7th ICTVT
International Conference on Technology and Vocational Teachers

PROGRAM BOOK

RESEARCH AND INNOVATION IN TECHNOLOGY AND ENGINEERING DURING THE COVID-19 PANDEMIC

October 5th, 2021

Universitas Negeri Yogyakarta, Indonesia

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2nd International Joint Conference on Engineering, Technology, and Vocational Education

7th ICTVT, 4th ICOVEMAT, 4th ICE-ELINVO, 4th ICSI

Universitas Negeri Yogyakarta, Indonesia

October 5th 2021

Venue	Time	Activity
Zoom Video Conference Platform	08.00 – 08.30	• Conference participant check-in • All participant joins in zoom meeting
	08.30 - 09.00	**Opening Ceremony** • Opening and National Anthem "Indonesia Raya" • Welcome Speech Chairman Organizer of by Dean of Faculty of Engineering • Opening Speech by Rector of Universitas Negeri Yogyakarta
	09.00 – 10.20	**Speaker Speech Session 1** • Prof. Yu-Ren Wu, Ph.D. Department of Mechanical Engineering National Central University, Taiwan • Assoc. Prof. Dr. Nirmal Nair University of Auckland, New Zealand • Discussion
	10.30 – 11.50	**Speaker Speech Session 2** • Hyungwook Choi National Agency for Administration City Construction, Republic of Korea (R.O.K) • Prof. Slamet. PH, MA, MEd, MA, MLHR, Ph.D Universitas Negeri Yogyakarta, Indonesia • Discussion
	12.00 – 13.00	**Break**
	13.00 – 16.30	**Parallel Session** All participants are respectfully asked to join the breakout room of each conference

** All times are in GMT +7 . time zone*

Topic Interest : Information Technology / Information Engineering / Nuclear and Physics Engineering **(ROOM 1)**

Moderator : Andian Ari Anggraeni, M.Sc.

Name of Presenters	Institution	Title of Paper
Mr. Chairul Insani Ilham	POLTEKTRANS SDP PALEMBANG	The Manifest Application Of Passengers And Vehicles At The Batulicin Crossing Port In Southern Kalimantan
Ms. Rusmala	UNIVERSITAS COKROAMINOTO PALOPO	Optimization of Production Profit Using Genetic Algorithm
Mr. Kristia Yuliawan	UNIVERSITY OF PAPUA	The Public Acceptance of BPS Website of West Papua Province Using the Unified Theory of Acceptance and Use of Technology Model
Mr. Rio Octovinary Pramanagara	UNIVERSITY OF PAPUA	Smart Air Pollution Monitoring System Planning Design in Manokwari
Dr. Dewa Gede Hendra Divayana	UNIVERSITAS PENDIDIKAN GANESHA	Improvement of Experts' Weights Based on Tat Twam Asi in the TOPSIS Method as a Supporting Parameter for Optimization of Blended Learning Evaluation Results
Mr. Zainullah Zuhri	UNIVERSITAS ISLAM NEGERI SUNAN AMPEL SURABAYA	Design and Development of Web-Based Simulator for Container Vessel Handling
Edhy Sutanta	INSTITUT SAINS & TEKNOLOGI AKPRIND YOGYAKARTA	Analysis of Student Academic Achievement and The Factors Affected as The Impact of Covid-19 Pandemic
Ms. Andian Ari Anggraeni	UNIVERSITAS NEGERI YOGYAKARTA	Delivering Blended Learning for Generation Z: When Will We be Ready?
Mr. Nirsal	UNIVERSITAS COKROAMINITO PALOPO	Dengue Fever Prediction Using Naive Bayes Algorithm
Mr. Indra Hidayatulloh	UNIVERSITAS NEGERI YOGYAKARTA	Gamification on Chatbot-based Learning Media: A Platform Perspective

Topic Interest : Electrical Engineering / Mechatronics Engineering/Nuclear and Physics Engineering **(ROOM 2)**

Moderator : Kusminarko Warno, M.Pd.

