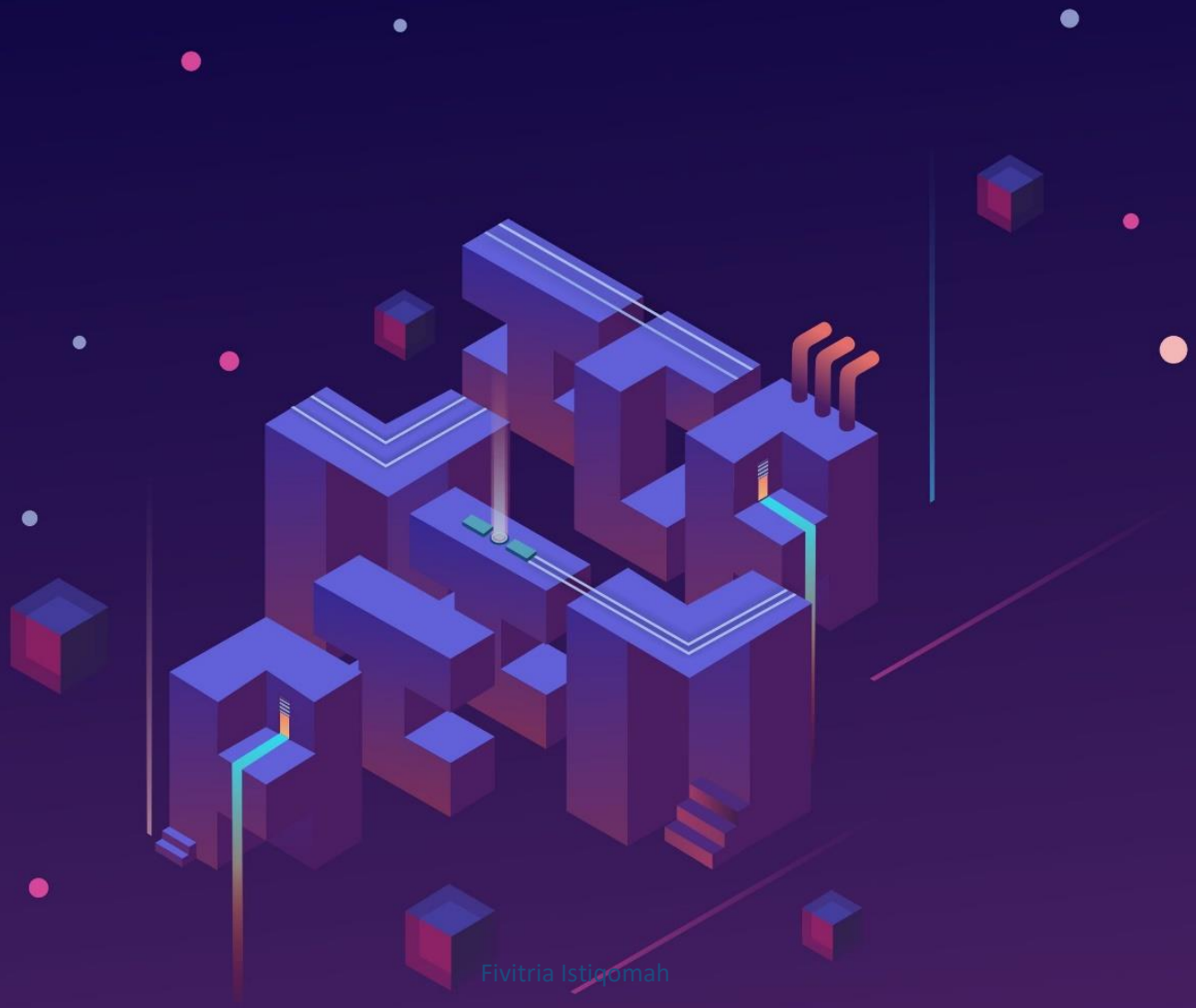
3rd ICAMIMIA

INTERNATIONAL CONFERENCE ON ADVANCED MECHATRONICS, INTELLEGENT MANUFACTURE AND INDUSTRIAL AUTOMATION

OCTOBER 9th - 10th 2019

Hotel eL Royal Kartika Wijaya
Batu, Malang
Indonesia



Building Towards Industry 4.0 by Strengthening The Development of Manufacturing and Renewable Energy

ITS Institut Teknologi Sepuluh Nopember | ITS SMART-ECO CAMPUS | ICT and Robotics Research Center | MIA | Pusat Unggulan Iptekis Perguruan Tinggi

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WELCOME SPEECH

Welcome to 3rd IEEE ICAMIMIA 2019

It is with my deep pleasure to welcome all of you to the 3rd IEEE International Conference on Advanced Mechatronics, Intelligent Manufacture, and Industrial Automation (ICAMIMIA 2019). ICAMIMIA is a conference which is held every two years by the Sepuluh Nopember Institute of Technology (ITS), the Center for ICT and Robotics Studies of ITS, the Center of Excellence for Mechatronics and Industrial Automation of ITS, and IEEE Indonesia chapter.

The conference aims are to provide a scientific discussion forum to scientists, researchers, and engineers from all of the world to exchange ideas and research results in the fields of Mechatronics, intelligent manufacturing, and industrial automation in which there is a convergence of multi-discipline, to develop new findings in fields of interest.

This year, 108 papers have been submitted from 4 countries and various universities, 76 papers were received divided into 7 track topics of interest in a theme "Building Towards Industry 4.0 by Strengthening the Development of Manufacturing and Renewable Energy".

I am pleased to give the highest appreciation and the greatest gratitude to the committee, all committee members, steering committee members, international committee members, and international reviewers, who have worked hard for the success of this conference. And specifically for ITS through research institutions and community service that has supported the conference to be successful.

