Energy Output Simulation of the Floating PV System of Karangkates Hydropower Dam in East Java, Indonesia

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***Abstract*— The Floating Photovoltaic (FPV) is expected one of the appropriate solutions for the expansion of the solar energy sector. This paper studies the possibility of implementing the FPV system in an existing dam in Karangkates, Malang District, East Java, Indonesia. The possibility of implementation is studied by simulating the energy output of PV systems using Solar GIS Pvplanner. The water surface area of the dam was found around 10,500,000 m^2. By considering 50% of the total area would be used for FPV system, about 560 MWp capacity solar panels would be possible to be installed. The annual energy production by FPV system would be around 721.2 GWh. The FPV system can be hybridized with the existing hydropower plant in Karangkates dam.**

Keywords*— *FPV, solar irradiation, Karangkatas, dam

I. Introduction

The use of fossil-based energy such as oil, gas, and coal continues to increase with population growth and technology and industrialization development. At the same time, fossil-based energy resources, on the other hand, are depleted. Besides, the side effect of fossil energy combustion is identified as a significant impact on global warming and climate change which is more real in recent years [1], [2]. It is necessary for us to attempt alternative energy sources that are environmentally friendly to assure the sustainability of energy and development.

In the General National Energy Plan (Rencana Umum Energy Nasional, RUEN) that the Government of Indonesia established in 2017 is targeting that renewable energy would supply 23% of the national energy demand by 2025 [3], [4]. There are various renewable energy resources available in Indonesia, such as geothermal, hydropower, biomass, and solar energy. Currently, renewable energy, particularly for electricity generation supply in Indonesia, is mainly from hydropower and geothermal. Of the various renewable energy resources, solar photovoltaics (PV) energy is expected to be generated about 6.5 GW of the total of 45 GW renewable energy generation by 2025 [5], [6].

One of the disadvantages of using the solar electricity PV system, particularly on a large scale, is it needs land or open space for mounting solar modules. It is estimated that a 1 MWp capacity of the PV system requires about 10,000 m2 of land [7][8]. For most cases, this number of the area would have a significant impact as they would not be possible to use for other purposes. The government of Indonesia promotes the use of rooftops known as the rooftop PV system [9]; however, still, it will only be able to provide a relatives small of the PV system generation.

The Floating Photovoltaic (FPV) is expected one of the appropriate solutions for the expansion of the solar energy sector. The FPV system is a kind of solar farm that is constructed on the surface of the water. The systems of FPV are commonly installed on dams, lakes, ponds, coastal, etc.[10]. The FPV installations open up new opportunities for scaling up the capacity of solar electricity generation. In general, the installation FPV system consists of a floating structure so-called pontoon, the anchor system, cabling system, and PV system components. The schematic diagram structure of an FPV system is shown in Fig. 1[10].

In the literature, there were various studies and implementation of FPV worldwide [11]–[14]. However, fewer studies and implementation on the FPV have been reported for the Indonesian situation[15]. This paper studies the possibility of implementation of the FPV system in an existing dam in Karangkates, Malang District, East Java, Indonesia. The possibility of implementation is studied by simulating the energy output of the PV system using Solar GIS Pvplanner.

Karangkates Dams, also known as Sutami Dam, is a water reservoir obtained by blocking the Brantas River flow located in Sumberpucung District, Malang Regency, East Java Province, Indonesia. The reservoir water comes from a spring on Mount Arjuno and adds the rainwater. The dam was build in 1961 and started in operation in 1972 [16]. The primary function of the dam are:

- Flood control,
- Power plant with a power capacity of 3 x 35 MW
- Provision of irrigation water 24 m^3 /s in the dry season
- Tourism and inland fisheries.

The objective of the study is to Fig. out and estimate the Karangkates Dams. The electricity generated can be exported or combined with the existing hydropower plant networks installed in the dams. This is actually one of the advantages FPV system, where it can be hybridized with the existing hydropower system.

