

# ICon EEI 2022

The 3rd International Conference  
on Electrical Engineering and Informatics

Virtual  
Conference  
**October  
19th-20th**

## BOOK PROGRAM AND ABSTRACT



## SUSTAINABLE ENGINEERING FOR INDUSTRIAL REVOLUTION 4.0

**IEEE Catalog Number: CFP22RPC-ART**

**ISBN: 978-1-6654-5434-6**

Organized by:



Department of Electrical Engineering  
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# 2022 3rd International Conference on Electrical Engineering and Informatics (ICon EEI)



2022 3rd International Conference on Electrical Engineering and Informatics (ICon EEI) took place 19-20 October 2022 virtually.

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ISBN: 978-1-6654-5434-6

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## Welcome Message from General Chair

Assalamualaykum Warahmatullahi Wabarakatuh.

Honorable, Prof Jun Kondoh, from Shizuoka University Japan. Honorable, Prof Azridjal Aziz, Dean of Engineering Faculty Universitas Riau. Dear colleagues, professors, lecturers, researchers, ladies, and gentlemen.

Alhamdulillahirabbil Aalamain, all praise due to Allah SWT and peace and blessing be upon his final messenger Muhammad Rasulullah SAW by reciting Allahumma shalli ala Muhammad wa ala ali Muhammad.

It is my great pleasure to welcome you to 2022 3rd International Conference on Electrical Engineering and Informatics (ICon EEI 2022) virtual conference.

ICon EEI 2022 is intended to provide a forum and bring together academicians, professionals, and governments in the fields of electrical power system, electronics, telecommunication engineering, control engineering, informatics, computer engineering, information technology and other Electrical Engineering and Informatics domains in order to learn about the latest developments in the research findings and share experience and ideas how we can all work together to make and deal with “**future electric system and big data analysis challenges in the most efficient way**”.

This year, the ICon EEI 2022 received 64 paper submissions from 15 countries throughout the world which are Indonesia, Japan, France, Vietnam, Malaysia, Pakistan, Italy, Ireland, India, China, Sri Lanka, Germany, Nigeria, Bangladesh, USA, Iraq, Saudi Arabia, Egypt, and Taiwan. All the submitted papers were thoroughly and independently reviewed by at Technical Program Committee totaling 65 people and additional 24 reviewers in accordance with standard blind review process. Based on the results of the rigorous review process, 37 papers have been selected. These papers have been grouped into 3 tracks which are:

- Firstly, Electrical Power System, Renewable Energy and High Voltage Engineering;
  - Secondly Electronic, Control System and Telecommunication;
  - and lastly Informatics, Computer Science, Computer Engineering and Information Technology.
- Besides those regular tracks,

The conference committee has invited Keynote speakers, namely: Prof. Jun Kondoh, Professor of Wave Electronics Engineering from Shizuoka University Japan.

As general chair, I am deeply indebted to all organizing committee members from Department of Electrical Engineering Universitas Riau, TPC members, volunteer reviewers, IEEE Indonesia section and IEEE MTT/APP Chapter Indonesia who have greatly contributed to the success of the ICon EEI 2022. Many thanks should be given to our keynote speakers and invited speakers who will present their works in this conference. In addition, our sincere gratitude should be given to all authors who submitted their works to ICon EEI 2022.

Thank you very much and Assalamualaykum Wr Wb

Sincerely yours,

Dr. Febrizal Ujang  
General Chair of ICon EEI 2022

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# Program

Jakarta time	Wednesday, October 19
8:00 - 8:30	RE: <i>Registration</i>
8:30 - 9:00	OS: <i>Opening Session</i>
9:00 - 9:45	KS: <i>Keynote Speech</i>
9:45 - 10:00	
10:00 - 12:00	VP: <i>Virtual Presentation Track 1 Morning</i> VP: <i>Virtual Presentation Track 2 Morning</i> VP: <i>Virtual Presentation Track 3 Morning</i>
12:00 - 13:30	
13:30 - 15:30	VP: <i>Virtual Presentation Track 1 Afternoon</i> VP: <i>Virtual Presentation Track 2 Afternoon</i> VP: <i>Virtual Presentation Track 3 Afternoon</i>
15:30 - 16:00	CR: <i>Close and Awards</i>

Wednesday, October 19

Wednesday, October 19 8:00 - 8:30

RE: Registration

Room: [Opening Virtual Room](#)

Wednesday, October 19 8:30 - 9:00

OS: Opening Session

Dean, General Chair

Room: [Opening Virtual Room](#)

Wednesday, October 19 9:00 - 9:45

KS: Keynote Speech

Prof. Jun Kondoh Professor of Wave Electronics Engineering Shizuoka University Japan

Room: [Opening Virtual Room](#)

Wednesday, October 19 10:00 - 12:00

VP: Virtual Presentation Track 1 Morning

Morning

Room: [Track 1](#)

***Applied Symbiotic Organisms Search Algorithm to Solve Economic Emission Dispatch Problems***

Phan Van Hong Thang (Ho Chi Minh City University of Technology & HBT Company, Vietnam); Tran The Tung (Ho Chi Minh City University of Technology, Vietnam)

Nowadays using of energy sources to produce electricity has many changes in increasing the proportion of using renewable energy. However, with the stability in generating capacity, fossil energy resources still play an important role in the power system. Therefore, solving the economic dispatch problem in terms of ensuring environmental factors is always a difficult task. This paper contributes one of the new effective method for solving the environmental economic dispatch problems - Symbiotic Organisms Search Algorithm (SOSA). The problems are solved in three optimization case: fuel cost, emission, and economic emission with the constraints on load balance, power generation limits, and fuel. The Symbiotic Organisms Search Algorithm will be applied to electrical systems include: 5-unit; 10-unit with power retaining in three weeks and IEEE 30 bus with wind turbines. These results have been compared with other algorithms in the same power system to demonstrate the effectiveness of Symbiotic Organisms Search Algorithm.

***High Voltage Plasma Convert Coconut Shell Charcoal to Few Layer Wrinkled Graphene (FLwG)***

Fri Murdiya, Dede Irawan, Amir Hamzah and Suwitno Suwitno (Universitas Riau,

Indonesia); M Rafi Epafra (Electrical Engineering, Indonesia); Firdaus Fakhruddin (Riau University, Indonesia)

Few-layer wrinkled graphene (FLwG) has been produced by burning a coconut-shell-based charcoal by using a plasma arc discharge. Raman spectroscopy and transmission electron microscopy (TEM) were implemented on analyzing of candidate graphene. The arc plasma was supplied in the air gap between the electrodes. The graphite rod was installed as an high voltage electrode and a ground electrode was made of aluminum material. The charcoal powder was put on a ground electrode surface in the air gap of 1.5 cm to the h.v. electrode. It is shown that the Raman spectroscopy analysis indicate an FLwG has been produced. TEM analysis confirmed the presence of FLwG with a wrinkled and folded structure as well.

### ***Analysis of PV Module Performance and Electrical Parameters Based on Different Tilt Angles***

Nur Inaara Aiman Binti Fahmi and Nur Hazirah Zainal (Universiti Teknologi Malaysia, Malaysia); Dalila Mat Said (Centre of Electrical Energy Systems (CEES), Universiti Teknologi Malaysia, Malaysia); Mohd Adib Sarijari (Universiti of Teknologi Malaysia, Malaysia); Mohamed Shahrman Mohamed Yunus (Multimedia University, Malaysia); mohd shukri Dolah (Jabatan Kerja Raya, Malaysia); Nasarudin Ahmad (Universiti Teknologi Malaysia, Malaysia)

PV panel application and optimization research has exploded in popularity in recent years. There have been several issues with the early phases of design and implementation, particularly for stand-alone solar systems. One of the primary challenges is determining the optimal slope of PV panels in order to optimise absorbed solar radiation. Although some research has been done in Malaysia to determine the best tilt angle, the goal of this study is to begin an examination into the slope of PV panels for two locations with different altitudes. The Liu and Jordan model is used to determine the monthly ideal tilt angle and fixed tilt angle for solar energy use in these areas. Other than that, for a country like Malaysia, finding a suitable installation location remains a challenge. As a result, the ideal quantity of solar panels and their orientation have become critical. HelioScope is a technology that can help answer that issue to some extent. This programme aids in maximizing the use of available space. In this research, a simulation has been developed to compare the irradiance produced by a small residential household with two field segments of roofs. One model consists of the same angle, separated roofs meanwhile the other model consists of different angle, connected roofs. Results generated suggests that the connected roofs produce more energy and captures more irradiance compared to the house with separated roof parts.