Name of Presenters	Institution	Title of Paper
Mr. Fredy Sidabutar	INDONESIA UNIVERSITY OF EDUCATION	ANTENNA DESIGN YAGI UDA 2,4 GHZ WITH MODULE NRF24L01 FOR RADIATION PATTERN DISTANCE OF 30 KM USING CST STUDIO SUITE SOFTWARE
Dr. Adelhard Beni Rehiara	UNIVERSITY OF PAPUA	System Dynamics Modeling for Estimating the Electrical Energy Demand of West Papua Province
Dr. Adelhard Beni Rehiara	UNIVERSITY OF PAPUA	An Extended IoT System for Real Time Solar Power Monitoring
Mr. Lion Ferdinand Marini	UNIVERSITAS PAPUA	Strategic Planning of Renewable Energy Utilization in Manokwari to Support West Papua as a Conservation Province
Ms. Bibiana Rosalina Wihyawari	UNIVERSITY OF PAPUA	Radial Power Flow Analysis of Rajawali Feeder in Manokwari Power Grid
Ms. Ayu Jati Puspitasari	POLYTECHNIC INSTITUTE OF NUCLEAR TECHNOLOGY	Temperature Screening and Face Recording with Telegram Messenger Interface
Ms. Ayu Jati Puspitasari	POLYTECHNIC INSTITUTE OF NUCLEAR TECHNOLOGY	CsI(Tl) Scintillation Detector for Planar Scintigraphy Technique
Dr. Marsono	UNIVERSITAS NEGERI MALANG	Calibration The Travel Resolution Stepper Motor Machines of CNC-Based Batik Robot Running GRBL Firmware
Mr. Muhamad Ali	UNIVERSITAS NEGERI YOGYAKARTA	Development Electrical Technician Competency Test Using Web-based Computer Adaptive Test
Mr. Muhamad Ali	UNIVERSITAS NEGERI YOGYAKARTA	Smart Monitoring and Inspection of Electrical Installation Based On The Internet Of Things

Topic Interest : Vocational Technology **(ROOM 3)**
Moderator : Dr. Widihastuti, M.P

Name of Presenters	Institution	Title of Paper
Dr. Moh. Rusnoto Susanto	UNIVERSITAS SARJANAWIYATA TAMANSISWA YOGYAKARTA	The Paradigm Shift of E-learning System in Indonesia During the Covid-19 Pandemic: A Phenomenological Perspective
Ms. Nurul Ridhi Utami	UNIVERSITAS NEGERI YOGYAKARTA	Utilization Of Digital Application "Webtoon:Lazy Cooking" An Alternative Vocational Learning Media Cullinary Art
Dr. Rina Febriana Hendrawan	UNIVERSITAS NEGERI JAKARTA	The Feasibility of the Mise en Place Restaurant Video Tutorial as a Tool for Teaching Practicum in the Food and Beverage Service Class during the Covid 19 Pandemic
Mr. MUKHLISIN	POILITEKNIK BOSOWA	Development Learning Model Industry Control Oriented of an Augmented Reality in Polytechnic
Mr. Tasri Ponta	UNIVERSITAS NEGERI MAKASSAR	The Effectiveness of PONTA Learning Model Based on Blended Learning in Vocational High School
Dr. Peni Handayani	POLITEKNIK NEGERI BANDUNG	Building Work-Skills Through On-the Job Training During the Covid-19 Pandemic
Mr. MUHAMMAD YASSIR	BPSDM SULAWESI SELATAN	HIGHER ORDER THINKING SKILLS BASED ASSESMENT FOR LEARNING MODEL IN PROBLEM BASED LEARNING USING SIAVO FOR VOCATIONAL SCHOOL STUDENTS
Mr. fuadi fuadi	UNIVRSITAS NEGERI YOGYAKARTA	INNOVATION ON RESEARCH METHOD IN VOCATIONAL MUSIC EDUCATION DURING THE COVID -19 PANDEMIC
Ms. Ariani Amri	UNIVERSITAS NEGERI YOGYAKARTA	Perceptions of Electrical Engineering Students towards Moodle in Electrical Installation Courses in the New Normal Era
Mr. Muhammad Nurtanto	UNIVERSITAS SULTAN AGENG TIRTAYASA	Bibliometric analysis of the term Professional Identity in teacher educators "PITE"