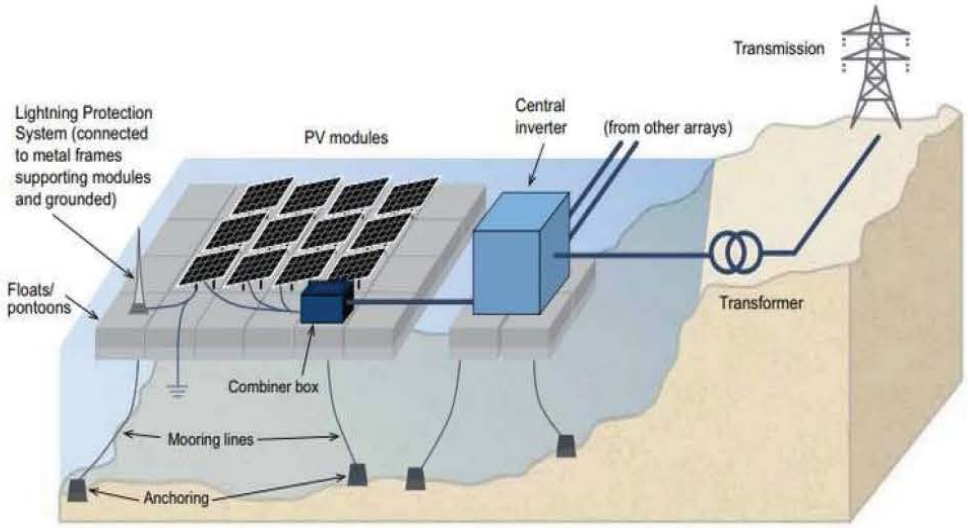

Fig. 1. Schematic diagram and components of FPV [10]

FPV system capacity that can be applied in the area of

Fig. 2. Water surface area of Karangkates Dam on Google Earth TM view

II. METHODS

The total area of the water surface is determined using the Polygon feature of Google Earth TM. Further, the effective area for solar panels is assumed to be 50% of the available surface. The possible water surface area generated from Google Earth TM is shown in Fig. 2.

SolarGIS PVplanner online simulation tools were used in simulation to estimate the energy output of FPV system [17], [18]. The input parameters and climate databases are simulated by the software numerically. The geographical data of the simulated location and the other input parameters are shown in Table 1. The climate databases (recorded by default on the software databases) are from the real measurement obtained from the nearest weather station.

TABEL 1. INPUT PARAMETERS FOR SIMULATION

Parameters	Input
Astronomic possition	07° 52' 57.66" S, 113° 03' 2.48" E
Time zone	UTC+07
Terrain Elevation	3 m
PV module type	c-Si - crystalline silicon (mono or polycrystalline)
Mounting system	Fixed mounting, free standing
Installed power	1 kWp
Inverter type	String inverter
Transformer type	Standard transformer
Slope inclination	15°
Snow and soiling losses at PV modules	Monthly soiling losses up to 3.5% · Monthly snow losses up to 0.0%
Cabling losses	DC cabling 1.0%; DC mismatch 0.5%; AC cabling 0.4%
System availability	98.0%

The capacity of the FPV system simulated is 1000 Wp, with a grid-connected installation system. This is to calculate the specific energy output of PV system for the location. The specific energy output is defined as the amount of energy output of a PV system in comparison with the total solar irradiation received by the solar panels under operating conditions. Therefore, the specific energy output is calculated by comparing PV system energy output Eout, in kWh to maximum power capacity, Pmax, in kWp under STC. Hence, the unit of the specific energy output is kWh/kWp. Mathematically it be written as:

$$Specific\ Energy\ Output = Eout, AC / Pmax, STC \quad (1)$$

where:

$Eout, AC$ = energy output for the actual condition;

$Pmax, STC$ = power capacity under standard test conditions.

The specific energy production information is then used to predict the energy output potential by scaling up the panel capacity according to the potentially available area.

The type of mountings of PV systems simulated is panel array without any tracking system, i.e., fixed free-standing one axis one angle with optimized angles. According to the geographical position, the optimum tilt is 12° from the horizontal, with a panel azimuth of 0o or facing to North.

III. RESULTS AND DISCUSSION

The potential of solar energy in a particular location is affected by many aspects such as the level of the Sun path, solar irradiation, humidity, and temperature. Sun path gives information about sun position overtime during a year. The Sun path in Karangkates is shown in Fig. 3 (left). It also shows the terrain horizon, module horizon, and active area with solar and civil time. The annual variation solar zenith angle of the long day in Karangkates is also shown in Fig. 3 (right). It can be seen that if there is any higher terrain horizon obstruction, the period of the Sun above the horizon would be shorter than the astronomical day length.

The annual global solar irradiation in Karangkates for the horizontal surface is shown in Fig. 4. The global irradiation consists component direct, diffuse, and reflected irradiation components. It is obviously seen that diffuse component dominates during November – December, as well as January – April. Meanwhile, the reflected radiation component is small all the time. The results simulation shows that the maximum average value of global solar irradiation in Karangkates was 4.58 kWh/m^2 during September, and the minimum is 2.43 kWh/m^2 during January. The daily average over a year is about 3.53 kWh/m^2. In general, solar irradiation in Karangkates relatively smaller in comparison to the surrounding area in the same province, such as Surabaya [19]. It can be understood Karangkates is a mountain area where fog is commonly formed during day time which covered the area. It

The monthly sum of global irradiation with direct, diffuse, and reflected irradiation components in Karangkates is presented in Fig. 4. The right vertical axis of the Fig. shows daily air temperature, which found varies from 21.4 – 23.5 °C. Considering that the Karangkates area is located around the equator, the temperature is considered low in comparison with the similar latitude position.