### ***The Effect of Lightning Characteristics on the Occurrence of Back Flashover on a 150 kV Transmission Line Using ATPDraw***

Feranita Feranita, M Luthfi Andika Jefri and Fri Murdiya (Universitas Riau, Indonesia)

Lightning is one of the main sources that can cause failure in the transmission overhead line system where the transmission system is threatened with overvoltage. When lightning strikes the phase wire, it causes shielding failure while the ground wire can cause back flashover. This research studies the effect of lightning characteristics on the occurrence of back flashover on a 150 kV transmission line. Data analysis is carried out by simulating all the parameters that have been obtained using ATP Draw software, then analyzing the amount of overvoltage that occurs each phase. The results of this study are showed that



the effect of lightning wave characteristics with different wave fronts and fixed wave tails resulted in overvoltage with the highest value at (1.8 x 50) micro second while for fixed wave front conditions and different wave tails, it was obtained the result of overvoltage with the greatest value at the value of (1.2 x 80) micro second.

### ***Numerical Study on Cavities Shape for the Hydrothermal Performance of Microchannel Heat Sinks with Elliptical Ribs and Secondary Channels***

Sen Rong Liu and Pan Zhongliang (South China Normal University, China)

In order to explore the effect of the different combinations of cavities, ribs, and secondary channels on the performance and efficiency of the microchannel heat sink (MCHS), this paper numerically investigated the heat transfer and fluid flow characteristics of MCHS with different shapes of cavities, elliptic ribs, and secondary channels, where the shapes of cavities include trapezoid, fan, elliptic, elliptic rectangle and triangle, named as MC-TraS, MC-FS, MC-ES, MC-ERS, MC-TriS, respectively. The results have verified that the overall performance of all the above radiators is better than that of smooth rectangular microchannels and the shape of cavities has an important effect on the pressure drop and the average temperature of the bottom surface. More specifically, compared with other optimized structures, MC-ERS has achieved the maximum system pressure drop but the highest overall heat dissipation performance with a maximum PEC of 1.73, while the MC-TriS has the minimum comprehensive performance with a minimum PEC of 1.26. In addition, there is little difference in heat dissipation performance between MC-FS and MC-ES.

### ***Heat Transfer of Spray Dryer Extraction Machine Based on Parametric Design Modeling***

Nurhayati Nurhayati and I Made Suartana (Universitas Negeri Surabaya, Indonesia); Fitri Adi Iskandarianto (Institut Teknologi Sepuluh Nopember, Indonesia)

Drying is a work process that requires intense energy, because of the latent heat in the air as the drying medium. This paper presents a model of the Spray Dryer Extraction Machine whose principle is drying using a vacuum model. The extraction process in this machine is located in a holding tube equipped with a water jacket with a lid that is connected directly to the vacuum pipe above. The heat source comes from a gas stove with a working temperature between 70-150 degrees Celsius. The computer simulation method used is to analyze the Blower Frequency Rotation and Heat Transfer Spray Dryer Extraction Machine. Starting from parametric 3D model design, geometric simplification and wizard simulation. The results show that the simulation of the rotation and frequency of the blower with 5 times the amplitude (increment) produces vibrations when there is a centrifugal force. With an LHV value of 46MJ/kg from the burner, it has a Heat Flux of 56,964,402 W/m<sup>2</sup>. A probe has been carried out on the tube nodes to determine the value of the heat flux at the desired node points. Node 1 has a heat flux value of 56,037,832 W/m<sup>2</sup> with a temperature of 522,781 K. Node 2 has a heat flux value of 56,964,402 W/m<sup>2</sup> with a temperature of 514,902 K. Node 3 has a heat flux value of 26,108,422 W/m<sup>2</sup> with a temperature of 506,104 K. Node 4 has a heat flux value of 387,335 W/m<sup>2</sup> with a temperature of 396,006 K. Node 5 has a heat flux value of 223,44 W/m<sup>2</sup> with a temperature of 372,793 K

VP: Virtual Presentation Track 2 Morning

Morning

Room: Track 2

## ***Study of Bending Effect of G652 and G657 Optical Fibers on Power Transmission Losses***

George Tongam and Catur Apriono (Universitas Indonesia, Indonesia)

Optical fiber is one of the most used guided transmission media due to its many advantages, including a high level of data security, a longer lifespan than other communication transmission media, and its ability to carry a large amount of data. Nevertheless, as a transmission medium, optical fiber incurs losses when conveying information, particularly power transmission losses, especially due to bending conditions. This study will investigate the bending effect of optical fiber based on power transmission utilizing an Optical Light Source (OLS) and Optical Power Meter (OPM) by modifying the bend in the optical fiber, the wavelength of the Optical Light Source, and optical fibers of G652 and G657. The findings show that the G652 cable type achieves a bending loss of -43.7 dB/unit in two turns with a bending radius of 0.5 cm, whereas the G657 cable type achieves a bending loss of -50 dB/unit in three turns with the same bending radius. Bending loss gets substantial results at bending radii less than three centimeters. The bending losses in optical fiber are affected by the kind of cable in the optical fiber, the wavelength at the optical source, the number of turns, and the bending radius, with the bending radius having the most important effect.

## ***Analysis of XG-PON Based FTTH Design for Downstream and Upstream Configurations***

Riko Adisatya (Universitas Indonesia, Indonesia); Yus Natali (Institut Teknologi Telkom Jakarta & Universitas Indonesia, Indonesia); Catur Apriono (Universitas Indonesia, Indonesia)

Passive Optical Network or PON is one of the widely used technologies in the application of optical fiber. Currently, there are various types of PON, some of which are still in the development phase, including XG-PON. This study designs and analyzes the configuration of XG-PON for FTTH using Optisystem software by considering parameters of the Q Factor and BER values. Two considered schemes are Downstream and Upstream XG-PON topologies with 1:32 and 1:64 splitting ratios. FTTH XG-PON 1:32 Downstream is effective at a distance of 40 - 41 km, FTTH XG-PON 1:64 Downstream is effective at a distance of 23 - 24 km, FTTH XG-PON 1:32 Upstream is effective at a distance of 38 - 39 km, and FTTH XG-PON 1:64 Upstream is effective at a distance of 23 - 24 km. According to the obtained data, the Q Factor for XG-PON is inversely proportional to adding distance, whereas the BER is directly related to adding distance. The proposed configuration can be a reference to develop an XG-PON for further research and deployment.

## ***Acetylene Black as Counter Electrode on Monolithic Perovskite Solar Cell***

Junivan Sulistianto (Universitas Indonesia, Indonesia & Shizuoka University, Japan); Akinori Konno (Shizuoka University, Japan); Tomy Abuzairi and Nji Raden Poespawati (Universitas Indonesia, Indonesia)

Perovskite solar cell (PSC) shows an outstanding performance growth in the last decade. The high-performing PSC currently is still on a laboratory scale and utilizes a noble metal for its counter electrode. The use of noble metal will later become an issue if PSC wants to enter commercialization. Carbon is a material that has a promising characteristic to replace noble metal. It is stable, low-cost, and abundant in

nature. Furthermore, various method of carbon layer deposition makes PSC with a monolithic structure can be realized. Monolithic PSC has the advantage of being easy to scale up. This work presents the use of acetylene black, one type of carbon black, as a counter electrode in monolithic PSC. Acetylene black has a higher conductivity than ordinary carbon black sourced from the incomplete combustible petroleum product. A simple deposition technique was used in the making of acetylene black electrodes. The performance of champion devices shows an open-circuit voltage of 0.83 V, short circuit current density of 14.59 mA/cm<sup>2</sup>, fill factor of 0.42, and efficiency of 4.99%. The result shows the prospect of acetylene black as a low-cost electrode for monolithic PSC.