Finally, I would like to thank the keynote speakers who include: Prof. Shinji Hara from the University of Tokyo JAPAN, Prof. Estiko Rijanto from LIPI INDONESIA, Prof. Siew-Kei Lam from Nanyang Technological University SINGAPORE, and Prof. Imam Robandi from the Sepuluh Nopember Institute of Technology INDONESIA who has been willing to share their knowledge and research experience with all of us at this prestigious conference. And also, I would like to say thank you to all authors and participants for their very meaningful contribution to this conference.
Welcome to Indonesia and welcome to the tourist town of Batu. Please enjoy your stay in Batu city and enjoy the fresh air and interesting tourist attractions.

Chairman,

Eko Setijadi, PhD.

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TIME SCHEDULE 3RD ICAMIMIA

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Wednesday, 9 October 2019	
07.30 - 08.00	Registration
08.00 - 08.15	Welcoming performance
08.15 - 09.00	Opening Ceremony
09.00 - 09.15	Photo Session I
09.15 - 09.30	Coffee Break
09.30 - 10.30	Keynote speaker I
10.30 - 11.30	Keynote speaker II
11.30 - 13.00	Break, Lunch
13.00 - 15.00	Parallel session I
15.00 - 15.30	Coffee Break
15.30 - 17.15	Parallel session II
Thursday, 10 October 2019	
07.30 - 08.00	Registration
08.00 - 09.00	Keynote Speaker III
09.00 - 09.15	Coffee Break
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10.15 - 10.30	Photo Session II
10.30 - 12.00	Parallel session III and Closing
12.00 - 13.00	Break, Lunch
13.00 - 18.00	Tour

ABSTRACT OF CONTRIBUTED SPEAKERS

Prof. Shinji Hara - **University of Tokyo**

Title:

"Hierarchically Decentralized Control for Networked Dynamical Systems with Global and Local Objectives"

Abstract:

There are many dynamical systems that can be regarded as hierarchical networked dynamical systems in a variety of fields related to smart cities. One of the ideas to treat those systems properly is "Glocal (Global/Local) Control," which means that the global purpose is achieved by only local actions of measurement and control. The key for realization of glocal control is hierarchical networked dynamical systems with multiple resolutions in time and space depending on the layer, and one of the main issues is to compromise the two different objectives, one for global and the other for local. After the explanation of control perspective on Internet of Things (IoT), a unified framework and its fundamental control theory for glocal control, we focus on how to design hierarchically decentralized control with global/local objectives by aggregation. Through the talk we show the effectiveness of the theoretical results for applications to electric vehicle control and power grids towards smart cities.

Prof. Estiko Rijanto - **Indonesian Institute of Science (LIPI)**

Title:

“Building Towards Industry 4.0 by Strengthening The Development of Manufacturing and Renewable Energy”.

Abstract:

Firstly, this speech overviews Industry 4.0, followed by the introduction of its worldwide adopters. Next, Indonesia's position in terms of its implementation is identified and the government's policy on Industry 4.0 is shared. Some implementation examples of the industry 4.0 are presented, from the viewpoint of self experiences, which include the fields of manufacturing and electric power industry. The challenging problems in the creation of Industry 4.0 in Indonesia are identified that include limited supply capacity and low affordability. Some ideas such as retrofitting and integration with information telecommunication technology are proposed as scenarios in developing Industry 4.0 under certain limiting conditions as a developing country.

Prof. Siew-Kei Lam - Nanyang Technological University

Title:

"Custom Computing for Edge Intelligence"

Abstract:

Internet of Things (IoT) for emerging applications in smart city, urban mobility, smart manufacturing, etc., have created the need for real-time artificial intelligence at the edge. Embedded computing devices (in smart sensors and mobile devices) will face unprecedented challenges to process large amount of data using complex algorithms while being expected to meet tight functional constraints (e.g. energy, cost, performance, and security). We need new algorithmic approaches that can achieve significant energy savings and reduce computational complexity. Furthermore, IoT have also exposed new avenues for attacks on embedded systems, resulting in serious cyber-security concerns. Designers will be placed under severe pressure to develop custom architectures to improve security and energy efficiency without violating time-to-market and non-recurring engineering costs. Therefore, new research directions in custom computing must be undertaken to address the technological challenges in achieving the cross cutting goals of security, energy efficiency, performance and cost at the application and architecture level for edge intelligence.

The first part of this talk will focus on the challenges and opportunities for edge intelligence in emerging applications. In the second part of the talk, I will share some of our recent work to address these challenges through custom computing

Prof. Imam Robandi - Institut Teknologi Sepuluh Nopember (ITS) Surabaya

Title:

"Application of Artificial Intelligence in Large Scaled Power System"

Abstract:

Stability is a main problem in large scale power systems. From the generation system to the loading (consumer), are always be controlled in order to keep the stability. Voltage, frequency, and power are output variables that are often used by controlling systems to be reference of the system improvement. Turbine rotation settings through valve control, excitation system tunnings, transmission system controlling, and many more tunning for the load. This has become a very interesting topic for the study of the dynamics of the electric power system stability.

The control engineering system has been developed very quickly era by era. Starting from the most conventional systems to the most sophisticated systems using intelligent technology. This has made the development of intelligent technology (Artificial Intelligence, AI) quickly. Applications of Fuzzy Logic, Particle Swarm Optimization, Genetic Algorithms, Ant Colony Optimization, and many others have been carried out by engineers to improve the performance of power system outputs. Here it shows that their application was very successful.

Application development from AI for large-scale systems is not limited for stability issues, but has also been widely applied to the problem of filtering, generator schedulling systems, load forecasting, speed controlling, reconfiguration for distribution system, power electronic equipment tunning, and economy dispatch.

Mechatronics, Robotics, Automation

001

Omni-Wheeled Robot with Rapidly-exploring Random Tree (RRT) Algorithm for Path Planning

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Abstract: Robot built with omni-directional wheels (omni-wheeled robot) is required to perform free movement. In some applications, the omni-wheeled robot is expected to avoid obstacle without breaking it down. Therefore, Rapidly-exploring Random Tree (RRT) algorithm is important to be implemented to the omni-wheeled robot for path planning. From the study results, the RRT algorithm is useful for generating paths from the starting point to the destination point. Experiment results show that obstacle shift occurred in 1 of 5 times experiments.