As previously mentioned that the area of the water surface for the dam is determined by using the Polygon Feature of Google Earth. The total area of the water surface measured, as shown in Fig. 2, was found

10,500,000 m^2. This total area, however, might not be completely used for FVP system as the dam itself is functioned for other purposes.

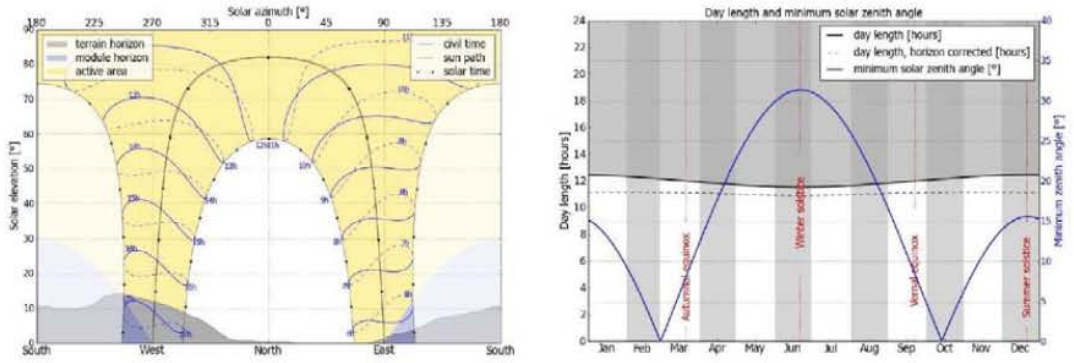

Fig. 3. Terrain horizon and day length

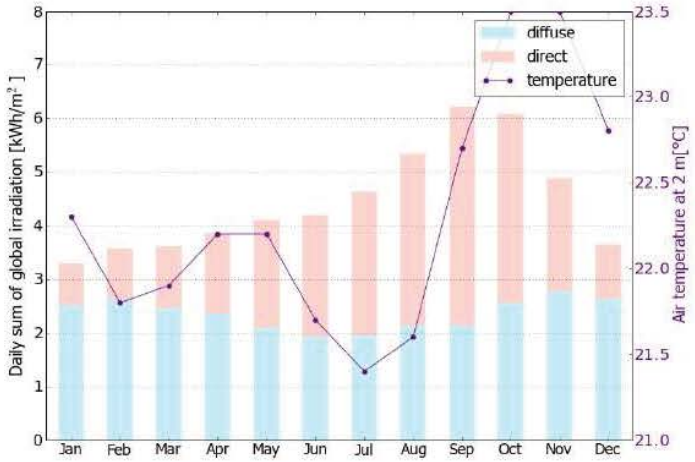

Fig. 4. Global horizontal irradiation and air temperature

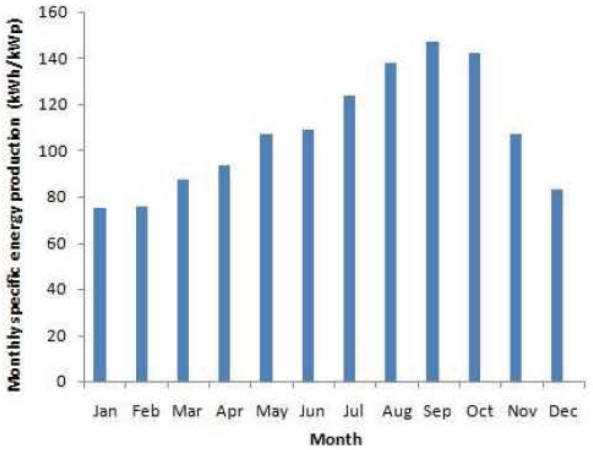

Fig. 5. Monthly specific energy output

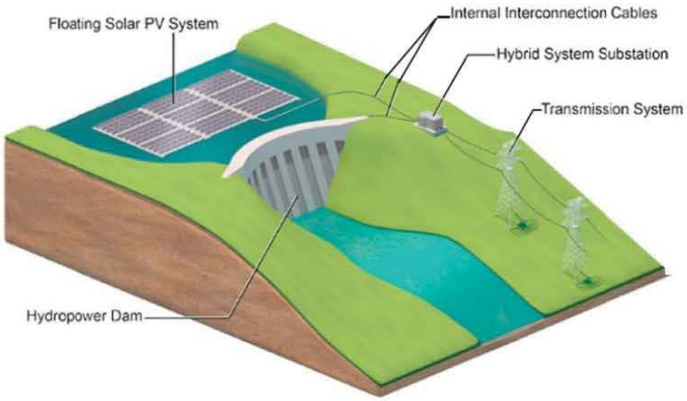

Fig. 6. Schematic of hybrid FPV and hydropower plant

In the simulation, 50% of the water surface area of the dam is considered to be used for FPV system, then the effective area for placing the solar module and the component system would be around 5,250,000 m2. Referring to the previous studies [7],[8], it is considered that a 1 kWp solar system with a fixed system (without a tracking system) would require a space area of 9.3 m2. Therefore the capacity of the solar FPV system that could be installed on the dam is about 560 MWp.

The results of the simulation show that the specific energy output of PV system in Karangkates varies from 75.2 kWh/kWp to 147.1 kWh/kWp per month, where the highest output occurs during September and the lowest during January. The detail of monthly specific energy output, obtained from simulation, in Karangkates is shown in Fig. 5, where the average is about 606 kWh/kWp. It is obviously seen that specific energy output in Fig. 5 is directly correlated with the global horizontal irradiation in Fig. 4.

The potential energy production of FPV can be calculated from the capacity of the PV system and the specific energy output information. As previously mentioned, that a 560 MWp of FPV system could be installed in Karangkates dam, then the monthly energy output from the system would vary from 42.1 GWh (in January) to 82.4 GWh (in September). Annual energy production would be around 721.2 GWh.

