45.60	48.30	38.00	344.89	356.58	6.26	6.26
2024-08-05 08:58:02	45.60	48.30	37.90	350.81	363.83	6.16	6.06
2024-08-05 09:28:00	45.60	47.02	38.50	340.38	334.30	4.54	5.03
2024-08-05 09:58:01	46.75	46.43	36.40	367.65	445.50	5.31	5.29
2024-08-05 10:28:05	48.45	45.14	35.20	365.93	356.52	6.17	6.13
2024-08-05 10:58:06	48.33	38.17	34.60	390.36	564.90	4.54	4.01
2024-08-05 11:28:01	48.45	47.09	34.00	393.04	362.12	5.23	5.38
2024-08-05 11:58:02	33.02	48.30	36.40	367.65	564.90	4.54	4.01
2024-08-05 12:28:03	33.03	48.31	36.41	367.66	564.91	4.55	4.02
2024-08-05 12:58:04	46.75	48.32	36.42	367.67	564.92	4.56	4.03
2024-08-05 13:28:05	46.76	48.33	36.43	367.68	564.93	4.57	4.04
2024-08-05 13:58:07	46.77	48.34	36.44	393.04	564.94	5.31	4.05
2024-08-05 14:28:07	46.78	48.38	36.45	393.05	564.95	5.32	5.29
2024-08-05 14:58:08	33.08	46.40	36.46	393.06	564.96	5.33	5.30
2024-08-05 15:28:02	48.33	46.41	36.47	393.07	362.12	5.34	5.31
2024-08-05 15:58:03	48.34	46.42	34.60	393.08	362.13	5.35	5.32
2024-08-05 16:28:04	48.35	49.27	34.61	393.09	362.14	5.36	7.07
2024-08-05 16:58:05	48.36	49.28	34.62	350.81	362.15	5.37	7.08
2024-08-05 17:28:06	48.37	46.29	34.63	350.82	334.30	6.11	7.09
2024-08-05 17:58:07	47.09	46.30	34.64	350.83	334.31	6.12	6.12
2024-08-05 18:28:00	47.10	46.31	34.65	350.84	334.32	6.13	6.13

2024-08-05 18:28:00	41.48	56.20	34.20	370.48	413.73	7.39	6.99
2024-08-05 18:58:01	48.82	57.51	34.20	365.99	410.02	7.33	7.10
2024-08-05 19:28:03	48.79	49.05	34.10	365.47	406.42	7.29	7.04
2024-08-05 19:58:04	35.53	44.59	33.80	363.49	406.12	7.47	7.01
2024-08-05 20:28:00	48.48	46.61	33.60	360.80	406.15	7.38	7.07
2024-08-05 20:58:01	35.53	46.97	33.30	358.32	403.78	7.32	7.13
2024-08-05 21:28:05	35.53	48.23	33.30	355.81	402.32	7.51	7.30
2024-08-05 21:58:06	35.45	48.18	33.00	355.06	400.03	7.45	7.02
2024-08-05 22:28:00	35.55	47.79	33.00	349.55	398.69	7.37	7.10
2024-08-05 22:58:01	35.99	46.10	32.60	347.48	398.67	7.45	7.31
2024-08-05 23:28:02	35.55	46.58	32.30	345.30	396.90	7.15	7.06
2024-08-05 23:58:03	35.55	47.04	31.80	342.79	395.78	7.38	6.58
2024-08-06 00:28:03	35.55	47.84	31.80	344.33	394.71	7.22	7.03
2024-08-06 00:58:04	36.02	49.27	31.30	343.74	394.28	7.24	7.32
2024-08-06 00:28:05	48.99	47.86	31.40	342.84	393.45	7.11	7.09
2024-08-06 01:28:00	48.99	47.55	31.40	341.96	393.41	7.09	7.16
2024-08-06 00:28:07	48.99	47.09	31.30	341.12	390.43	7.19	6.58
2024-08-05 01:28:01	36.48	47.04	31.30	338.36	390.04	7.36	7.31
2024-08-05 01:58:02	48.65	46.29	31.30	339.29	389.21	7.42	7.29
2024-08-06 02:28:09	48.23	46.70	31.10	337.69	388.57	7.41	7.30
2024-08-06 02:58:10	48.67	46.39	30.80	338.11	389.14	7.38	7.18
2024-08-06 03:28:01	48.67	47.23	30.20	336.88	388.98	7.42	7.31
2024-08-06 03:58:02	31.11	46.22	30.20	341.40	388.30	7.36	7.04
2024-08-06 04:28:03	31.11	46.58	29.80	337.73	387.40	7.19	7.32
2024-08-06 04:58:04	32.10	47.16	31.30	317.96	321.61	7.27	7.27
2024-08-06 05:28:00	33.02	47.16	37.00	342.90	335.39	6.20	6.19