Topic Interest : Vocational Technology **(ROOM 4)**
Moderator : Dr. Nani Ratnaningsih, M.P

Name of Presenters	Institution	Title of Paper
Dyah Retno Septiani	UNIVERSITAS SEBELAS MARET SURAKARTA	VOCATIONAL SKILLS OF GRAPHIC DESIGN FOR BRANDING THE SCHOOL'S CREATIVE INDUSTRY: THE PERSPECTIVE OF DEAF CHILDREN
Mr. YUSHANAFI MURSID NURSITA	YOGYAKARTA STATE UNIVERSITY	Learning Media of Mobile Augmented Reality Based Electrical Measurement Tools In Design and Testing
Mr. Adhan Efendi	POLITEKNIK NEGERI SUBANG	Development of Graphic Info-Based Poster Media as Work Safety Induction Media
Ms. SRI MUGIYATI	UNIVERSITAS NEGERI JAKARTA	Academic Mapping and Selection of Junior High School Students in West Jakarta Based on School Status
Mr. Basori Basori	UNIVERSITAS SEBELAS MARET	Profile Of Critical Thinking Skill Of Vocational High School Students On Simulation And Digital Communication Subjects
Mr. Andika Bagus Nur Putra	UNIVERSITAS NEGERI MALANG	The Innovation of TVET Based E-Training to Increase The Human Resources Level for Vocational Educators in The Era of Society 5.0
Dr. I Putu Wisna Ariawan	UNIVERSITAS PENDIDIKAN GANESHA	Usage Tests of Blended Learning Based on TKP-Kelase for Mathematics Lessons at Senior High Schools or Vocational Schools
Dr. I Putu Wisna Ariawan	UNIVERSITAS PENDIDIKAN GANESHA	Usage Tests of the CIPP Model Evaluation Application Integrated with the SAW Method to Evaluate the Effectiveness of the E-Learning Implementation
Mr. Rahmat Fadillah	UNIVERSITAS NEGERI PADANG	Need Analysis: Digipreneur-Based Learning Management System in Vocational Education
Dr. Dewa Gede Hendra Divayana	UNIVERSITAS PENDIDIKAN GANESHA	Use of DIVAYANA Formula in Determining Discrepancy Asuri Daiwi Sampad in the Evaluation Process of Flipped Learning

Topic Interest : Vocational Technology **(ROOM 5)**
Moderator : Nurullia Nur Utami, S.T.P., M.Sc.

Name of Presenters	Institution	Title of Paper
Dr. Sintha Wahjusaputri	UNIVERSITY OF MUHAMMADIYAH PROF. DR. HAMKA	Implementation of Online Learning in Indonesian Vocational Education During COVID-19 Pandemic : A Comprehensive Review
Ms. Resi Sepsilia Elvera	UNIVERSITAS NEGERI YOGYAKARTA	FAST FASHION TECHNOLOGY AND PRODUCTS: STUDENT PERCEPTIONS OF YOGYAKARTA STATE UNIVERSITY
Mr. Mahfudi Sahly Subandi	UNIVERSITAS NEGERI MALANG	TPACK and HOTS Preparation for Engineering Education Students with Integrated Project-based Learning Live MOOCs
Dr. Suharno	UNIVERSITAS SEBELAS MARET	Exploring Students' Knowledge of HOTS learning: Case Study of Students in Indonesia
Dr. Tuwoso Tuwoso	UNIVERSITAS NEGERI MALANG	E-System Technology of Powtoon Concept with a Panicgogy Model to Upgrade The Adaptive Skills of Post-Pandemic Vocational Education Students
Ms. Riana Nurmalasari	UNIVERSITAS NEGERI MALANG	Urgensity of Synergy Between Industry and Educational Institutions Using Technology to Support Implementation Freedom to Learn-Independent Campus
Mr. Muhammad Noor Fitriyanto	UNIVERSITAS MUHAMMADIYAH PALANGKA RAYA	Development Green Skills Through 6R Work Culture Concept
Ms. Chia-Mei Liang	NATIONAL YUNLIN UNIVERSITY OF SCIENCE AND TECHNOLOGY	Constructing a digital resume and sustainable development of science and technology education for the glass bead craft industry of the Paiwan ethnic group
Dr. LI-Hsun PENG	NATIONAL YUNLIN UNIVERSITY OF SCIENCE AND TECHNOLOGY	Using innovative technology and land game in vocational education design to revive the Kaxabu's tribal Culture