### ***Hybrid Cooperative Spectrum Sensing Algorithm for Cognitive Radio Networks***

Mohammed Alfaqawi (Capgemini Engineering, France)

Cognitive radio (CR) promises to tackle the challenge of spectrum scarcity by enabling spectrum sharing between secondary and primary users. In this regard, several spectrum sensing approaches have been proposed to maintain spectrum sharing without interfering the primary user (PU) activities. These approaches have different levels of computational complexity and accuracy. Despite the level of accuracy, none of the spectrum sensing approaches can overcome the hidden node problem. Therefore, this paper aims to tackle this problem by proposing a hybrid cooperative spectrum sensing (HCSS) algorithm. The proposed HCSS deploys the approaches of energy detection (ED) and cyclostationary feature detection (CFD) to detect the PU's channel occupancy. Furthermore, OR-rule is deployed in order to minimize the interference of secondary users (SUs) on PU. The proposed HCSS is analyzed and compared against the non-cooperative case of ED and CFD and subject to AWGN and Rayleigh fading. The proposed HCSS algorithm is found to outperform ED and CFD in terms of probability of detection at various levels of signal-to-noise ratios (SNR).

### ***A Low Complexity Signal-To-Total Variance Precoding Scheme for Downlink Multi-Stream MU-MIMO Systems***

Aamna Zahid Piracha (AJOU University, Pakistan); Hunaina Farid (University of Bologna, Italy); Kashif Shahzad (NUST College of EME, Pakistan); Muhammad Zeeshan (South East Technological University, Ireland)

Multi-stream multiuser multiple input multiple output (MS-MU-MIMO) downlink systems are an emerging topic in wireless communications as they can achieve very high data rates by spatially multiplexing independent data streams to multiple users. However, their performance is degraded due to multi-user interference in addition to noise in wireless channels. To overcome this problem, base station (BS) uses channel state information to apply precoding schemes. In this paper, we propose a novel linear variance-based approach that reduces the computational complexity compared to the regularized block diagonalization (RBD) and signal-to-leakage-and-noise ratio (SLNR) precoding schemes. The proposed scheme is based on maximization problem of signal to total variance ratio (STVR). It minimizes the variance of signal power leakage to other users while keeping the maximum energy for the signal power directed towards the intended user. This problem is solved by simultaneous reduction of a generalized eigenvalue decomposition. The proposed solution requires low-order eigenvector decomposition to get the precoding vectors for all users. Simulation results and computational complexity analysis in terms of flops show that the performance of proposed STVR is comparable with classic linear precoding schemes while achieving significantly low computational overhead.

### ***Comparative Study of PID and FOPID Control Techniques for a Quadcopter***

Shreya Maggo, Sameer Hussain, Amruta Deshpande and Sanjaykumar Patil (College of Engineering Pune, India)

Drones or quadcopters are being used increasingly in a wide spectrum of applications ranging from the defence sector to the civil sector. The quadcopter is an unmanned aerial vehicle with four rotors. It is a non-linear system with four control inputs and six degrees of freedom, thus rendering it an underactuated system. This paper aims to perform a comparative study of two different control strategies, namely PID (Proportional Integral Derivative) and FOPID (Fractional Order Proportional Integral Derivative) when applied to a non-linear, underactuated quadcopter system. The vehicle dynamics of the quadcopter are studied based on which a mathematical model of the same is derived. With the help of MATLAB Simulink software, the mathematical model is simulated. The two control strategies, namely, PID and fractional order PID are used to stabilise the motion of the quadcopter and the results are compared to determine which control strategy among the two produces better results.

## VP: Virtual Presentation Track 3 Morning

Morning

Room: Track 3

### ***Hybrid Method to Identify Diabetic Retinopathy***

Dian Candra Rini Novitasari (Universitas Islam Negeri Sunan Ampel, Indonesia); Fatmawati Fatmawati (Universitas Airlangga Surabaya, Indonesia); Rimuljo Hendradi (Universitas Airlangga, Indonesia)

Convolutional Neural Network (CNN) is a deep learning method that performs well in the image data processing. The disadvantage of CNN is that it takes a long time for training and requires a lot of computer memory, so in this study, it is proposed to use the Hybrid method (Convolutional feature learning and Extreme Learning Machine classification) to overcome these problems. The Hybrid method Convolution Extreme Learning Machine (CELM) will classify fundus images of Diabetic Retinopathy (DR). World Health Organization (WHO) recognizes that DR is a significant eye disease that causes blindness and requires special attention because this disease is increasing quickly. The processes carried out in this research are preprocessing (Cropping, Resize, and Augmentation) and classification using CELM. The overall accuracy result is obtained by the CELM method, which reaches 99.95% of accuracy and the best architecture obtained on ResNet50 using 800 hidden nodes and it produces a short training time of 1,539 seconds.

### ***Majority Voting Transfer Learning CNN for Peanut Leaf Types Identification***

Nur Nafi'iyah (Institut Teknologi Sepuluh Nopember, Indonesia); Nende Fatonah (Universitas Esa Unggul, Indonesia)

In agricultural information systems, an effective way to identify plants is from their leaves because they have different characteristics and types, are easy, do not damage trees, and do not even need to be picked. Research related to the introduction of plant species using leaf-based CNN (Resnet101, ResNet50, ResNet18, MobileNet V2, DenseNet201, and GoogleNet) transfer learning has been carried out previously,

but it is still not effective because of how to recognize peanut plant species using a single leaf and the accuracy value an average of 82.97%. So this study proposes Majority Voting from the identification of the CNN transfer learning method to be able to effectively identify the type of bean based on the leaves of all the leaves on the stalk. The Majority Voting technique proposed is based on the type of class that is the most majority or dominant. Selection the proposed majority experimented with datasets of peanut leaf types, namely mung bean, soybean, long bean, and peanut leaves, a total dataset of 456 images of peanut leaves. Data collection is done by taking directly on the farmer's land. The CNN transfer learning model used is Resnet101, ResNet50, ResNet18, MobileNet V2, DenseNet201, and GoogleNet. Results the Majority voting of proposed transfer learning has an accuracy of 96.93%.

### ***Performance Evaluation of Intrusion Detection System Performance for Traffic Anomaly Detection Based on Active IP Reputation Rules***

Didit Hari Kuncoro Raharjo, Ade Nurmala and Rico Dwo Pambudi (Universitas Indonesia, Indonesia); Riri Fitri Sari (University of Indonesia, Indonesia)

As a signature-based Intrusion Detection System (IDS), Suricata conducts data inspections based on rules to provide warnings from data traffic that meets the criteria of the rules. It means that the more complex the rules, the more comprehensive Suricata should be in detecting anomalies in data traffic. This study aims to analyze the influence of the number of rules on IDS performance in detecting anomalies in data traffic, focusing on Internet Protocol (IP) reputation rules in Suricata. The author will generate a multi-IP communication simulation using network simulator NS3. The NS3 results in packet capture (pcap) file will be used as the Suricata test dataset to calculate the percentage of packet drops and the percentage of rules detected. That pcap is replayed using the Tcpreplay application while Suricata performs packet data inspections. This paper shows that the number of activated rules has a linear effect on Suricata's performance in the detecting process. Suricata's performance decreased by approximately 14% in detecting 10,000 IP reputation rules in scenario one and decreased more than 45% and continued to decrease drastically to only 16.24% when the number of IP Reputation Rules was in the range above 200,000 to 1 million IP lists in scenario 2.

### ***Sentiment Analysis for Super Applications in Indonesia: A Case Study of Gov2Go App***

Marzuki Pilliang (Esa Unggul, Indonesia); Habibullah Akbar (Universitas Esa Unggul, Indonesia); Gerry Firmansyah (Esa Unggul University, Indonesia)

Recently, the Government of the Republic of Indonesia assessed that the number of applications (approximately 24,000) spread across various ministries and regional institutions were less effective and efficient. Therefore, the government will prepare a super application to replace thousands of applications to support electronic government and will use 2,700 data centers that can produce data integration according to the one-data policy concept. To support this initiative, our research proposes a sentiment analysis based on Expectation-Confirmation Theory (ECT). The proposed framework consists of several stages, namely, data pre-processing (cleaning of input data), tokenization, clustering (using a combination of K-Means and Elbow methods to determine the best K value), TF-IDF feature extraction, and classification based on two classification models for comparison, namely Long Short-Term Memory (LSTM) and Naïve Bayes. The ECT constructs used are expectation, confirmation, and satisfaction. We used comment data (review) from the Gov2Go application on the Google Play Store as a case study. The experimental results show that the LSTM model achieves an accuracy value of 97.23%, 2% better than the Naïve Bayes method.