Keywords: Omni-Wheeled Robot; Obstacle; Rapidly-exploring Random Tree (RRT); Path Planning

002

Object Detection of Surgical Instruments for Assistant Robot Surgeon using KNN

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Abstract: Automatic object recognition is the main key to the auto robot system. As like the eye in humans, object recognition is a system of identification on a computer. With this capability, object recognition can be developed to help facilitate human work from monotonous and repetitive work. In the field of medical, object recognition can be combined with an operating robot to free the nurse's duties from the work of sending and retrieving surgical instruments during the operation process. One of the simplest recognition methods is using the K-Nearest Neighbor (KNN) algorithm, by finding the closest distance between the object and the dataset. OpenCV is added as an additional library that aims to facilitate the pre-processing of image. This paper implements the KNN algorithm to distinguish the surgical instrument with a relation test set to train set is 1:1. The pre-processing section has been done with OpenCV which is used to separate interest objects with a background. The classifier parameters that used are aspect ratio, solidity, and contour ratio. A region of interest (ROI) is required to limit the object area to be processed. It helps to find the principal axis to rotate the image. The aim is to extract the important information as a new orthogonal variable called main components. The KNN method test results show the robustness of automatic intraoperative object detection that can be used to improve the specialist's preventive state acknowledgment amid the robot-helped medical procedure.

Keywords: Object recognition; OpenCV; KNN; surgical instruments

003

Design of Condensers on Miniplant Pyrolysis "Machine for Converting Plastic Waste Into Oil Fuel"

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Abstract: Miniplant pyrolysis is a device that functions to convert plastic waste into fuel oil based on the steam boiling point difference. In order for the product from the pyrolysis minimplant to be more maximal and much needed a coolant / condenser to convert steam from LDPE plastic (Low Density Polyehtylee) to condensate. This condenser serves to accelerate the steam cooling process. From the design activities that have been carried out, it can be seen that the dimensions of the tube-shaped shell are made of stainless steel with a thickness of 2 mm, a length of 0.5 m, a diameter of 0.4 m that can accommodate water fluid of approximately 63 liters. In the shell will flow cold fluid in the form of water with a temperature range (T = 16), cylindrical shaped tube, tube made of copper with a length of 6 m as much as 2 pieces, inner diameter 0.01587 cm, tube made in the form of 16 pieces with a distance per tube equal to 5. From the test results to cool the steam from temperature 93,8 and 122,30C to temperature 36 and 38 it takes approximately 45 minutes. For the condenser calculation results produce effectiveness of 76,12%.

Keywords: condenser; heat transfer; design; shell; double spiral tube

004

Artificial Intelligent Based Fall Detection System for Elderly People Using IoT

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Abstract: In general, one of the serious problems faced by elderly people is falling. Sometimes, this fall, not a little can cause death. if a person falls and does not get help within one hour, then the impact that must be borne will be felt up to 6 months later. Therefore, Fall detection for elderly people is a crucial problem which requires the development of modern technology that is easy and practical to use. Besides, the use of the devices do not limit and interfere with the activities of the elderly. This paper proposes a fall detection device which is able to monitor and inform all activities of the elderly people, especially some dominant events that have the impact of falling by utilizing IoT-based technology. It used two sensor to detect falling event including gyroscope and sound. The signals sent by the two sensors are then processed by the microprocessor using the fuzzy PSO algorithm to identify and distinguish between ordinary activities and falling events. PSO is used to optimized the membership functions of the fuzzy in order to improve fuzzy performance in identifying falling event. If the results state that a fall occurs, a notification will be sent to the medical officer at that place via a wi-fi network. To test the reliability of the device that have been made, two performance indices are measured, namely sensitivity and specificity. The experiment results showed that the sensitivity and the specificity of the device were 100 % and 100%, respectively when it was located on the chest and the abdomen.

Keywords: PSO, fuzzy, fall detector, IoT, sensor

005

Design and Implementation Digital Rain Climate Measurement using Wireless Sensor Network

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Abstract: Digital Rain Climate Measurements (DRCM) is an electronic system that measures a climate measurement. The main purpose of a DRCM is mapping the climate measurements particularly in Toba Samosir Regency, North Sumatera Province through wireless sensor networks using WiFi and sends the data to the database and can be monitored using web application. In this research, the authors aim to create a Digital Rain Climate Measurements prototype that will measure the measurements from the sensors and send it to database and can be viewed via web application. Parameters that are sent and monitored by DRCM are rain gauge, temperature, humidity and rain pH. The DRCM also has an additional feature which is on-grid system and a novel method to measure the rain gauge by implement the ultrasonic sensor and show how the resolution of ultrasonic sensor and design of the water tank reservoir can influence the sensitivity and the accuracy the rain gauge measurements. The DRCM is created using microcontroller, sensors, and other components including Arduino Uno, temperature and humidity sensor, pH sensors, ultrasonic sensor, WiFi module and DC fan. The DRCM is applied on flat surface and has the internet connectivity using the Router, then the DRCM will able to pair the connection to the internet and send all of the data that measured to data base. And web application is used as User interface to monitor the real time measurements from DRCM.

Keywords: Rain gauge, Ultrasonic Sensor, Microcontroller, wireless sensor network, Wi -Fi

006

Lane Keeping Assist Based on Fuzzy Logic using Camera Sensor

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Abstract: This paper discusses the use of camera sensor on Lane Keeping Assist (LKA). LKA is a subsystem of Advanced Driver Assistance System (ADAS) that functions to keep vehicles from getting off track, especially on toll road. The data from camera sensor is used as input data of fuzzy logic controller processed on a microcontroller which outputs the decision of the movement of the experimental car's motor to keep it on the lane. The result of the experiment shows that LKA can successfully avoid the car from getting off the lane with safety index of 95% for High Speed Mode and 100% for Medium and Low Speed Mode.