Name of Presenters	Institution	Title of Paper
Dr. LI-Hsun PENG	NATIONAL YUNLIN UNIVERSITY OF SCIENCE AND TECHNOLOGY	The use of spell reunion in vocational technology education and digital design

Topic Interest : Industrial Engineering/Mechanical Engineering **(ROOM 6)**
Moderator : Dewi Eka Murniati, S.E., M.M.

Name of Presenters	Institution	Title of Paper
Dr. Tuswan Tuswan	DEPARTMENT OF NAVAL ARCHITECTURE, INSTITUT TEKNOLOGI SEPULUH NOPEMBER, INDONESIA	Finite element analysis and lightweight optimization design of rocket motor tube using a thin-walled cylinder
Mr. Lasinta Ari Nendra Wibawa	BADAN RISET DAN INOVASI NASIONAL (BRIN)	Effect of cylinder length on the ratio of safety factor and weight of rocket motor tube using thin-walled cylinder
Ms. Elly Wuryaningtyas Yunitasar	UNIVERSITAS SARJANAWIYATA TAMANSISWA	Saving Matrix Application to Minimize Fuel Distribution Route Allocation
Ms. Nani Mulyaningsih, S.T., M.Eng.	UNIVERSITAS TIDAR	Alternatives to Preventing Corrosion of Vehicle Components during a Pandemic
Mr. V. Reza Bayu Kurniawan	UNIVERSITAS SARJANAWIYATA TAMANSISWA	Determining Best Controls On Occupational Risks Using The Best-Worst Method In An Indonesian Furniture Company
Ms. Dyah Ari Susanti	UNIVERSITAS SARJANAWIYATA TAMANSISWA	Supplier Selection Problem for Multiple Items: an MCDM Approach
Dr. Muhammad Akhlis Rizza	POLITEKNIK NEGERI MALANG	Intermolecular Force On Movements Of Water In Porous Media
Retno Widiastuti	UNIVERSITAS SARJANAWIYATA TAMANSISWA	Implementation of The Cardiovascular Load and Rating Scale Mental Effort To Reduce The Bakery Worker's Workload
Mr. Lasinta Ari Nendra Wibawa	BADAN RISET DAN INOVASI NASIONAL (BRIN)	The Effect of Load Variations and Thread Types on The Joint Strength of The Rocket Cap and Tube Using Finite Element Method
Ruslan R	STKIP BIMA	Salt Iodization Technology To Improve Salt Quality at IKM Sanolo Jaya Bima Regency

Topic Interest : Civil and Planning Engineering/Environmental Engineering/Vocational Technology **(ROOM 7)**

Moderator : Arum Widyastuti Perdani, S.T.P., M.Sc.

Name of Presenters	Institution	Title of Paper
Ms. Maulina Tanjung	POLITEKNIK PELAYARAN MALAHAYATI	Analysis of seawater intrusion into groundwater in the coastal area of Durung Village, Aceh Besar Regency, Aceh Province, Indonesia
Ms. Dillah Nurfathiyah Mufti	UNIVERSITAS GADJAH MADA	Stability Of Yogyakarta International Airport Underpass Structure Based On Analytical And 3d Numerical Solutions
Dr. Kinanti Wijaya	UNIVERSITAS NEGERI MEDAN	Design and Validation of Lesson Plan Development in Materials Technology Courses with an Output Based Education Approach
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Ms. Purris Rachelina Girsang	KALIMANTAN INSTITUTE OF TECHNOLOGY	SPATIAL PATTERN ANALYSIS OF THE COVID-19 PANDEMIC IN BALIKPAPAN CITY
Mutiara Nugraheni	UNIVERSITAS NEGERI YOGYAKARTA	Product development of gluten-free dried noodle from composite flour of germinated organic brown rice, Vigna radiata, Sago and tapioca flour
Ms. NOLIS MARLIATI	UNIVERSITAS NEGERI YOGYAKARTA	TRANSPARENT SOAP FORMULATION WITH FRAGILE PANDAN LEAF POWDER (Pandanus amaryllifolius Roxb.)
Mr. Abdul Malik	UNIVERSITAS NEGERI YOGYAKARTA	The Effectiveness of the Industry Competency Certification Program: Construction Field Overview