This indicates that the proposed framework can effectively detect the polarity of user sentiment and thus can be used as a recommendation to improve application features

### ***A Comparative Study on Machine Learning-Based Prediction Models for Public Participation Rate in an Election Voting***

Arif Senja Fitriani (INSTITUT TEKNOLOGI SEPULUH NOVEMBER & Universitas Muhammadiyah Sidoarjo, Indonesia)

Prediction of public participation in elections is one measure of election success. Voter participation is at the polling station level and involves four data sources: voters, polling stations, recapitulation, and village profiles. The preprocessing stage is carried out on each dataset, including maintenance, transformation, and integration. Two types of datasets are defined, involving all attributes and removing the result from attribute correlation. Classification method with five machine learning algorithms (ML) with participation prediction classes labelled High and Low. The highest result is 85.90% for the type 1 dataset and Artificial Neural Network (ANN) algorithm with 60% training and 40% testing split dataset. Furthermore, for detachment type 2, by eliminating several attributes, 100% results are obtained for the K-Nearest Neighbor (kNN) algorithm with a split dataset of 70% training and 30% testing. Of the five ML algorithms, only the Naïve Bayes (NB) algorithm did not experience an increase in prediction results. Furthermore, the significant influence of attributes on the prediction class is shown in each attribute of the dataset, including the Permanent Voter List at the Polling Place (DPT TPS), Local, Health Access and Total Recapitulation..

### ***The Impact of Under-Sampling Techniques on Classification Accuracy in Multi-Class Imbalance Data***

Suwanto Sanjaya, Rahmad Abdillah and Iis Afrianty (Universitas Islam Negeri Sultan Syarif Kasim Riau, Indonesia)

We solve the class imbalance problem, especially in the Under-Sampling technique. This problem arises because much literature does not explain the data evaluation results that are not used in the Under-Sampling technique. This technique eliminates the data in the majority class to balance the number of data in the minority class. Our study uses LVQ3 and K-fold Cross-Validation to solve this problem. LVQ3 is used to classify and k-fold cross-validation to perform classification performance tests. The research parameters used were learning rate 0.00001 0.0001 0.001 0.01 0.1 and window 0.001 0.2, n-prototype 10, 13, 26, 41 and 46, epoch 2000 and epsilon 0.2. The results showed a significant difference in accuracy when using old and new data. This research suggests that the balanced distribution of the data, the experimental setting, and differences in data sampling affect the accuracy. As a result, data not used in the technique becomes useless, although the data cannot be said to be useless, especially regarding accuracy.

### ***Presenting a Client-Based Cross-Browser Web Privacy Measurement Framework for Automated Web Tracker Detection Research***

Philip Raschke and Thomas Cory (Technische Universität Berlin, Germany)

Exploiting and monetizing personal data in exchange for free content and services sparked controversy in past years. Thus, Web Tracking gained increased attention among researchers and the general public. Various empirical studies to quantify and assess the impact of Web Tracking on our privacy emerged

along with measuring techniques and technologies. Two approaches for Web privacy measurements have proven successful: client-based and proxy-based approaches. Proxy-based approaches offer cross-browser support by design, while client-based measurement tools must be adopted for each browser. This paper presents a client-based cross-browser Web privacy measurement framework, which is easy to set up and extend. We demonstrate the performance of our tool by carrying out 12 crawls of the Tranco top 10K pages. Our results show significant differences in third-party and Web tracking activity among browsers. Privacy-focused browsers like Brave show significantly less Ad & Web tracking activity than Chrome or Firefox. Therefore, our tool enables cross-browser Web privacy measurements with the client-based approach suitable for studies in which the proxy-based approach is not applicable.

Wednesday, October 19 13:30 - 15:30

VP: Virtual Presentation Track 1 Afternoon

Afternoon

Room: Track 1

### ***Machine Learning Based Techniques for Fault Detection in Power Distribution Grid: A Review***

Oladapo Tolulope Ibitoye (Afe Babalola University, Nigeria); Moses O. Onibonoje (Afe Babalola University, Ado Ekiti, Nigeria); Joseph Dada (Afe Babalola University)

One of the many issues with the availability of usable power is constant faults in power distribution network (PDN). Fault in distribution network is an anomaly situation that prevents quality power from getting to consumer units when due. Detection of faults based on parametric monitoring using automated machine learning techniques offer tremendous potential. The utilization of machine learning techniques for detecting various fault conditions in power grid is a major solution to power quality problems as it provides a reliable, efficient, and fast approach to resolving issues of power failure. This article presents a brief overview of machine learning methods for fault detection in PDN. The article discusses the pros and cons of existing machine learning methods such as; artificial neural networks, deep learning techniques, support vector machines, k-nearest neighbor, and decision trees. Further research directions toward effective machine learning-enabled systems of fault detection in power grid were also suggested.

### ***Implementation of Five Types Strategies for Maximum Power Point Tracking in Photovoltaic System***

Furqan AlDhahir (Middle Technical Universty & Middle Technical University, Iraq); Adel Obed (Middle Technical University, Iraq)

The photovoltaic system demonstrates rapid growth due to several advantages of solar energy, such as being environmentally friendly, free of maintenance, and omnipresent. Still, it does not come for free because it is affected by weather conditions (temperature and irradiance). Extracting maximum power point (MPP) from PV requires implementing MPPT techniques to get the optimal case that has witnessed a swift amelioration. Thus, maximum power point tracking (MPPT) controllers demonstrate great interest as a significant optimum area of a photovoltaic system MPPT techniques are therefore classified into several types. In this paper, MATLAB/Simulink software has been implemented standalone PV system to test

the performance of fixed and variable step size techniques and then compared with artificial intelligence technique based on various factors: oscillation around the MPP, response time, complexity, and efficiency. When comparing the methods, the fuzzy logic controller has been proven to satisfy the best performance in all factors.

### ***Design and Development of Single Phase Inverter with Regulated Output Voltage***

Suwitno Suwitno, Iswadi Hasyim Rosma, Amir Hamzah, Dian Yayan Sukma and Fri Murdiya (Universitas Riau, Indonesia)

As the welfare of Indonesia has been improving, the annual energy demand is also increasing. In alignment with that, the Indonesian government seeks to make policies and regulations to support the development of renewable energy to meet its 23% target mix by 2025. Among the renewable energy mix comes from solar power plants. The photovoltaic module is used to generate electricity from the solar power plant, producing energy in the form of direct current (DC). However, since the consumer uses alternate current (AC), an inverter is needed to convert AC to DC with a specific frequency and voltage. It uses voltage and current sensor as feedback to regulates the output voltage as needed. The results of this sensor are then equated to the modulation wave in the form of a saw-tooth wave to produce Pulse width modulation, which functions to regulate the ignition of the power transistor. Based on the data from the test results of the inverter with 500 W incandescent lamps, the inverter output voltage is within the range of 234.3 volts-260 volts and a frequency of 51.28-52.63 Hz.

### ***Design and Implementation of SEPIC Converter with MPPT P&O Algorithm plus PI Control Using STM32F4VET6***

Hendrikus Ferdian Mahadewa and Leonardus Heru Pratomo (Soegijapranata Catholic University, Indonesia)

As time goes on, fossil energy is increasingly being shifted to green energy, which is low in carbon emissions and environmentally friendly. One of the green energy is a solar cell or photovoltaic. Photovoltaic (PV) is green energy that has high efficiency because it does not have moving components. However, PV itself is not capable of producing stable power and depends on weather conditions. So, by combining this photovoltaic with a maximum power point tracker (MPPT) with the Perturb and Observe (P&O) algorithm which functions to maximize the power conversion results from the photovoltaic. This algorithm is used because it is simpler and easier and can extract large amounts of power. To adjust the output to be more flexible and as needed, the converter used is the SEPIC converter. SEPIC converter can increase or decrease the voltage so it is more flexible to use. The control system used is a close loop system equipped with PI control which is designed using a STM32F4VET6 microcontroller so that if there is a shift in value, the microcontroller will adjust and find the maximum value automatically. The load used is a 12V battery and proves that MPPT with P&O algorithm can increase the efficiency of PV.