One of the considerable advantages of the FPV system in Karangkates dam is hydropower plant capacity with the capacity of 3x35 = 105 MW, where the FPV system can be hybridized with the power plan system. The electricity from hydropower can be combined with electricity from FPV system using a hybrid system substation, then transmitted to the same transmission line as shown in Fig. 6.

IV. CONCLUSIONS

Simulation of the FPV system for Karangkates Dam East Java, Indonesia, has been carried out in this study. The total area of the water surface of the dam is about 10,500,000 m2 . By considering 50% of the total area would be used for the FPV system, about 560 MWp solar panels would be installed. The average specific energy output in Karangkates was found about 106 kWh/kWp per month. The annual energy production by the FPV system would be around 721.2 GWh. The FPV system can be hybridized with the existing hydropower plant in Karangkates dam.

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General Schedule, Day 1
Wednesday, 21 July 2021

Time	Agenda	Venue
07.30 - 08.30	Registration	ON LINE
08.30 - 09.00	Opening Ceremony: • **Welcome speech and official opening by Rector of ITS**	ZOOM MEETING
09.00 - 10.30	Technical Session 1 : Oral Presentation	ZOOM MEETING
10.30 – 12.00	Technical Session 2 : Oral Presentation	ZOOM MEETING
12.00 - 12.10	Group photo session	ZOOM MEETING
12.10 - 13.30	Lunch Break	ZOOM MEETING
13.30 - 14.20	1st Keynote Speaker (Prof. Wolfgang Bösch)	ZOOM MEETING
14.20 - 15.10	2nd Keynote Speaker (Dr. Danny Pudjianto)	ZOOM MEETING
15.10 - 15.20	Group photo session	ZOOM MEETING

General Schedule, Day 2
Thursday, 22 July 2021

Time	Agenda	Venue
07.30 - 08.00	Registration	ON LINE
08.00 - 09.30	Technical Session 3 : Oral Presentation	ZOOM MEETING
09.30 - 11.00	Technical Session 4 : Oral Presentation	ZOOM MEETING
11.00 - 11.50	3rd Keynote Speaker(Dr. Adhi Dharma Wibawa)	ZOOM MEETING
11.50 - 12.40	4th Keynote Speaker(Prof. Shiang-Hwua Yu)	ZOOM MEETING
12..40 - 12.50	Group photo session	ZOOM MEETING
12.50 - 13.30	Break	ZOOM MEETING
13.30 – 16.00	IEEE Student Branch(5th Keynote Speaker)	ZOOM MEETING
16.00 - 16.10	Group photo session	ZOOM MEETING