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An Extended IoT System for Real Time Solar Power Monitoring

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Abstract. Industrial revolution 4.0 has been marked with the human needs of big data from all over devices, and it has been triggering the massive development of the Internet of Things (IoT). In this paper, an IoT system for solar power monitoring system is developed to measure voltage, current, temperature, and humidity using a voltage divider, ACS712, and DHT11 sensor. An ATMega328 microcontroller then processes data, and hereafter it is given to the ESP8266 module to be sent thru an internet connection via the TP-Link TL-MR3420 modem. The result of the running system shows that the proposed IoT system can well run to measure the system variables. As samples of the test measurement data on 4th April 2021, about 70%RH, 35^{0}C, 13V and 0.25A for humidity, temperature, voltage and current respectively can be sensed. However, the data is sent to a cloud system and displayed in the LCD for local monitoring.

INTRODUCTION

Technology is created to help and reduce human work. Since the first industrial revolution, technology has developed to be more sophisticated, simple, and easy to use. In every industrial revolution, technology is focused on differently. Some points of the current industrial revolution 4.0 are the internet of things (IoT), networking, and cyber-physical system. An IoT allows a device to exchange data utilizing an internet network. The IoT application covers many technology areas, but it is mostly used to monitor and control devices [1-2].

Solar power is a kind of renewable energy that becomes popular to be developed. People are more intent to use this power together with the maturity of solar technology, the simplicity to be installed, and the attractive price of the solar power unit. On the other hand, the disadvantages are the dependency on weather, the effective time of solar radiation and the coverage area for the panel installation.

Many researches have been issued in solar power monitoring, i.e., 1) Gopal et al. have built an IoT based solar power monitoring to monitor voltage and current of a PV panel. It is not stated where the data is stored [1], 2) Husin et al. design a solar power monitoring device and the data is given in online mode. The device also does an algorithm to track the sun so that the power plant will produce maximum energy [3], 3) Li et al. develop an IoT technology to monitor, maintenance and performance of a solar PV. This device includes GPS and camera system connected to a raspberry PI[4], 4) Priharti et al. design a device for online monitoring a PV panel. This device include a light intensity sensor[5], and 5) Rehiara et al. implement a data logger for real time solar power monitoring where the data is stored on local drive[6]. From this point of view, many of them are focused on monitoring voltage, current, and generate energy, while solar power generation is very dependent on weather.

In this paper, an extended IoT system for solar power monitoring is proposed. A DHT 11 sensor is added to measure humidity and temperatur where is negletecd by previous researchers. Therefore the IoT system can measure more variables such as voltage, current, temperature, and humidity so that the given data is useful for monitoring, modeling, and forecasting both solar energy and weather.

METHOD

System Diagram

The block diagram of the proposed IoT system is given in Figure 1. It consists of a solar power system measured with current and voltage sensors, and temperature and humidity sensors are extended in this system to provide information about the weather. All of the data is processed by an ATMega328 microcontroller, and the output is sent to an LCD, serial monitor, and cloud storage.