### ***The Small-Scale Portable Power Generator Supports for MSMEs***

Azriyenni Azhari Zakri (Universitas Riau, Indonesia); Dirman Hanafi (Universiti Tun Hussein Onn Malaysia, Malaysia & Universitas Bung Hatta, Indonesia); Fauzan Ahmad (University of Riau, Indonesia)



This research was conducted to develop a device for portable solar power generator which serves as the source of solar cell energy. Solar energy is an alternative electrical energy for consumers to save and increase access to electricity, especially for those who are in far locations. The purpose was to design a multipurpose portable device with a storage system for electrical energy obtainable from solar cells and a series of transformers. Meanwhile, a transformer series is provided to anticipate situations when the weather does not support the charging process and this mechanism is also tested using the same variation of batteries. It is expected to increase further innovation as an alternate power source for small portable capacities. A test was performed on this portable generator using an energy source from solar cells, and tested with a variety of battery capacities. This product have ability to increase the variety of electric power supplies a capacities below 100 Watts, which are used as alternating and direct voltages. Finally, what is required of this research, this small-scale portable power generator is used efficiently to support Micro, Small and Medium Enterprises (MSMEs) and street traders in urban area.

## VP: Virtual Presentation Track 2 Afternoon

Afternoon

Room: Track 2

### ***IoT-Based Monitoring and Control on Essential Oil Distillation Systems***

Syamsul Syamsul (Politeknik Negeri Lhokseumawe, Indonesia); Suherman Suherman (Lecturer, Indonesia); Sri Yeni Widiarti (Politeknik Negeri Lhokseumawe, Indonesia)

The focus of this research is the application of a control system on steam distillation in the process of refining essential oils. The control system uses a microcontroller-based PID method to get the efficiency of gas fuel consumption. In the distillation system used, heating is carried out using two energy sources, namely electricity to heat the heating element, and LPG gas. To improve the performance of the control system, IoT is added for inputting data on the characteristics of essential oils to be distilled in the refining process. Monitoring of temperature and pressure on steam distillation is delivered periodically. Temperature monitoring is also carried out on the distillation cooling system. The efficiency of gas fuel consumption is obtained by applying the PID control method, namely the temperature is set in the range of 100°C -120°C, and the pressure is set in the range of 1 atm. The results obtained from the application of the PID control method with IoT-based monitoring are gas fuel efficiency (LPG). For the refining of nutmeg essential oil, the efficiency obtained is 17%, for 9 hours of the distillation process. And in the patchouli essential oil refining process, the efficiency of using LPG gas is 14% for 8 hours of the refining process. For citronella essential oil distillation, the efficiency of using LPG gas is 6%, for 5 hours of the distillation process. The yield of nutmeg essential oil was obtained at 5% for 9 hours of distillation. Patchouli essential oil yield was obtained 1.30% for 8 hours of distillation. And the yield of citronella essential oil was obtained at 1.1% for 5 hours of distillation time.

### ***Remotely Operated Rotary Inverted Pendulum System for Online Control Engineering Education***

Ridma Ganganath Sumanasiri (University of Wolverhampton & The Kingdom of Raigam, Sri Lanka); Chathura R. Sumanasiri (University of Wolverhampton, Sri Lanka); Buddhika Annasiwaththa (University of Ruhuna Galle, Sri Lanka)

Balance control systems are known to be one of the most crucial and challenging systems in the field of controls engineering. Rotary Inverted Pendulum (RIP) system is an experimental platform which can perform a wide range of balance control experiments. In an era where physical movements are restricted and with social distancing and remote learning, conducting laboratory experiments have become much more challenging. Hence, the goal of this study is to test the feasibility in performing laboratory experiments on a RIP system in a simulation environment for distance learning purposes. In this study, the developed RIP system was used to perform experiments on PID and LQR control. All the simulations were performed using SolidWorks, Simscsape Multibody link and MATLAB Simulinksoftware. When the simulations were tested for distance learning, identical results were observed proving the feasibility of linear & nonlinear simulations for remote-learning. Hence, this simulation platform is capable of fulfilling the task of providing hands on experience in control engineering laboratory experiments for remote/distance learning purposes.

### ***Design and Analysis of Multimode Signaling and Crosstalk Harnessed Signaling Technique with FPGA Implementation***

Azniza Abd Aziz (Intel Malaysia, Malaysia); Intan Zainal Abidin (Universiti Sains Malaysia, Malaysia)

Demands on a smaller platform with higher data rate cause the density of data bus wiring increase that will result crosstalk increment and degrade the system performance. Multimode signaling and Crosstalk Harnessed Signaling (CHS) are the promising methods to mitigate crosstalk at a higher data rate but there is no proof of concept on circuit implementation on the real channel due to design complexity. Thus, in this paper, the CHS and Multimode signaling encoder and decoder are proposed to design using Field-Programmable Gate Array (FPGA) by implement in the real channel by observing the signal performance through the actual measurement. Register Transfer Level (RTL) code is implemented using logic gates for circuitry design and floating point is developed into design to indicate 32-bit binary data. The FPGA board measurement and simulation were carried out to compare the crosstalk performance between Multimode signaling and CHS. Based on the analysis, it proof-of-concept that CHS and Multimode signaling method can be designed and implemented in the FPGA. Overall, CHS is the most efficient to eliminate crosstalk with a smaller number of gates resource with a 74% reduction compared to Multimode signaling. CHS shows the best eye improvement with 15% to 28.6% eye height and eye width with 17% to 21.7% compared to the binary signaling and eye height improvement from 4.5% to 5%, 8.8% to 12% on eye width compared to Multimode signaling.

### ***Arduino Based Vehicle Distance Locator, Accident Alert and Current Location Tracking Using IoT***

Riasat Khan (North South University, Bangladesh & New Mexico State University, USA); Arif Rabbani (Pabna University of Science and Technology, Bangladesh); Md Nihal Al Rafi (North South University, Bangladesh); Khandoker Samiul Hoque (BRAC University, Bangladesh)

The concept of tracking the current location of a car and receiving an accident notice through SMS is not new, and automobile manufacturers have made significant efforts in recent years to improve their technological solutions. This advanced technology can provide enhanced security, vehicle and time management, insurance policy, etc. This study intends to integrate several features into the current

invention to benefit drivers and non-driving vehicle owners. Typically, automobile owners utilize their vehicles as ridesharing services. The distance between the driver's vehicle and other objects will be displayed on the dashboard on both the front and back sides of the car. In addition, the vehicle owner will be notified through text messages if a road collision occurs. This alert contains information regarding the specific location of the vehicle. Finally, the owner can track the exact location of the vehicle using an Android mobile application. The cost-effective device comprises an approximate weight of 50 gm.

### ***Smart Garden Monstera Adansonii Based on IoT Using DHT11***

Soraya Mustika (Universitas Negeri Malang, Indonesia); Muladi Muladi (State University of Malang & Universitas Negeri Malang, Indonesia); Anik Nur Handayani and Muhammad Afnan Habibi (Universitas Negeri Malang, Indonesia); Zein Farhan Makarim (State University of Malang, Indonesia); Eko Noerhayati (Universitas Islam Malang, Indonesia)

Watering plants is unquestionably an important aspect of plant care. Water the *Monstera adansonii* plant well twice a day, in the morning and in the evening. This plant can withstand temperatures between 21 and 29 °C and more than 60% humidity as long as it is kept in a shaded area away from the sun. We'll use a Smart Garden built on the Internet of Things for private use to monitor and care for *Monstera adansonii* plants. The Smart Garden system is used for both monitoring and controlling, with monitoring used to track the data provided by the system's sensors and controlling used to manage the tools that have been installed. Controlling is required to maintain the desired value or condition of each sensor parameter installed on the Smart Garden system. A soil moisture sensor, a DHT11 sensor for temperature and humidity sensing, a DC mini pump for watering control, and the NodeMCU ESP8266 microcontroller are all included in this Smart Garden system. While simultaneously using features in the Blynk application to water the plants, the values of these sensors will be presented in real-time in the Blynk application. Users will find it easier to take care of *Monstera Adansonii* plants with just a smartphone and an internet connection thanks to this tool.