Keywords: TSL1401 Camera Sensor; Fuzzy Logic Control; Lane Keeping Assist; ADAS

007

Depth Control Simulation of Autonomous Underwater Vehicle with Communication Delay

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Abstract: This paper presents depth control simulation of autonomous underwater vehicle (AUV) using a new approach of decentralized system environment called Open Control Platform (OCP). We discuss briefly various time delay phenomena of the actuator model, network latency, and computing time process, those are approximated using time delay approximation reflected to the system design infrastructure. The proposed structure is composed of optimal regulator equation with state delay obtained by taking the original problem to the linear quadratic (LQ) servo design and a delay compensation, which modifies the delay in the input (generated by the human operator) and output. Numerical methods for delay differential equation (DDE) are direct analogies of the classical numerical method of ordinary differential equation (ODE), and it will be compare with proposed method. Simulation results are presented, demonstrating performance of both the traditional method and new method based on OCP.

Keywords: Depth Control; Underwater Vehicle; OCP; LQR

008

Detection of Children's Personality with Fingerprint Using K-Nearest Neighbor (Knn) and Decision Tree Methods

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Abstract: Now in many parts of the world technology has been developed that is able to identify individuals from individual biological characters known as Biometrics. Biometrics itself is a way of identifying and verifying individuals based on their physical characteristics or behavior. So fingerprints are an option to detect a child's personality. The desire of parents to print their children into superior seeds is getting bigger. Questions about how to maximize talent, potential, and children from the start often haunt the minds of today's parents. Realizing the importance of this, psychologists continue to perfect tests to analyze children's intelligence and personality. With the occurrence of these problems, this study will design a system that can read fingerprints with the results knowing the child's personality and Learning style. This system is designed by using the Gray Level Co-Occurrence (GLCM) feature extraction and is classified by the K-Nearest Neighbor (KNN) Method and Decision Tree which can go through a data or a fact that moves forward to a conclusion. In this research, the two classification methods have different accuracy, KNN has an accuracy of 85% and 89% Decision Tree has more accuracy than KNN because it uses a decision tree.

Keywords: fingerprint; Learning style; GLCM; K-Nearest Neighbor (KNN); Decision Tree

009

Detection of Children With Personality Through Fingerprint Random Forest And Maximum Entropy Method

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Abstract: very child has a personality and learning style that can be known from birth, now has found the latest method that is by analyzing fingerprint patterns. A person's fingerprint is a very unique characteristic, because no one has the same fingerprint pattern. Some have learned that fingerprint patterns are related to a person's character. Then it will be discussed the design and discussion of a person's character system based on fingerprint patterns using the gray co-occence matrix (GLCM) for feature extraction and classified with the Random Forest and Maximum Entropy Method. The dataset in this study was taken directly to elementary school children, ranging in age from 7 to 8 years. To find out the child's personality and learning style, fingerprint patterns were taken on the middle finger, ring finger and little finger taken with ink. In this case the class will be divided into three Loop, Whorl, and Arch. From that experiment has been done, of the 123 student data or datasets that have the best accuracy results is with 95% obtained using the random forest method while for the maximum entropy method only gets an accuracy of 44%.

Keywords: Image Processing; Random Forest; Maximum Entropy; Fingerprint; Nature; GLCM

010

Monitoring System Garden Light Solar Cell Based on Smart IoT

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Abstract: The garden light is one of a public facility that serves to give illumination on each of the existing parks in the city. Most of the park lighting systems in Indonesia, the garden light outages are still handled manually by relying on information from the community to report via the command center or checking manually by patrol. In this study, we proposed, a system monitoring tool garden light solar cell that can be accessed through the website. Monitoring the performance of park lights with remotely and real-time is one application of the smart city concept. Namely by facilitating the monitor process and automatic battery power check. The result of the existing problems in the field, monitoring tool designed garden light solar cell-based website using a microcontroller connected ESP8266 NodeMCU internet network so that it is able to display voltage and current data on photovoltaic, batteries, and lights. Other functions of this tool to monitor the condition of the lamp flame or outages on Garden lights solar cell and know the layout of the existing garden light poles in the field. This research has been tested directly in public parks in the city of Surabaya, with the accuracy of updating information at 100% and the accuracy level of the battery at 98.78%.

Keywords: Garden Light Solar Cell, Monitoring, NodeMCU, Website.

011

Toothpaste Tube Detector Inside Cardboard Using Proximity Inductive Sensor To Maintain Quantity Of Product

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Abstract: To fulfill human needs, in this world there are a lot of factories produce daily goods products or commonly referred to as FMCG (Fast - Moving Consumer Goods). In general, FMCG-based plant machines will work continuously for 24 hours, therefore, errors and mistakes often occur. In the packing line especially toothpaste factory there is a packing machine that serves to insert and pack several boxes of toothpaste products into large cardboard. Due to errors and mistakes, the products inside the cardboard is not filled in full. If those products reached the consumer, it will cause the company to lose consumers' trust, and it definitely can reduce the number of sales. So we made a device that serves to detect whether the product inside the cardboard is full or less. To do so, we are using inductive proximity sensors to detect a tube of toothpaste made from metal. When the cardboard doesn't contain full products is detected, then the conveyor will stop automatically. And the product will not be processed to the next packing step. This system has an accuracy of 79% of 3 times trial with different conditions and using 10 cardboard for each.