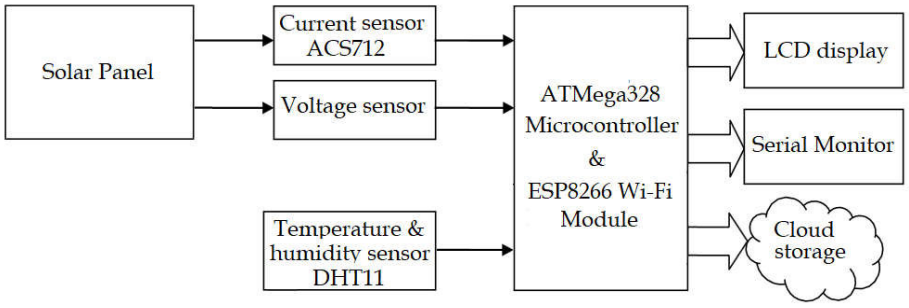

FIGURE 1. The proposed IoT system diagram

Voltage Divider

In this project, a voltage devider is used to reduce solar panel voltage so that the voltage can be sensed by the analog to digital (ADC) part of the microcontroller. The voltage divider is a simple but useful device to separate high voltage into some fraction in the output part. In general, this device is built using two or more resistors which are in pairs within series pair with input voltage shown in the Figure 2 [6-7].

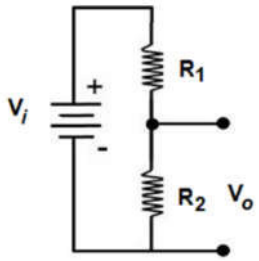

FIGURE 2. Voltage divider

According to Ohm's law, current I flow in the voltage divider is equal to the input voltage divider by total resistivity, R_1, and R_2. Then the output voltage V_o is the output resistance R_2 by current I. Therefore the voltage divider can be formulated as follows, where the current I is processed inside the bracket [6-9].

$$V_o = \left(\frac{V_i}{R_1 + R_2} \right) R_2 \tag{1}$$

Cloud Storage

The sensing data is sent to cloud storage so that everyone worldwide can monitor solar power. Many free websites are provided, such as ThingSpeak[8][10], Blynk [11], Cayenne, etc. In our case, the ThingSpeak platform was selected due to its simplicity, but unfortunately, it has limited to 7 channels and 3 million data for a free user

account. ThingSpeak gives a complete service for an IoT system, including aggregate, visualize, and analyze data streams in a cloud platform. In addition, it can send alerts while creates a data visualization instantly.

SYSTEM IMPLEMENTATION

Hardware

Based on the proposed system shown in Figure 1, some hardwares are used to build the completed system where completed system are connected as shown in Figure 5. The hardwares are detailed as follows.

a. Uno Wi-Fi Board

In this board, a microcontroller Atmel ATMega328, Wi-Fi module ESP8266 with 32 MB flash memory and CH340G USB-TTL converter are integrated on one board. The board has compatibility with Arduino Uno R3, and so it can be programmed with Arduino IDE. A DIP switch is provided for setting the configuration as specified and the physical of the board is given in Figure 5 [12].

b. LCD Display

Liquid Crystal Display (LCD) is a media display that used liquid crystal for displaying any character. Some types of LCD are segment LCD, dot matrix character LCD, and graphic LCD. In this paper, a dot-matrix LCD that can display 16 X 2 characters. The LCD 16x2 has 16 pins which are categorized into three parts [13], *i.e.*:

1. Data pins data which are used to send characters data to the LCD, D0 to D7. In an application using a micro-controller, only data pins from D4 to D7 are used.
2. Setting pins that are used to set the LCD. The pins are RS (Register Select) pin for indication or set the type of incoming data as a data or command, R/W (Read Write) pin as an instruction for write or read data, E (Enable) pin to latch the data.
3. Power pins are used for powering the LCD, which are A, K, VD, VSS, and VDD.

c. ACS712 Current Sensor Module

This sensor module is a low price current sensor but powerful inaccuracy for sensing AC or DC current. The current is measured using a linear Hall circuit while providing low power loss due to small internal resistance. The ACS712 sensor has been factory-trimmed, and it has nearly zero magnetic hysteresis, so there is no need for calibration. This module and its schematic are figured in Figure 3, while its important features are given in Table 1 [14].