### ***FPGA Based DCO with Fine Control Correlation Calibration Technique***

Abdullah Ibrahim Almasoud (King Saud University & Advanced Electronics Company, Saudi Arabia); Mohamed Abbas (King Saud University, Saudi Arabia); Mohammed Abdelmonem Abou ELEla (King Saud University, Egypt); Abdullah Alghaihab (King Saud University, Saudi Arabia)

Digital controlled oscillators (DCOs) play an important role in all digital phase locked loop (ADPLL) performance. DCOs have many advantages compared to their voltage controlled oscillators (VCOs) analog counterparts, such as: their wide frequency and supply voltage range, smaller area and being fully synthesizable. This work presents an FPGA based DCO implementation for use in ADPLL. It also presents the calibration technique which solves the non-monotonicity problem between the control code and the oscillation frequency. The issue is observed when implementing fine control of the DCO using ring oscillator (generator on delays) which is implemented with 4 carry4 blocks and 16 input multiplexers within the seven series Xilinx FPGAs for minimum controlled delay. The work is implemented on an Artix7 Xilinx FPGA using NEXYS 4 development board from Digilent and measured performance using oscilloscope is presented. Comparison between the control code and frequency relation prior and after calibration is also

shown.

## VP: Virtual Presentation Track 3 Afternoon

Afternoon

Room: Track 3

### ***A Method Comparison on Multi-Label Question Classification for Assessment-Based Personalised Scaffolding Adaptive Learning Path***

Yulia Wahyuningsih (Institute Of Technology Sepuluh Nopember & Widyathama Parahita, Indonesia); Arif Djunaidy (Institut Teknologi Sepuluh Nopember, Indonesia); Daniel Oranova Siahaan (Institut Sepuluh Nopember, Indonesia)

Classification of the topic of a question is one of the fundamental problems in e-learning systems. Unlike single-label Classification, the multilabel classification method simultaneously predicts more than one class label. This research is a series of process development of a Personal Diagnostic system based on assessment. This system needs annotated question bank because multilabel question items can be used to build a concept effect relationship (CER). The purpose of building CER is to track the failed concept of the student who can not pass the formative tests. So, it's necessary to look for the multilabel question classification method. Therefore, this paper compares several multilabel classification methods in determining subject topics associated with questions in a formative test question bank. This study investigates the non-neural-based and neural-based multilabel Classification. The test results show that TF-IDF with Random Forest produces the best F1 while CNN produces an F1 value that is better than LSTM at a threshold of 0.3.

### ***Masked Faces Classification Using Deep Convolutional Neural Network with VGG-16 Architecture***

Oladapo Tolulope Ibitoye and Oluwafunso Oluwole Osaloni (Afe Babalola University, Nigeria)

Recent years have seen a significant increase in attention given to object detection techniques, particularly in the field of face mask detection, classification, and masked face recognition. Due to the contact-based nature of other biometric methods and the possible outbreak of a pandemic, facial biometrics is now the most secure option for authentication and access management. Experts have advised that adequate preparation must be made to tackle any occurrence of another respiratory-related pandemic in the future. One of the areas worthy of seeking and securing absolute technological breakthroughs is the aspect of face mask detection and classification. The current face mask detection and identification technologies were created using the principles of fair-skinned individuals. This study was carried out with a view to improving the existing systems to perform brilliantly in real-time on dark-skinned faces using a convolutional neural network with VGG-16 architecture. The system was evaluated, and the results show a better performance.

### ***A Review of Gamification Related to Mental Health Treatment***

Daniel Fujiono, Calvin Arihta and Veronica Lee (University of Bina Nusantara, Indonesia)

Mental health is a state of mental well-being that enables people to cope with the stresses of life, realize their abilities, learn well and work well, and contribute to their community. Mental health conditions include mental disorders, psychosocial disabilities, and other mental states associated with significant distress, impairment in functioning, or risk of self-harm. People with mental health conditions are more likely to experience lower levels of mental well-being. A study found that a co-occurring mental health disorder was strongly associated with higher resources used and an increased cost of care for patient. Meanwhile other method such as relaxing application with the goal to relax the state of mind has been proven to be effective as a mental health intervention in alternative to counseling by psychologists or mental therapy such as hypnotherapy. This paper aims to summarize and review the current knowledge regarding gamified treatment as an alternative to mental health treatment and how it affects mental health.

### ***Image Retrieval of Indonesian Batik Clothing Based on Convolutional Neural Network***

Mutia Fadhillah, Des Suryani, Nesi Syafitri N and Hendra Gunawan (Universitas Islam Riau, Indonesia)

Indonesian Batik is well-known for unique and distinct pattern. Searching Indonesian Batik clothing images is a challenging problem due to its wide pattern variations. In this paper, proposed image retrieval model of Indonesian Batik clothing image searching based on Convolutional Neural Network (CNN). Autoencoder proposed as CNN model that trained to reconstructed original input batik clothing image. So, the visual features can be extracted from CNN Autoencoder. Based on the experimental results, the proposed method can reach 90.8% in retrieval accuracy, 58.8% in mean average precision, and 61.9% in average recall.

### ***Interactive English Teaching and Learning Based on Mobile Application***

Panji Rachmat Setiawan, Arbi Haza Nasution, Anggi Hanafia, Yudhi Arta and Evizal Abdul Kadir (Universitas Islam Riau, Indonesia)

English is a universal language used worldwide as the primary language. Learning English can open more opportunities for someone to get involved with the international world. In Indonesia, English is not the primary language, but English still occupies an important position in daily life. For some students, English is not something easy to learn, and they constantly face difficulties such as lack of self-confidence, hard to understand grammar, and hard memorize English vocabulary. The author developed an Android application to help high school students to learn English. This application contains theory for grammar, English vocabulary to memorize with a track record, and a chatbot to increase self-confidence to speak in English. Interactive English Learning Application has user's status to track how far users have already learned English and helped with quizzes. This application was developed using flutter as its front-end, MySQL as its database, and PHP as the backend.

### ***Image Segmentation of Palm Leaf Pests to Determine Caterpillar Egg Populations Using Marker Watershed***

Ana Yulianti (Universitas Islam Riau, Indonesia); Ause Labellapansa (University of Islam Riau, Indonesia); Hanafia Pertiwi, Sri Listia Rosa, Muhammad Rizki Fadhilah and Octadino Haryadi (Universitas Islam Riau, Indonesia)

Oil palm is an important industrial plant producing cooking oil, industrial oil, and fuel (biodiesel). One of the factors that can cause a decrease in production yields on oil palm plants are pests. Palm oil companies through the Pest and Plant Diseases team prevent the breeding of pests by taking leaf samples first, for leaf sampling, they must carry out the stages of preparing an early observation schedule, determining sample points and sample lines, and determining sample subjects and will take a long time. Long enough to get the results. In this study, the detection of the population of caterpillar eggs contained in oil palm leaves was carried out using digital image processing with the Segmentation method using a Marker Watershed. The stage of image processing begins with taking data obtained from one of the palm oil companies in Riau, then cropping is carried out and followed by color segmentation using Hue Saturation and Value (HSV) by taking the Value score and then segmenting the marker watershed. The method of testing the credibility of the system uses the one feature method: single decision threshold. The results of testing the credibility of the system obtained a Sensitivity Value Percentage of 90.8%, so that there were still 9.2% of the number of caterpillar eggs of oil palm leaf pests that had not been identified and the system accuracy was obtained at 89.4%.

### ***Fire Hotspots Mapping and Forecasting in Indonesia Using Deep Learning Algorithm***

Sri Listia Rosa and Evizal Abdul Kadir (Universitas Islam Riau, Indonesia); Abdul Syukur (National Taiwan University Science and Technology, Taiwan); Hitoshi Irie (Chiba University, Japan); Rizky Wandri (Universitas Islam Riau, Indonesia); Muhammad Fikri Evizal (National Taiwan University Science and Technology, Taiwan)

Indonesia is one of the countries in South East Asia has significant forest fire with dangerous impact to neighboring countries of the emission of haze and carbon. In this research aims to do plotting and mapping location with high number fire hotspot then forecasting potential number of hotspots in future time based on previous of history data collected. The forecasting data achieve is very important and beneficial for the authorities as one of references for preventive action and avoid scattering of forest fire. Long Short-Term Memory (LSTM) algorithm implemented in this research for analysis and forecasting of fire hotspot number while Python programming used to plot hotspot point. The source of fire hotspot dataset is referred to The National Aeronautics and Space Administration (NASA) Moderate Resolution Imaging Spectroradiometer (MODIS) recorded from year 2021 with total number is about 100,000 hotspots in Indonesia region. Results show the distribution of fire hotspot concentration most in Sumatra and Kalimantan Island because the typical of land which peat that potential for getting fire. Forecasting of number hotspot for the year 2022 has achieve with good results with error less than 5% which only 4.56%.