Keywords: WeMos D1 R2; Proximity Inductive Sensor; Photoelectric Sensor

012

Calculator for Blind with Self Correction Feature using Voice Output

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Abstract: Calculator for blind with self-correction feature using voice output is used to help blind to increase their skill in calculation. This tool is an interesting topic to be explored because there is not self correction in common calculator for blind people. Self correction is used for blind to practice their braille reading. The proposed feature in this research is self correction. By using this feature, all of the answer given by the blind using voice and number input will be corrected automatically by the system. The self-correction mechanism is active while the blind calculates number using braille calculator. After the result calculation is showed in braille calculator, then the blind could speak the result by reading the braille calculator into it. Then the braille calculator will check the answers that blind given into it. The answer from blind will be converted from speech to text. Then, the text will be identified by system. When it has been identified, this system will be given the response correct answer automatically. So, the blind can learn the correct answer and improve the braille reading, especially in reading number.

Keywords: calculator for blind, self-correction, braille calculator

013

Flight Test of Pasopati Electric Cruise Missile

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Abstract: Cruise missiles are very strategic air defense facilities that are very important to be developed. The development of electric ducted fan (EDF) cruise missiles is the first step to find out the characteristics of cruise missiles before entering jet turbine cruise missiles. After the airframe has been manufactured, the next stage is the design of the avionics system and flight test to obtain the missile performance. This research is intended to design the Pasopati Cruise Missile avionics system for a distance of 40 km with an Electric Ducted Fan engine and conducted flight tests to measure missile capabilities. Avionics systems are designed according to the mechanical needs of missiles with certain specifications, which are then tested flying in autonomous mode by carrying out missions through predetermined waypoints and analyzing the stability of the parameters of airborne missile flight, Avionics systems will use Flight Controller and Mission Planner as Ground Control Station and 433MHz RxTc Xtend Communication Module as a medium for sending data via radio waves. The results of this study are Flight Properties of Electric Cruise Missiles with a distance of as far as 40 km, flight over waypoints accurately, and produce coincident characteristics of actual attitudes and navigation output which then can be used as a reference for the next development stage of the avionics system and the flight test procedure of the electric cruise missile.

Keywords: Electric Cruise Missile, Avionic System, Flight Test, way point, stability

014

Design Of Sinusoidal Signal Generator Using Pipelined CORDIC Architecture Based On Altera Cyclone II FPGA

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Abstract: Numerical Control Oscillator (NCO) is a main component to generate a signal. The uses of NCO is widely increased because of its simplicity of use and able to obtain high precision signal. One of many methods used by NCO is CORDIC algorithm. Coordinate Rotation Digital Computer (CORDIC) is one of many popular method used in trigonometric calculation and digital signal processing. It is said that this algorithm has a high efficiency for hardware implementation. CORDIC is often used as a core of DDS (Direct Digital Synthesis) to generate a signal. In this research, a sinusoidal wave is generated using 16 stages pipelined CORDIC algorithm system with look-up table. The system is designed using Intel ALTERA FPGA Cyclone II and its RTL model is simulated using ModelSim. The results show that the system is able to generate the signal with approximately 0.42% of error, and the proposed pipelined architecture is able to increase the systems maximum restricted clock speed from 8.2 MHz to 89.17 MHz.

Keywords: CORDIC algorithm; Intel Altera; FPGA; Pipelined Architecture

015

Automated Bag Opener for Polypropylene Bag Assembly Machine

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Abstract: Moisture is a major issue in the fertilizers industry. To overcome this problem, a double layer polypropylene bag is used. The double layer of polypropylene bag consists of the woven polypropylene bag and the clear polypropylene bag. Today, the process of inserting the clear polypropylene into the woven polypropylene are still using the conventional method. Fertilizers industry still depending on the labour force to assemble the bags. Using the conventional method, fertilizers industry needed a large number of workers thus incurred high cost for mass production. By assembled the bag manually, worker undergoes repetitive works that affect workers psychologically and physically. In order to prevent this problem, automated polypropylene bag assembly system is introduced. This system can improve the quality, cost and also direct human labour.

Keywords: Polypropylene bag; fertilizers industry; labour force; repetitive works.

016

Design of Earthquake Shaking Table (EST) Using Ball Screw Guide Linear Actuator

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Abstract: Earthquake shaking table is one of the tools used to simulate earthquake behavior and its effect for the structures. This research describes a process of designing a dual-axis shaking table using ball screw linear guide actuator as its main actuator. The system utilizes Bressenham algorithm for controlling both actuators synchronously. ZX gesture and motion sensor is used to monitor every movement from the table. The main controller uses ARM Cortex M4 microcontroller to ensure fast movement and response for both actuator and sensor system

Keywords: Ball Screw, Bressenham Algorithm, Earthquake Shaking Table

017

Classification Of Eligibility Consumption Of Manalagi Apple Fruit Varieties Using Backpropagation

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Abstract: This research aims to sort the quality of Manalagi apple fruit varieties.The sorting system used is still manually in fruit sorting with the help of human labor that takes a long time. Sorting manually has fewer results and the quality produced is not the same. The parameters used in the Manalagi apple sorting are based on the skin color of the fruit. The color of the fruit skin will be taken color features with average RGB. In this study, the sorting system is automatically developed for the Manalagi apple fruit with the extraction of the average RGB color feature with the Backpropagation algorithm. The purpose of the developed system is to distinguish the Manalagi apple fruit of worth consumption and not worth the consumption. The fruit classification is based on the average RGB color composition of the fruit skin. Systems developed using image processing such as image segmentation, color feature extraction with average RGB models and fruit quality classification decisions with the Backpropagation algorithm. The developed system can take the decision automatically fruit worth consumption and not worth the consumption with an accuracy rate of 90%.

Keywords: Image Processing, Artificial Intelligence, Manalagi Apple Fruit, Classification, Eligibility Consumption

Manufacture, Instrumentation, and Measurement

018

Performance Evaluation of Hybrid Electric Propulsion System for AUVs with Simulation Results

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Abstract: This paper presents some simulation results and implementation description regarding the design of a hybrid waterjet propulsion system resource that is being designed to be used as a propulsion system for the Autonomous Underwater Vehicle (AUV). Broadly speaking, propulsion systems are made using materials made from Carbon Fiber Reinforced Composites Polymeric (CFRP) to have mild yet strong properties. The drive system uses a pneumatic vectoring nozzle and can be directed to horizontal and vertical axes. The hybrid power source that can be used by the electric waterjet propulsion system consists of solar cells and batteries. The Hybrid Waterjet design with Thrust Vectoring for AUV does consist of many subsystems, and each subsystem has a scale of complexity, but the test results are the same subsystems that we have done with the same device but are different for other purposes, so we can say that we We have previously started this study, therefore we can say that the results of our simulations will report simplifications of the various subsystems that are integrated with each other, and may not be identical to the actual system being made.