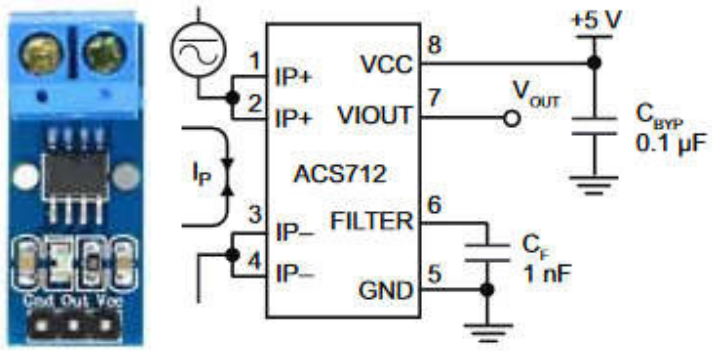

FIGURE 3. ACS712 current sensor module

TABLE 1. Features of ACS712

Description	Values
Internal conductor resistance	1.2 mΩ
Output sensitivity	66 to 185 mV/A
Zero current output voltage	VCC x 0.5 V
Total output error	1.5% at 25°C
Internal conductor resistance	1.2 mΩ

d. DHT 11 Sensor Module

DHT11 is a temperature and humidity sensor offering excellent quality, long-term stability, fast response, anti-interference ability, and cost-effectiveness. The sensors measure humidity using the resistive-type humidity measurement component while using NTC for sensing the temperature. The output of both temperature and humidity data are 40-bit data, and those are sent together simultaneously and on the same wire. The 5KW pull-up resistor is needed to latch the data within a 20m distance, and it is inside the module, as shown in Figure 4 [15].

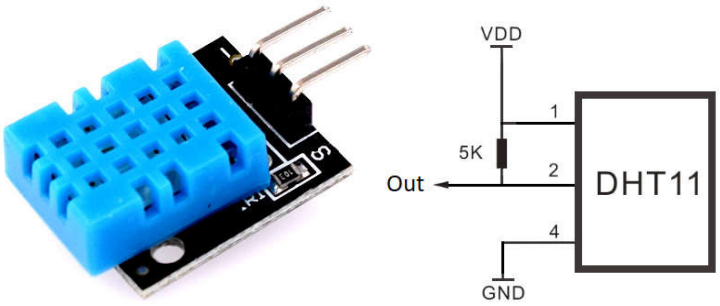

FIGURE 4. DHT11 sensor module

e. Solar Panel

The solar panel is also called a photovoltaic panel or solar cells. The term "cells" means that this panel contains some independent solar cells built by mixing some semiconductor elements like silicon, phosphorus, and boron layers [1][16]. These cells are structured in a grid-like pattern on the solar panel's superficies. Most solar panels are built from crystalline silicon solar cells due to their durability to high temperatures. However, some solar panels are designed from a thin film that converts solar radiance spectrum into electric energy. This thin film may not be lasting in high temperatures, and so it is mainly used in a place with low temperatures.

Firmware

This project used ATMega328 microcontroller in an Uno Wi-Fi board. The microcontroller needs firmware as the primary instruction to be executed along the hardware process. Due to the compatibility of the Uni Wi-Fi mainboard with an Arduino, it can be programmed in Arduino IDE. This IDE provides a simple way to program a microcontroller than the other IDE, such as WinAVR, BASCOM AVR, etc.

System Design

The completed system design with the wiring data is provided in Figure 5. DHT 11 sensor module will send the data through port 2 of the main board, while ACS 712 sensor module and voltage divider are connected to ADC port A1 and A2, respectively. The voltage divider designs so that the solar panel voltage is divided into six parts, and the mainboard will sense 1/6 of the solar panel voltage. Therefore the maximum sensing is about 30 VDC.