Technical Session Schedule

Room and Track

paper ID	Room Code	Title	Authors
1570703219	S101	Medical Images Compression and Encryption Using DCT, Arithmetic Encoding and Chaos-Based Encryption	Tiffany Maliati Khumairoh Afandi; Dion Fandiantoro; E Endroyono; I Ketut Eddy Purnama
1570703220	B101	Recent Development in DGA Diagnosis Using Graphical Analysis Method	Putu Raditya; I Made Yulistya Negara; Dimas Anton Asfani
1570703529	B102	Design of EV Hardware-In-The-Loop Simulator of Battery and Supercapacitor Hybrid Storage System	La Ode Muhamad Fathur Rachim; Vita Lystianingrum; Dedet Riawan; Irwandi Gunanda
1570704995	J101	Effect of CT-Scan Image Resizing, Enhancement and Normalization on Accuracy of Covid-19 Detection	Nurdina Gita Pratiwi; Yumna Nabila; Rian Fiqraini; Agung W. Setiawan
1570705099	S102	Spectral Efficiency of MU-Massive MIMO System for Perfect and Imperfect CSI Condition	Ika Rohmatul Aini; Puji Handayani
1570705817	J102	CNN-Based Autoencoder Application in Breast Cancer Image Retrieval	Agus Eko Minarno; Kharisma Muzaki Ghufron; Trifebi Shina Sabrila; Lailatul Husniah; Fauzi Dwi Setiawan Sumadi
1570708228	B103	Study of the Utilization of Local Renewable Energy Potential in Sebotok, West Nusa Tenggara	Mujammil Asdhiyoga Rahmanta; Faris Aditama; Prasetyo Adi Wibowo
1570709850	B104	MPPT of 1.5 kW Wind Turbine With Pitch and Voltage Control Based on Artificial Neural Network	Feby Agung Pamuji; Muhammad U 'Azmi; Dedet Riawan
1570710088	SS101	PI and PI Antiwindup Speed Control of Switched Reluctance Motor (SRM)	Diky Zakaria; Hilwadi Hindersah; Arief Syaichu-Rohman; Ade Abdullah
1570711460	B201	Online OPF Using Combined MOGA-ETS to Minimize Losses and Extend Battery Lifetime in Micro-Grid	Primaditya Sulistijono; Adi Soeprijanto; Dedet Riawan
1570711980	J201	NETWORK TRAFFIC PREDICTION OF MOBILE	Giovanni Abel Christian; Ihsan Pandu Wijaya; Riri Fitri Sari

		BACKHAUL CAPACITY USING TIME SERIES FORECASTING	
1570712140	B202	Integration of DFIG-Based Variable Speed Wind Turbine Into Load Flow Analysis	Rudy Gianto
1570712263	J202	Analysis of EEG-Based Stroke Severity Groups Clustering Using K-Means	MY Teguh Sulistyono; Evi Septiana Pane; Adhi D Wibawa; Mauridhi Hery Purnomo
1570712418	J103	Web Caching Strategy Optimization Based on Ant Colony Optimization and Genetic Algorithm	Mulki Indana Zulfa; Rudy Hartanto; Adhistya Permanasari; Waleed Ali
1570712983	S103	A Data Chaining on Relational Database: A Case Study in Indonesian Genomics Information System	I Gede Eka Sulistyawan; Achmad Arifin; Muhammad Hilman Fatoni
1570713006	J104	Evaluating Extractive Summarization Techniques on News Articles	Sreeya R. K. Harinatha; Beauty T. Tasara; Nunung Nurul Qomariyah
1570713146	S104	Multimodal Biometric System Based on Feature Source Compaction and the Proposed VCG Feature	Mulyanto Mulyanto; Bayu Firmanto; Bedi Suprapty; Achmad Gaffar; Arief Putra, ABWP
1570713229	B105	PV Grid Inverter Dynamics on Load Active and Reactive Power Demand for Weak Grid Stability	Shaka Kargbo; Hermawan Hermawan; Susatyo Handoko; Iwan Setiawan; Trias Andromeda
1570713348	J105	Technology Trend of Traffic Density Prediction - A Systematic Literature Review	Nabila Rahmi Maulida; Kusprasapta Mutijarsa
1570713472	S105	Two Level Prediction Error and Three Direction Shifting for Hiding Data in Digital Video	Alek Nur Fatman; Tohari Ahmad
1570713501	J203	Traffic Density Classification Using Multilayer Perceptron and Random Forest Method	Nabila Rahmi Maulida; Kusprasapta Mutijarsa
1570713605	SS102	Multibody Dynamics Modeling and Control of Wheelchair Balancing System	Sokmengkeang Doung; Unggul Wasiwitono
1570713683	S201	Audio-Based Data Hiding Using All-In Modulo of Difference	Ilyas Bintang Prayogi; Tohari Ahmad
1570713693	SS103	Modeling and Control of Inertia Wheel Pendulum System With LQR and PID Control	Alfiana Nur Hidayati; Unggul Wasiwitono
1570713717	J204	Traffic Lights and Traffic Signs Detection System Using Modified You Only Look Once	Alvin Abraham; Avian Lukman Setya Budi; Djoko Purwanto; Hendra Kusuma