Keywords: Autonomous Underwater Vehicle; Hybrid Electric Propulsion; Waterjet Propulsion System; Solar Cells; Internal Combustion Engine

019

Prototype Design Mapping of kWh Meters Based on Internet of Things (IoT)

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Abstract: At present electricity is one of the most widely used energy sources for humans to support their daily needs. The electricity consumption used by each customer also varies according to the power capacity obtained by each of the electricity customers. Problems with the use of electricity consumption also occur in the campus environment. in the campus environment, the use of electrical energy is included in the high usage due to the dense activity on campus. Generally, the use of high electricity consumption occurs during working hours during the day. but it does not rule out the possibility also occurs at night with additional activities such as research labs and non-academic student agendas. In the construction of the kWh meter in this study, an integration tool of digital power meter (kWh meter) was made with the internet network using a microcontroller and IoT module. By connecting the kWh meter device with IoT, the measurement data can be easily monitored remotely. To monitor the data, a web application was made to monitor the data on electricity consumption. It is expected that with this monitor system users can manage electricity consumption better in accordance with needs. In the measurement accuracy testing, the accuracy value obtained with a multimeter of 99.19% was obtained in the 1P Voltage parameter, and for the results of the throughput test the best value was obtained 100% with a delivery time span every 5 minutes.

Keywords: kWh meter, IoT, monitoring, power meter, microcontroller

020

Water Monitoring Prototype Using Internet of Things Technology

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Abstract: In the digital era, the using of Internet of Things (IoT) is popular among the industrial revolution 4.0. This technology offers to integrate information from several entities at several sources which can be accessed at any places. In the water monitoring system, the conventional measurement leads the efficiency and complexity issues. Conventionally, to check the water quality, the researcher must come to the place to monitor the water directly or by analyzing it into Laboratory. Therefore, in this study, we apply this technology for a water monitoring system. In this system, to acquire water quality, there are several physical parameters which measured by sensor module such as temperature, pH, turbidity, and conductivity. Those parameters are transmitted to microcontroller i.e., Arduino MKR Wifi 1010 which has the Internet of Things (IoT) platform. According to the result performances, our system successfully displays the water quality using IoT Platform. Hence, information about water quality can be monitored and accessed everywhere and anytime..

Keywords: kWh meter, IoT, monitoring, power meter, microcontroller

021

Centralized Post Paid Water Meter Controller Using Wireless Sensor Network

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Abstract: Conventional monitoring and termination system in Indonesia's water company is done by direct inspection to each customer's house. With the number of customers reaching 160,604, this system is no longer effective and efficient. In order to support the increasing needs of population, new technology is needed to centralized monitoring and controlling system. In this paper, we proposed the implementation of wireless sensor network (WSN) for centralized valve control in the form of digital water meter. The implementation uses water flow sensor to calculate water discharge, solenoid valve as valve controller, and LoRa SX1278 as communication between node and sink node. Results shown that the calculation of our proposed work is valid proved by sensor accuracy that reached 99,035%. Data transmission that used single-hop routing LoRa SX1278 showed 95% accuracy in 10 meters distance and 77% in 200 meters. Average time to communicate between node and concentrator is 1.0086 seconds while from concentrator to each node is 0.8818 seconds.

Keywords: wireless sensor network, water flow sensor, valve control, digital water meter, LoRa SX1278

022

Coordination of Electricity Protection in Piru Power Grid

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Abstract: T. Seram Energi Lestari, a developer company, is planned to interconnect Biomass Power Generation 2 x 3 MW with Piru 20 KV system PT. PLN Maluku and North Maluku Region. The purpose of this system development is expected to meet all load needs in Piru Island system. This interconnection system requires a study of electrical analysis both on Biomass Generation and the distribution network of PT. PLN itself. From the results of simulations and tests, correct setting and coordination values can be obtained, include characteristic curve of protection relay, where relay set is both overcurrent and ground fault relay. This study suggested longer gradation time for releasing CB to meet the needs of Piru to Kairatu load requirements. Result of research aims to improve reliability and continuity of new integrated power grid.

Keywords: Interconnection System, Overcurrent Relays, Protection Coordination, Ground Fault Relay

023

Wavelength Effect on Graphene Oxide-Coated Plastic Optical Fiber for Dissolved Oxygen Sensor

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Abstract: Dissolved oxygen (DO) is one of the parameter to determine the quality of the water. High quality and healthy water is needed for fish cultivation. Therefore, it is important to measure the DO in the water. In order to measure DO, the DO sensor is needed to be developed. In this paper, the optical fiber sensor with grapheme oxide coating was utilized for DO sensor. The wavelength effect to the sensor performance was evaluated by using different LEDs (blue and red LED). The result shows that the blue LED caused the optical fiber sensor has greater performance with the sensitivity of 0.875 dBm/mg/L. The proposed configuration offered simple, low cost and ease of fabrication.

Keywords: wavelength, dissolved oxygen, optical fiber, sensor

024

Structural Displacement Measurement with High-speed Vision System and Retro-reflective Markers

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Abstract: This study proposes a vision system for structure dynamics measurement. The system captures lateral and vertical displacements at multiple points on a truss bridge model. Retroreflective corner cube and coaxial lighting device were used to obtain high-contrast appearance of markers at long-distance measurement. The markers were aligned within the depth of field of the vision system with different slant angles so that all markers could be captured in a single field of view without occlusion. Scaling factor was calculated taking into account the slant angles of each particular marker and calibrated against a laser displacement sensor. Estimated displacement from dynamics measurement was compared against contact accelerometer. Resonant frequency and damping ratio of the structure from impulse excitation was evaluated using Fourier transform and half-power method.