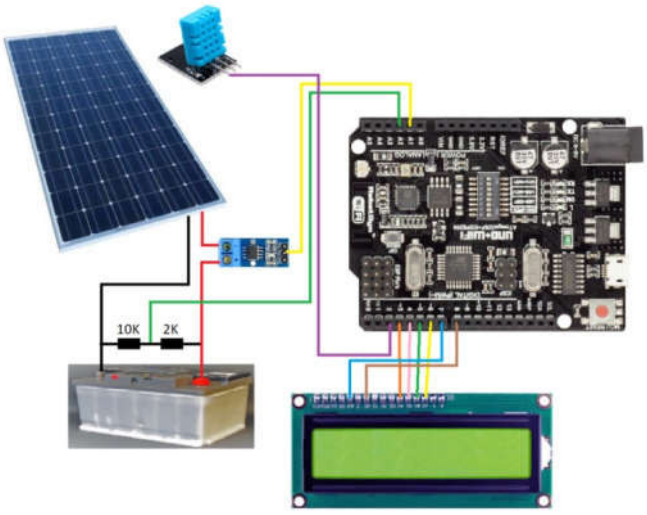

FIGURE 5. Wiring diagram

RESULT

Connection Testing

The connection to the internet is made via a Wi-Fi connection provided by the TP-Link TL-MR3420 modem. Figure 6 shows the connection test of the implemented system, namely ESP_05FF7B, which is captured from the modem traffic monitor list. The figure also shows that the IoT system actively sends the data to the cloud website.

Connection Type	Device Name	MAC Address	Real Time-Rate	Traffic Usage
2.4G	iPhone	E2-34-BC-D0-2F-8A	4.470KB/s↑ 35.150KB/s↓	1.277G
2.4G	Willy-iPhone	6C-40-08-7F-C0-C2	26B/s↑ 11B/s↓	504.846M
2.4G	iPhone-001	B9-78-2E-72-FB-0E	0B/s↑ 0B/s↓	160.682M
2.4G	DESKTOP-4N71407	00-27-10-F8-B9-42	96B/s↑ 101B/s↓	57.014M
Wired	iPhone	D0-41-5F-80-15-B1	0B/s↑ 0B/s↓	4.107M
Wired	iPhone的Keniro	DC-41-5F-84-58-96	0B/s↑ 0B/s↓	11.628M
2.4G	ESP_05FF7B	EC-FA-BC-05-FF-7B	53B/s↑ 53B/s↓	402.030K

FIGURE 6. Connection test

Logging Data

In this project, about 4 channel data have been used to save the data from the IoT system where each channel is used to collect data from each sensor. The IoT system is designed to send data every 20 seconds, and Figure 7 shows the collected data on 4th April 2021 started from 15:14 to 15:34. For each channel, 180 samples of actual data were collected for about 60 minutes. However, in the cloud service platform, only 60 samples (20 minutes) will show.

FIGURE 7. Logging data

At the time of logging data, the weather is slightly cloudy after heavy rain, where the humidity and temperature are high, about 70%RH for humidity and 35^0C for temperature. On the other hand, the voltage is measured at about 13V while the battery is almost full, as shown in a little current flow of about 0.25A. This IoT system can provide some parts of weather system data; therefore, it can be used to monitor solar power and for modelling and forecasting the weather.

Based on observation, there are some delays between sending data and displaying data to the ThingSpeak. These delays cause by a slower internet connection between the device and the cloud service. However, all of the data was sent successfully. The duration of about 20 seconds is more than enough for the device to resend the data before new data arrives.

CONCLUSION

In this article, a solar power monitoring device has been designed and developed. The mainboard consists of an ATMega328 microcontroller and Wi-Fi module ESP 8266. The monitoring system can run well to sense the voltage, current, temperature, and humidity of a solar power generation system. A current sensor ACS712 is occupied in getting the current data while the voltage data is given using a voltage divider. The temperature and humidity sensors are added to extend a conventional monitoring system using the DHT 11 sensor module to develop a device that can also be used to monitor, model, and forecast the weather. The sensing data are displayed in LCD and sent to ThingSpeak.com as a cloud website. The developed IoT system is connected to the cloud service via internet connection by TP-Link TL-MR3420 modem. The measurement data test on 4^{th} April 2021 shows that the IoT system can work as expected. The measured data are 70%RH, 35^0C, 13V, and 0.25A for humidity, temperature, voltage, and current, respectively.

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