2024-08-06 05:58:01	33.02	47.16	36.70	337.66	332.09	6.47	6.11
2024-08-06 06:28:07	45.60	48.30	38.00	344.89	356.58	6.26	6.26
2024-08-06 06:58:08	45.60	48.30	37.90	350.81	363.83	6.16	6.06
2024-08-06 07:28:04	45.60	47.02	38.50	340.38	334.30	4.54	5.03
2024-08-06 07:58:05	46.75	46.43	36.40	367.65	445.50	5.31	5.29
2024-08-06 08:28:01	48.45	45.14	35.20	365.93	356.52	6.17	6.13
2024-08-06 08:58:02	48.33	38.17	34.60	390.36	564.90	4.54	4.01
2024-08-06 09:28:00	48.45	47.09	34.00	393.04	362.12	5.23	5.38
2024-08-06 09:58:01	33.02	48.30	36.40	367.65	564.90	4.54	4.01
2024-08-06 10:28:05	33.03	48.31	36.41	367.66	564.91	4.55	4.02
2024-08-06 10:58:06	46.75	48.32	36.42	367.67	564.92	4.56	4.03
2024-08-06 11:28:01	46.76	48.33	36.43	367.68	564.93	4.57	4.04
2024-08-06 11:58:02	46.77	48.34	36.44	393.04	564.94	5.31	4.05
2024-08-06 12:28:03	46.78	46.39	36.45	393.05	564.95	5.32	5.29
2024-08-06 12:58:04	33.08	46.40	36.46	393.06	564.96	5.33	5.30
2024-08-06 13:28:05	48.33	46.41	36.47	393.07	362.12	5.34	5.31
2024-08-06 13:58:07	48.34	46.42	36.48	393.08	362.13	5.35	5.32
2024-08-06 14:28:07	48.35	49.27	34.61	393.09	362.14	5.36	7.07
2024-08-06 14:58:08	48.36	49.28	34.62	350.81	362.15	5.37	7.08
2024-08-06 15:28:02	48.37	46.29	34.63	350.82	334.30	6.11	7.09
2024-08-06 15:58:03	47.09	46.30	34.64	350.83	334.31	6.12	6.12
2024-08-06 16:28:04	47.10	46.31	34.65	350.84	334.32	6.13	6.13
2024-08-06 16:58:05	33.03	46.30	36.43	367.68	564.94	5.34	7.08
2024-08-06 17:28:06	33.04	46.31	36.44	367.69	564.95	5.35	7.09
2024-08-06 17:58:07	33.05	46.32	36.45	367.70	564.96	5.36	7.10
2024-08-06 18:28:00	33.06	46.42	36.46	367.71	564.97	5.37	7.11

## DAFTAR RIWAYAT HIDUP



Sri Hartati adalah nama penulis ini. Lahir pada tanggal 2 pebruari 2003, Desa Turunan Tengah, Tanjung Hataran, Kecamatan Bandar Hulan, Kabupaten Simalungun, Provinsi Sumatera Utara. Penulis merupakan anak ke 3 dari 3 bersaudara, dari pasangan bapak Sugino dan ibu Suriatun. Penulis pertama kali masuk pendidikan pada tahun 2009 di SD Negeri 091669 Bandar Betsy pada tahun 2009 dan lulus pada 2014. Kemudian melanjutkan pendidikan di sekolah SMP Negeri 1 Bandar Hulan dan lulus pada tahun 2017. Penulis kemudian melanjutkan pendidikan di SMA Negeri 1 Pematang Bandar dan lulus pada tahun 2020. Pada tahun 2020 penulis terdaftar sebagai Mahasiswa di Program Studi Fisika Universitas Islam Negeri Sumatera Utara Medan untuk memperoleh gelar Strata-1 (S1) dan lulus pada tahun 2024. Atas Berkat Karunia Allah SWT, dukungan, do'a, motivasi dan materil dari kedua Orang Tua, serta arahan dan bimbingan dari berbagai pihak sehingga penulis dapat menyelesaikan Skripsi. Semoga dengan adanya penulisan Skripsi ini mampu memberikan kontribusi lebih bagi dunia pendidikan terkhusus program studi Fisika. Akhir kata penulis mengucapkan Hamdallah atas terselesakannya Skripsi yang berjudul " Sistem Monitoring Pertumbuhan Tanaman Kangkung Yang Diaplikasikan Pada Pertanian Akuaponik".

UNIVERSITAS ISLAM NEGERI  
SUMATERA UTARA MEDAN