Keywords: structural health monitoring, high-speed vision, retro-reflective marker, scaling factor, vibration analysis

025

The Feasibility Study of Mountain Water Treatment into Drinking Water Using Reverse Osmosis in Kediri, Indonesia

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Abstract: This study aims to determine the feasibility of water quality as a result of using reverse osmosis in Puncu, Kediri, East Java. Puncu is one of the small villages in Kediri that has a lot of potential water resources to be utilized so that become more productive and profitable. The water from Mount Kelud can be processed using a 2000 reverse osmosis machine to produce the healthy water. Seeing the potential of abundant water sources, the planning of reverse osmosis filter machine installation that is able to turn water into pure water ready to drink will be a positive activity that has a long-term prospect to raise the economy of the citizens. In short, a reverse osmosis filter machine (RO filter) is a machine with the latest technology that can purify water. This technology uses RO filters with membranes that have very small pores. In this RO membrane there are pores with a magnitude of 0.0001 microns. The very small size of this RO membrane makes only pure water (H2O) that can pass through these pores. RO filters work in the presence of pressure applied to the semipermeable membrane so that the water will be forced to pass through the RO membrane then the water that passes through the RO membrane is water that has high purity and is free from unwanted contaminants. The reverse osmosis installation is expected to be the first step so that Puncu village can produce mineral water which can later be marketed and become one of the superior products and pride of the village. Therefore, this activity will focus on installing reverse osmosis equipment using photovoltaic solar panels and assistance to the production of "Puncu mineral water" which is ready to be marketed in and out of town which will ultimately have an impact on improving the living standards of villagers.

Keywords: reverse osmosis, mountain water, drinking water, Kediri

Control and Modeling

026

Peformance Analysis of Multihop Communication on a SCADA System

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Abstract: In the electricity distribution system managed by the PT Perusahaan Listrik Negara (Persero), the SCADA becomes the primary support of the electricity service management, especially for maintaining the reliability of the electricity services. In this paper, we have done modelling and simulation of communication network for Keypoint on SCADA system using Network Simulator (NS) 2.35. Modeling is done using an NSG application that will produce a .tcl script as one of the Otcl language requirements in NS-2. Furthermore, communication performance analysis will be performed using .awk scripts to evaluate performance in the form of Average Delay, Packet Delivery Ratio (PDR), and Throughput. The simulation results show that the average delay value on the two ULPs does not have a big difference, which is worth around 249 ms. PDR both have 99% value. But with a greater number of connections, packet transactions sent and received become larger. While the value of throughput has a higher value when the number of nodes and the number of connections is greater.

Keywords: SCADA, Multihop communication, Adhoc network

027

Constrained H∞H∞ Control Application to Inverted Pendulum with Control Moment Gyroscope

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Abstract: This paper presents the dynamics and control of a gyroscopic inverted pendulum where the stabilization of the inverted pendulum is achieved by control torque generated by gyroscopic precession momentum. Two flywheels rotating in opposite directions at the same speed is considered. The control strategy is proposed to stabilize the inverted pendulum at the upright unstable equilibrium point and to maintain the gimbal angle as small as possible. Such a problem is formulated as a constrained H∞H∞ disturbance attenuation problem and then transformed into a solving of Linear Matrix Inequalities (LMIs). The effectiveness of the H∞H∞ state-feedback controller is illustrated through simulation. It is shown that the state-feedback control strategy effectively stabilizes the inverted pendulum.

Keywords: Inverted pendulum, Control moment gyroscope, State feedback control, Actuator saturation

028

Design of Wind Turbine Output Voltage Control Systems in Multi-Input Buck Converter Using Fuzzy Logic Control for Battery Charging

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Abstract: Wind energy is a renewable energy that continues to be developed in Indonesia. Pantai Baru Hybrid Power Plant, Pandansimo is a wind power plant combined with solar power. The measured wind speed at Pantai Baru Hybrid Power Plant, Pandansimo is at 3 - 8.1 m/s. Wind speeds that vary each time cause the voltage of the wind turbine generator to change as well. This can be proven through simulation with Matlab simulink software. Multi-input buck converter and its control is a method of controlling the voltage of a wind turbine generator. The stable output voltage is expected to charge the battery. The wind turbine used is type AF 1-24-0125 (406 PMG) with a generator in the form of PMSG. The control method use fuzzy logic control. The transient-response characteristics for a multi-input buck converter has a delay time of 0.012 s, rise time of 0.1859 s, peak time of 0.1870 s, and settling time of 0.1870 s. The maximum error generated is 0.1618 Volts or 1.037%.

Keywords: Fuzzy logic control; Multi-input buck converter; Voltage; Wind turbine; Wind velocity

029

Carbon Monoxide and Methane Gas Identification System

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Abstract: Health issues will haunt those who work close to the exploited site of natural gas. Carbon Monoxide (CO) and Methane (CH4) are two poisonous natural gases that could cause serious effect such as difficulty of breathing, unconsciousness, or even death to human. These gases are difficult to be observed or smelled. The development of a system which can measure and display the concentration of these two gases will help those whose activity are impacted. In this research we built the system which consists of two separated devices, the first device was planted in the affected area, while the other was placed in the safe area. The planted device identified the concentrations of CO and CH4 while the other device displayed it to human so any prevention action could be done. CO and CH4 were identified by sensor MQ-7 and MQ-4 respectively. Like any other sensor, these two requires preheating process before they can be used to measure the gases accurately. Based on the test results, it could be seen that the average preheating time of MQ-7 and MQ-4 were 83.3 and 78.2 seconds respectively. The error percentage of the concentration identification yielded the biggest value at 11,043% for MQ-7 and 5,984% for MQ-4.