1570714050	B203	H-Infinity Controller Design of Two-Wheeled Mobile Robot Under Disturbance	Muhamad Rausyan Fikri; Djati Wibowo Djamari; Steven Mark Levy
1570714089	B204	Battery Energy Storage System as Frequency Control at Substation Based on Defense Scheme Mechanism	Zainal Arifin; Aditya Firmanto
1570714104	B205	Green IT as the Basic of Renewable Energy Industry in Facing Competitive Advantage	Doni Purnama Alamsyah; Norfaridatul Akmaliah Othman; Nina Kurnia Hikmawati; Rudy Aryanto; Indriana Indriana; Satrio Matin Utomo
1570714424	B301	Implementation of Charging Equalizer With Master-Slave Method on Lithium-Ion Batteries	Heri Suryoatmojo; Ahmad Firyal Adila; Feby Agung Pamuji; Dedet Riawan; Ronny Mardiyanto; Miftahul Arifin
1570714437	B302	FLI for Unbalanced and Harmonic Current Mitigation in Rooftop Solar Connected Distribution Network	Dedy Kurnia Setiawan; Mochamad Ashari; Heri Suryoatmojo
1570714464	B303	An Improving Efficiency MPPT in PV Systems With a Modified Voltage Regulator	Widjonarko Widjonarko; Saiful Bukhori; Arzoga Putra Pratama
1570714522	S202	Eyeball Movement Detection Using Sector Division Approach and Extreme Learning Machine	Fitra A. Bachtiar; Gusti Pangestu; Fajar Pradana; Issa Arwani; Dahnial Syauqy
1570714555	B304	Energy Output Simulation of the Floating PV System at Karangkates Hydropower Dam	Elieser Tarigan
1570714572	S203	Analyze the Datasets of Software Effort Estimation With Particle Swarm Optimization	Ahmad Setiadi; Wahyutama Fitri Hidayat; Ahmad Sinnun; Ade Setiawan; Muhammad Faisal; Doni Purnama Alamsyah
1570714587	SS104	Optimized DOCR Setting by Considering Generator Scheme and Different Configuration on Ring System	Imam Suri Tauladan; Vincentius Raki Mahindara; Margo Pujiantara; Ardyono Priyadi
1570714721	J302	Dataset transformation using hybrid method of polar-based cartesian and image filtering technique for annual rainfall clustering	Rheo Malani; Bedi Suprapty; Agusma Wajiansyah; Anggri Wiguna

1570714786	SS105	Driver for LED Lamp With Buck Converter Controlled by PID	Widjonarko Widjonarko; Gamma Aditya Rahardi; Cries Avian; Widyono Hadi; Dedy Wahyu Herdiyanto; Panji Langgeng Satrio
1570715073	S204	LORAPAI: LoRa Routing Protocol for an Agricultural Irrigation System	Arief Kurniawan; Dewinda Julianensi Rumala; I Ketut Pumama; Habib Al-Hakim
1570715146	S205	Robustness of Convolutional Neural Network in Classifying Apple Images	Dzalfa Tsalsabila Rhamadiyanti; Suyanto Suyanto
1570715225	B305	Multi Source Partial Discharge Detection Analysis Using Antenna in Oil Insulation	I Made Yulistya Negara; Dimas Anton Asfani; I Gusti Ngurah Satriyadi; Daniar Fahmi; Addien Wicaksono; V. Ryan Wijanarko
1570715294	SS202	ICT and Consumer Behavior: A Study of Students' Self-Perceived Digital	Norfaridatul Akmaliah Othman; Doni Purnama Alamsyah; Indriana Indriana; Mira Rustine; Rudy Aryanto; Irma Setyawati
1570716169	SS203	Implementation of Fuzzy Logic on Fire Fighting Robots	Budi Kustamtomo; Aris Triwiyatno; Munawar A Riyadi
1570717076	J303	Prediction of Ammonia Contamination Levels in Wastewater Management Plants Using the SVM Method	Lukman Lukman; Andani Achmad; Syafruddin Syarif
1570717104	SS204	Implementation of Light Detection and Ranging in Vehicle Braking System	Muhammad Rivai; Djoko Purwanto; Arsya Razak; Dony Hutabarat; Dava Aulia
1570717299	S301	Identification of Parking Lot Status Using Circle Blob Detection	Mohammad Nasrul Mubin; Hendra Kusuma; Muhammad Rivai
1570717621	J304	Robotic Hand Exoskeleton With Tactile Feedback for Post-Stroke Spasticity Rehabilitation	Hanan Yumna; Achmad Arifin; Atar Fuady Babgei
1570717666	J305	MIMO-FLC for Hybrid of Exoskeleton of FES for Post-Stroke Rehabilitation of Hemiparetic Patients	Danar Agnanto; Achmad Arifin; Atar Fuady Babgei
1570717702	J401	A New Approach for Hot Spot Solar Cell Detection Based on Multi-Level Otsu Algorithm	Andi Najiah Nurul Afifah; Indrabayu A; Ansar Suyuti; Syafaruddin Syafaruddin
1570717708	SS205	Contribution of Virtual Reality Technology to Increase Student Interest in Vocational High Schools	Fairuz Maulana; Gusti Pangestu; Albert Verasius Sano; Agung Purnomo; Sandi Rahmadika; Vandha Widartha
1570717757	B401	BLDC Performance Analysis Due to Stator Winding Unbalance	Dimas Anton Asfani; I Made Yulistya Negara; I Gusti Ngurah