Wednesday, October 19 15:30 - 16:00

CR: Close and Awards

Room: [Opening Virtual Room](#)

# Fire Hotspots Mapping and Forecasting in Indonesia Using Deep Learning Algorithm

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**Abstract**—Indonesia is one of the countries in South East Asia has significant forest fire with dangerous impact to neighboring countries of the emission of haze and carbon. In this research aims to do plotting and mapping location with high number fire hotspot then forecasting potential number of hotspots in future time based on previous of history data collected. The forecasting data achieve is very important and beneficial for the authorities as one of references for preventive action and avoid scattering of forest fire. Long Short-Term Memory (LSTM) algorithm implemented in this research for analysis and forecasting of fire hotspot number while Python programming used to plot hotspot point. The source of fire hotspot dataset is referred to The National Aeronautics and Space Administration (NASA) Moderate Resolution Imaging Spectroradiometer (MODIS) recorded from year 2021 with total number is about 100,000 hotspots in Indonesia region. Results show the distribution of fire hotspot concentration most in Sumatra and Kalimantan Island because the typical of land which peat that potential for getting fire. Forecasting of number hotspot for the year 2022 has achieve with good results with error less than 5% which only 4.56%.

**Keywords**— Fire Hotspots, Mapping, Forecasting, LSTM Algorithm

## I. INTRODUCTION

Forest fire is a common issue globally, most of region with high intensity of wild and forest potential for getting fire. Beside that behavior of community living around the forest area is another source of getting fire for example free land cleaning and de-forestry. Indonesia is a country located in South East Asia which tropical region that has only two season which dry or summer and raining. Contour and typical land of Indonesia with forestry and peat land especially for Sumatra and Kalimantan Islands high potentially contribute fire in dry season. Most of every year forest fire happened in summer because of typical land and behavior of community in rural area with lack of education the cleaning the land by deforestation. Furthermore, impact of the forest fire to the community is very dangerous for example air pollution due to haze and carbon emit from the fire to the human health as well as for the ecosystem surrounding the forest area. Children and human has difficulty fir breath and respiratory issue because of bad oxygen as well as for flora and fauna.

Research in this topic has been done by several researchers in prediction of forest fire with various of approach and objectives. In [1-4] discussed method of data analysis in prediction of fire hotspot used machine learning with several kinds of model. Climate change has influence of the characteristic and typical source of environmental and data aspect. The prediction process of fire hotspot and accuracy related to the meteorological data as well as other factor in environmental changes. The other research discussed on the data analysis with comprehensive study of fire hotspot by measure the size of spot and fire concentration in common country potentially getting fire in tropical region. The analysis of fire hotspot also considers the color and size of fire with prediction potential spreading scales as elaborated in [5-7]. The occurrence of fire hotspot determined of how high potential and the impact due to forest fire.

In the first stage of analysis by identify amount of smoke spread on the air from forest fire is one of the techniques discussed by [8-11] to check how much the potential the area getting fire. LSTM algorithm applied to identify of model and pattern of the previous collected fire hotspot data. The prediction only covers in the small dedicated area to proof that proposed algorithm is working fine. Wild and forest fire investigation and forecasting by consider fire datasets by computerized reasoning as discussed is one of method to do a prediction of fire spreading. Recurrent Neural Network (RNN) is an algorithm which capable to integrated in prediction and propagation fire spreading likely better in data analysis by a time series data. Wireless sensor network (WSN) is a technology used to detect wild and forest fire in low level or ground sensing system as elaborate in [12-15]. The rising of ground temperature due to forest fire has impact to many of ecosystem on earth, efforts have been taken to minimize and overcome the fire by prediction the event. WSN system applied for ground sensing with advantages to collect fire data directly with high accuracy and minimum noise, but in limited cover area due to short sensing range. Another discussed results as mention in [16] which a method to do predication of forest fore hotspot used machine learning algorithm.

## II. FIRE DATA AND MONITORING

There are many kinds of natural disaster worldwide, wild and forest fire is one of the disaster due to natural phenomena for example extreme hot land due to summer or dry season. Indonesia is a country located in South East Asia with typical forestry because of in tropical region. Forest fire one of the disasters that frequency happen in almost every year during summer because of typical peatland that easy getting fire when the ground is dry. Many efforts implement by government, industries and community to prevent case of forest fire but not significantly solve the issue, several research have been conducted as well to find the source of fires. In this research use deep learning algorithm and LSTM model to do a prediction and plot forecasting results in order to achieve distribution and scattering area of fire hotspot in Indonesia region. Collected fire dataset by NASA is very useful to analysis the data and plot in a map, then how the hotspot distribution be able to analysis in detail.

The method used which is LSTM deep learning algorithm model has ability to handle the problems with long-term dependencies of RNN. While in some other algorithms unable to do in accurate result because of long history and variety of data. Big numbers of data with variety in which the conventional algorithm unable to do in precise of the information stored in the long-term memory but can gives more accurate prediction from the recent information. LSTM can apply by default to retain the data in a long-term period of time. Normally used for predicting, processing, and classifying on the basis of time-series data [17]. Prediction model to calculate future number of fire hotspot used LSTM algorithm require to justify the error, several model can be used to calculate the forecasting such as Mean Square Error (MSE) to calculate error in square. While Mean Average Error (MAE) to calculate average error in a prediction of dataset. A method called  $R^2$  shows a proportion the number of variants in the prediction of dataset, the calculation of all those methods can be find as equation (1), (2), and (3) for  $MSE$ ,  $MAE$ , and  $R^2$  respectively.

$$MSE = \frac{\sum_1^N (y_i - y'_i)^2}{N} \quad (1)$$

$$MAE = \frac{\sum_1^N |y_i - y'_i|}{N} \quad (2)$$

$$R^2 = 1 - \frac{\sum_1^N (y_i - y'_i)^2}{\sum_1^N (y_i - y_{avg})^2} \quad (3)$$

where  $y_i$  is actual number of fire hotspot in a time of  $i$ ,  $y'_i$  is a number of prediction hotspot in a time of  $i^{th}$ ,  $y_{avg}$  is number of sample dataset as training data, while error number use of metric regression model. All the model used to calculate error assisting to check how the performance of forecasting dataset in future time as well as calculate mean error in a simulation.

The source of fire hotspot dataset refers to MODIS data available in NASA earth data, there are 15 indicators in the dataset as shows. MODIS dataset based on satellite imaging to detect the active fire hotspot from the sky, in some case the image received from satellite may in low quality then effected to the decision which number of hotspot and location. Strategy to improve data quality and value that related to the number of fire hotspot which preliminary analysis by filtering incomplete or missing of dataset. Only complete and valuable dataset process by the application to determine location and number of fire hotspot. Total number of MODIS dataset collected from NASA more than 100,000 data as for the year 2021 and forecasting for year 2022 [18]. All the fire dataset only in Indonesia territory, data normalization is applied for the first step of processing to avoid noise and incomplete data in decision. Table 1 shows a set of data after filtering and select only used data for analysis which only four parameters in year 2010 to 2021.

TABLE I  
NUMBER OF DAILY HOTSPOT DATA YEAR 2010 TO 2021

No	Latitude	Longitude	Date	Total
0	0.02110	116.87390	2010-01-01	42
1	0.48080	116.08060	2010-01-01	66
11	2.15090	117.49680	2010-01-01	0
10	-8.10890	118.07430	2010-01-01	0
8	-8.15960	117.58570	2010-01-01	43
..	..	..	..	..
14208	-7.22331	110.42920	2021-12-31	67
14209	-6.96059	110.45844	2021-12-31	55
14210	-5.80178	139.61118	2021-12-31	65
12211	-4.51654	136.84802	2021-12-31	56
14213	-4.54666	136.77507	2021-12-31	52

The distribution of fire data refer to the table 1 based on daily event which in single day may have many occurrence of fire hotspot detected. In order to create daily event of fire graph then the data has to scale or group in every single day that consist numbers of hotspot. Table 2 shows fires dataset has been group into a single date of fire occurrence, the total number of data from year 2010 to 2021 which is 12 years more than 4000 hotspot. Those number of data used for data training and testing to achieve forecasting in future year. Grouping of the data to single day to optimize in the analysis that forecasting of fire hotspot refer to single data. The distribution of the data plotted in the line graph to check maximum and minimum versus time in every year. Scalability applied to do analysis in detail based on monthly then number of hotspots be able to check in detail compare to yearly. The minimize and analysis only the use of data is good to reduce processing time and memory then fast processing.