			Satriyadi; Daniar Fahmi; Michael Sihombing; Putu Mira Tazia Dewi
1570717763	B402	Low Voltage Series Arc Modelling Based on Neural Network Considering Harmonics Load Current	Dimas Anton Asfani; I Made Yulistya Negara; I Gusti Ngurah Satriyadi; Daniar Fahmi; Shafirah Khairina Budiawan; Reynaldi Syahril
1570717876	B403	Potential of the Diponegoro Education Reservoir as a Research Place for Floating Photovoltaic	Karnoto Karnoto; Hermawan Hermawan; Trias Andromeda; Pangestuningtyas Diah Larasati
1570717965	SS301	The Implementation of DBLC Design Model for Orbital Database System	Yoga Andrian; Siti Kurniawati Fatimah; La Ode Muhammad Musafar; Rhorom Priyatikanto
1570718026	J402	Rice Grain Habitat Identification System Using Convolution Neural Network on Hyperspectral Imaging	Adhi Harmoko Saputro; Zhorif Akram
1570718046	B404	Design of Wind Turbines Power Coefficient on Wind Farm Based Centralized Control	Dwiana Hendrawati; Jafar Mukhlis; Ampala Khoryanton; Sahid Sahid; Brainvendra Widi Dionova
1570718096	S302	Compression-Encryption Model for Digital Images Based on GAN and Logistic Map	Mulkiah Mulkiah; Suprapto Suprapto; Anny Kartika Sari
1570718121	J403	Brain Controlled Lego NXT Mindstorms 2.0 Platform	Sebastian Rosca; Monica Leba; Remus Sibisanu; Fabian Panaite
1570718127	SS302	Detection of Kinship Through Microexpression Using Colour Features and Extreme Learning Machine	Ike Fibiriani; Ronny Mardiyanto; Mauridhi Hery Purnomo
1570718151	S304	Violence Classification Using Support Vector Machine and Deep Transfer Learning Feature Extraction	K Karisma; Elly Imah; Atik Wintarti
1570718163	J404	Color Retinal Image Enhancement Using Exposure Fusion Framework	Agung W. Setiawan
1570718186	B405	Real-Time Monitoring of Dual-Axis PV System Based on Internet of Things	Aji Akbar Firdaus; Machrus Ali; Riky Tri Yunardi; Dimas Fajar Uman Putra; Novian Patria Uman Putra
1570718214	SS305	Development of Obstacle Detection Based on Region Convolutional Neural Network for Autonomous Car	Khairunnisa Nurhandayani; Djoko Purwanto; Ronny Mardiyanto

1570718224	SS401	Vacuum Cleaner Robot With Staircase Cleaning Feature and Boustrophedon Path Planning	Gregorius Gery Gavindra; Hendra Kusuma; Tasripan Tasripan
1570718227	SS303	Lane Detection Using Edge Detection and Spatio-Temporal Incremental Clustering	Sayyidul Aulia Alamsyah; Djoko Purwanto; Muhammad Attamimi
1570718311	B406	Optimization PI Using ACO for Control Energy System Photovoltaic Battery and Supercapacitor	Dwi Ajiatmo, Imam Robandi, Muhlasin
1570718325	S305	Improvement of Quality and Signal Coverage LTE in Bali Province Using Drive Test Method	Lukman Silalahi; Setiyo Budiyanto; Freddy Artadima Silaban; Imelda Simanjuntak; Agus Dendi Rochendi
1570718329	S401	Internet Based Remote Laboratory Architecture for 3-Phase Induction Motor Control System Experiment	Ade Kurniawan; Ahmad Hakiki; Kevin Banjarnahor; Mohamad Abdul Hady; Ari Santoso; Ali Fatoni
1570718332	S402	Delivery Data Digital HF Radio Wave Using Advanced Encryption Standard Security Mechanism	Setiyo Budiyanto; Lukman Silalahi; Freddy Artadima Silaban; Rachmat Muwardi; Hongmin Gao
1570718344	SS402	Development of a Low-Cost System for Liquid Clustering Using a Spectrophotometry Technique	Andres Javier Duarte Ariza; Totok Mujiono; Tri Sardjono
1570718457	SS403	Impact of Aligning Saliency Maps on COVID-19 Disease Detection Using Chest X-Ray Images	Ardimas Andi Purwita; Nunung Nurul Qomariyah
1570719718	S404	Early Warning Pedestrian Crossing Intention From Its Head Gesture Using Head Pose Estimation	Muhammad Ilham Perdana; Wiwik Anggraeni; Hanugra Sidharta; Eko Mulyanto Yuniarno; Mauridhi Hery Purnomo
1570719719	J405	Analysis The Opinion of School-from-Home during The COVID-19 Pandemic using LSTM Approach	Feby Artwodini Muqtadiroh; Diana Purwitasari; Eko Mulyanto Yuniarno; Supeno Mardi Susiki Nugroho; Mauridhi Purnomo
1570719721	S405	Low Cost Analog Video Transmission Security of Unmanned Aerial Vehicle (UAV) Based on LFSR	Ronny Mardiyanto; Heri Suryoatmojo
1570719734	SS404	Pedestrian Crossing Decision Prediction Based on Behavioral Feature Using Deep Learning	Hanugra Sidharta; Eko Mulyanto Yuniarno; Mauridhi Hery Purnomo; Berlian Al Kindhi

1570719809	SS405	Optimization Learning Approaches in Predicting Facebook Metrics From User Posts Behavior	Yuliazmi Yuliazmi; Diana Purwitasari; Surya Sumpeno; Mauridhi Purnomo

Technical Session 1 (July 21st, 2021)				
Rooms and track				
Time	Sumatra	Jawa	Bali	Sulawesi
	IT,SP, TN, CS, AI	BE, RA, AI	HV, PE, CS	SI, CE, ED, CS, IT, RA, AI
09.00-09.15	S101	J101	B101	SS101
09.15-09.30	S102	J102	B102	SS102
09.30-09.45	S103	J103	B103	SS103
0945-10.00	S104	J104	B104	SS104
10.00-10.15	S105	J105	B105	SS105
Technical Session 2 (July 21st, 2021)				
Rooms and track				
Time	Sumatra	Jawa	Bali	Sulawesi
	IT,SP, TN, CS, AI	BE, RA, AI	HV, PE, CS	SI, CE, ED, CS, IT, RA, AI
10.30-10.45	S201	J201	B201	
10.45-11.00	S202	J202	B202	SS202
11.15-11.30	S203	J203	B203	SS203
11.30-11.45	S204	J204	B204	SS204
11.45-12.00	S205		B205	SS205
Technical Session 3 (July 22nd, 2021)				
Rooms and track				
Time	Sumatra	Jawa	Bali	Sulawesi
	IT,SP, TN, CS, AI	BE, RA, AI	HV, PE, CS	SI, CE, ED, CS, IT, RA, AI
08.00-08.15	S301	J302	B301	SS301
08.15-08.30	S302	J303	B302	SS302
08.30-08.45	S304	J304	B303	SS303

08.45-09.00	S305	J305	B304	SS305
09.00-09.15			B305	
Technical Session 4 (July 22nd, 2021)				
Rooms and track				
Time	Sumatra	Jawa	Bali	Sulawesi
	IT,SP, TN, CS, AI	BE, RA, AI	HV, PE, CS	SI, CE, ED, CS, IT, RA, AI
09.30-0945	S401	J401	B401	SS401
09.45-10.00	S402	J402	B402	SS402
10.00-10.15		J403	B403	SS403
10.15-10.30	S404	J404	B404	SS404
10.30-10.45	S405	J405	B405	SS405
10.45-11.00			B406	

Code		Code	
AI	AI & Machine Learning Applications	IT	Information Technology
BE	Biomedical Engineering	PE	Power and Energy Systems
CE	Computer Engineering	RA	Robotics and Automation
CS	Control Systems	SI	Sensors and Instrumentation
ED	Electrical Engineering and IT Education	SP	Signal and Image Processing
HV	High Voltage Engineering	TN	Telecommunications and Networking

22nd ISITIA 2021

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CERTIFICATE

It is hereby certified that

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