TABLE II  
HOTSPOT DATA YEAR 2010 TO 2021

No	Date	Total
0	2010-01-01	12
1	2010-01-02	12
2	2010-01-03	5
3	2010-01-04	14
4	2010-01-05	36
..	..	..
4360	2021-12-27	7
4361	2021-12-28	6
4362	2021-12-29	4
4363	2021-12-30	30
4364	2021-12-31	7

A special RNN type of network which is LSTM algorithm working based on a memory that in long data with short-term network has ability to learn in long-term connections. One of the advantages of the LSTM model is to do a forecasting of event in series of time data and wide range of issues can be handle. Thus, many case to solve the problem use this algorithm and model to do analysis of data as well as in prediction of data in future time. Furthermore, LSTM algorithm ability to organize model in order to form of a chain structure and has four interacting layers with a unique method of communication each other's in data processing. Figure 1 shows an analysis block diagram how the forecasting process of the fires hotspot in the future times. Data training dan testing in separate block and running in each process before LSTM algorithm do the analysis and forecasting.

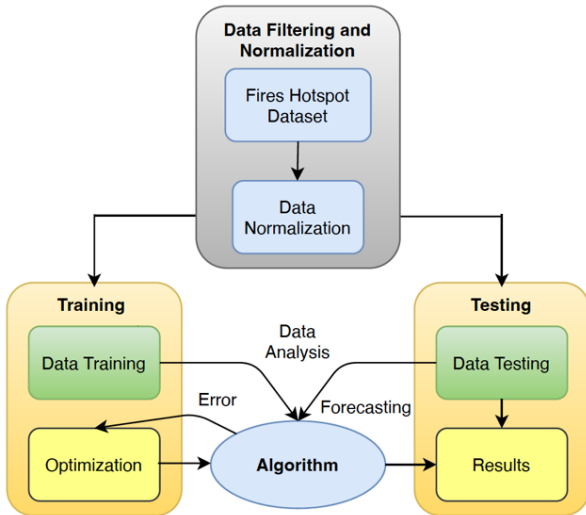


Fig. 1. The analysis of block in data forecasting

The algorithm in this process of data mapping and forecasting is refer to LSTM and the pseudo code as shows in the figure 2, where  $X$  is the input data of fire hotspot in time series from year 2010 to 2021 and the  $O$  is output forecasting data for the future year and in this case prediction for one year which is 2022.

**Algorithm FORE-LSTM.**

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**Input:** data stream  $X = \{x_1, x_2, \dots, x_i, \dots\}, x_i \in R$ , epoch  $I$ , number of iterations  $K$ , error parameters  $\sigma$ , cycle index  $N$ , Number of decompositions  $m$ , White noise data  $W$ .

**Output:** Forecasting Result  $O$ .

- 1:  $X \leftarrow x_1, x_2, \dots, x_i, \dots, x_i \in R$  // Input data
- 2:  $O \leftarrow \{\}$  // Output data
- 3: **for** each  $i \in N$  **do**
- 4:      $H_i^+ \leftarrow x + W_i^+; H_i^- \leftarrow x + W_i^-$
- 5:     **for**  $j \in I$  **do**
- 6:          $H_{ij}^+ \leftarrow FORE(H_i^+); H_{ij}^- \leftarrow FORE(H_i^-)$
- 7:     **end for**
- 8: **end for**
- 9: **for**  $j \in m$  **do**
- 10:      $O \leftarrow \sum(LSTM(IMF_j))$
- 11: **end for**

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Fig. 2. The proposed deep learning algorithm

III. RESULTS AND DISCUSSION

The results of mapping and forecasting of fire hotspot dataset refer to MODIS data consist from several year with parameter coordinate of hotspot, date and time, confidence level which represent the probability of occurrence of fire, brightness level, etc. as shown in previous data. In this research and analysis, the available dataset only used four indicator that to process further which are acquisition date (acq\_date), coordinate (latitude and longitude), and confidence level. The distribution of level hotspot classified into five categories or level of confidence, this method applied in order to check which hotspot is very potential getting fire for forest and which data is just low level that less occurrence that not much impact. Figure 3 shows a complete map of Indonesia region with number of fire hotspot plotting base on the location and confidence level.

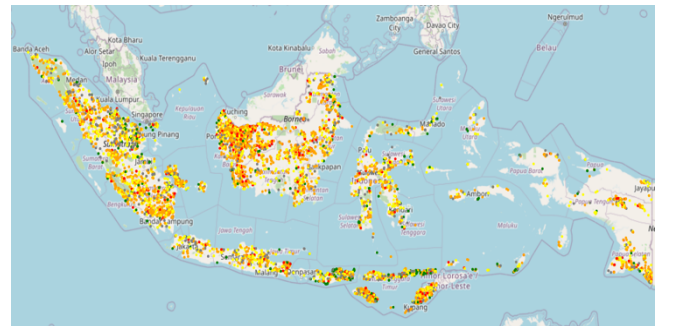


Fig. 3. Mapping of fire hotspot in Indonesia region

The number of fire hotspot in Indonesia region refer to the collected data and confidence level which classified in five levels, then total number hotspot detected in every year with thousands hotspot. In this analysis data presentation by plotted the graph yearly indicate every level from January to December in year 2021. Figure 4 shows the distribution of hotspot every month for every level and the black line is the total number of hotspots for the year 2021.

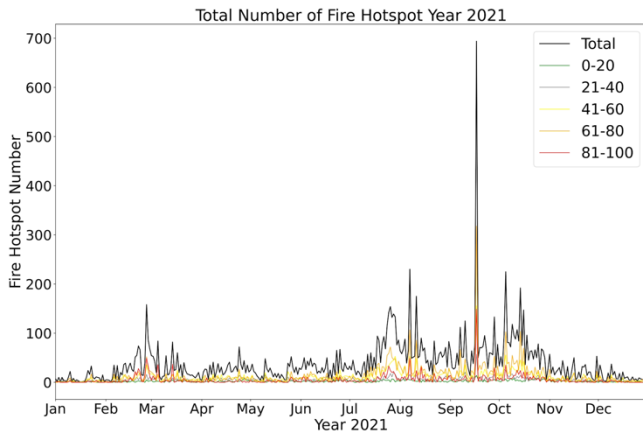


Fig. 4. Fire graph of hotspot event in montly for the year 2021

Finally, forecasting result of fire hotspot achieved for the year 2022, the distribution of training data more than 4000 dataset and 20% testing then plotted into a forecasting graph. Fig. 9 shows the actual data year 2020 and 2021 and forecasting data for the 2022 which similar trend and pattern as well as the distribution of fire hotspot and rise in end of year.

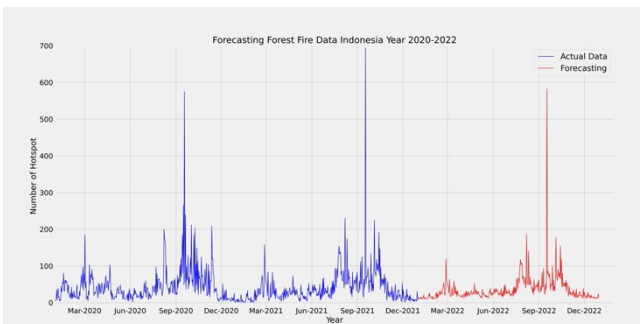


Fig. 5. Forecasting results of the hotspot for the year 2022

#### IV. CONCLUSION

Forecasting model used LSTM model have been done for the year 2022 with training data 80% and 20% testing data as results shows with performance accurate more than 95% with error 4.56%, the successful of data forecasting indicate by the pattern of data very similar as well as the trend for hotspot in every month. Future work has plan to minimize or scale down the mapping and forecasting in small zone based on state or area may improve the accuracy to achieve detail results.

#### ACKNOWLEDGEMENT

We would like to express our gratitude to the Ministry of Education, Culture, Research and Technology of Indonesia for funding the research. Chiba University Japan for the overseas joint research program, National Taiwan University of Science and Technology and Universitas Islam Riau, Indonesia for research facilities.

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