Keywords: Poisonous gas; Carbon monoxide; Methane; Identification system; Sensor

030

Prototype of Liquid Materials Mixing System using Microcontroller

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Abstract: In the material processing industry there are several processes for processing materials from raw materials into finished materials that are ready to be marketed. Among the many processing processes, there is a material mixing process that functions to mix the material processed from raw material into a search material which is then mixed with other ingredients to produce a mixture or ingredients that are in accordance with the wishes of the industry. Parts of the material mixing process need appropriate systems, grooves and tools so that the mixing process runs well. Based on this description, an automatic preblend tank and prototype tank system consists of Flow Meters, Selenoid Valves, pumps, stirring motors, and then the data will be processed by Arduino Uno. Preblend tank automatic system is a system for the mixing process that has an automatic system that can turn on and turn off the valve so that filling from the material tank can be carried out alternately, turning off the pump after the passing material has reached the limit, starting the stirring motor with the speed and torque that has been set, turning off and reset all components after all processes have run. This preblend tank automatic system will be able to produce the transfer process along with the mixing of materials with an automatic system which can later be applied in industries both large scale and home industries.

Keywords: Preblend tank; Arduino uno; Automatic system; Mixing process

031

Design of Gas Detection Toxic Sulfur Dioxide (SO2) in The Mountain Activity Area

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Abstract: The danger of poisonous gas is caused by volcanic activity, one of the toxic gases is sulfur dioxide (SO2), if inhaled by humans at a level that exceeds the dangerous level. In this study portable detection devices have been created that can monitor the condition of residential residents on the mountain slopes. This tool consists of a microcontroller (Arduino Uno) which has been equipped with a program and has been configured with hardware components such as the TGS2602 sensor which is used to detect SO2 gas and the Thermocouple type-66K Max 6675 sensor used for temperature detection. The interface used in this tool is LabVIEW, which is used to display and monitor data that has been read by the gas sensor and temperature via radio waves. The results of this study are that the system can monitor the gas level and temperature where the calibration and comparison measurements have been made with a percentage error of 0% - 0.1%, temperature with an error percentage of 0-0.03%. Assembled device applications can be used to monitor the level and temperature of SO2 gas in the mountain activity area in real time.

Keywords: Poisonous gas; Sulfur dioxide (SO2); Sensor

032

A Water Tank Level Control System Using Angular Movement in the SLC Plant

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Abstract: The water tank level control system using angular movement is applied in Simulator Level Control (SLC) plant. User of the SLC Plant is able to adjust the level in the tank as they desired by entering the set point in the panel box. Three motor stepper valves are used for actuator and angular sensor to detecting opening valve in the SLC plant. The control system using PID controller with 20 Kp value, 0.1 Ki value and 3 Kd value. There are 2 conditions in the control system, namely normal conditions and disturbance conditions. When normal conditions is running with 20 cm of set point level, it takes 60 seconds to reach the steady state level with valve inlet V1 and valve outlet V2 are 75% opened. In the condition of disturbance, the valve V3 is 20% opened to reach a steady state.

Keywords: Level control; PID controller; Angular movement; Angular sensor; Valve

033

A Feasibility Study of Piping System for Water Supply from Bengawan Solo River to Sinan Lamongan

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Abstract: Based on map of the Bengawan Solo river watersheds, Sinan village is a part of Gawerejo administration, Karang Binangun, Lamongan. The average distance between Sinan village and the Bengawan Solo riverside is 1.5km. However, report from the residents about, during the drought season, Sinan village had suffered by dryness. This has been proved with the lack of water supplies since in the middle of 2019. This condition wad the residents very depends on the payable water supplies to support the households activities needs. For that matter, the residents that mostly works as farmer became incriminate in the term of economics. Therefore, a project to handle this problem has been proposed. The main idea is to bring the water supplies from Bengawan Solo river to the Sinan village by installing pipelines to connect them. Determining the piping system track, is not easy as connect two dots in the map, there should be a feasibility study to prevent social and geotechnical problem. The GPS were also being utilize to measure the distance using actual coordinates. Then, based on geographical map, there were 3 piping system track that designed and being proposed. Inspection, study area and survey were being conducted to map the social condition and the topography of the track. The result shows that among those 3 pipeline tracks, the first pipeline tracks is the most relevant line for planting the pipelines with 4.4 km length.

Keywords: Piping system, Water supply system; Dryness; Pipelines

034

Heading Control on Differential Drive Wheeled Mobile Robot with Odometry for Tracking Problem

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Abstract: This paper describes the process of designing odometry and heading controls from a differential steering wheeled mobile robot (DSWMR). The odometry system aims to estimate the position relative to the initial position of the robot to estimate changes in position from time to time in the trajectory tracking process. The problem that often arises in the tracking problem is the heading error that can be caused by a slip on the robot wheel or an irregularity between the speed of the DC motor on the robot wheel. Heading errors in DSWR can be obtained with the help of a rotary encoder located on a DC motor. This work applied PID control to obtain the heading error close to 0 degrees on the odometry system for trajectory tracking. It works by controlling the rotating speed of each DC motor on the robot wheel. The results of the PID control parameters implemented on the DSWMR were obtained from the results of tuning experiments

Keywords: DSWMR; Heading control; Tracking problem

035

An Improved PID Controller Using Fuzzy Logic for SEPIC DC/DC Converter

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Abstract: The SEPIC converter is one of the unique DC-DC converters where this converter can maintain a constant output under varying and changing input conditions, a small input current ripple, and the same output polarity with its input, therefore this converter is widely used in systems with input voltages that vary from nominal voltage such as battery-based systems, and renewable energy-based generation fields such as photovoltaic. However, the characteristics of the output response in the open loop condition of the SEPIC converter have a considerable overshoot, the time to reach a steady state condition is quite long, and oscillations occur at the output voltage. Then, with changes in input voltage and load it will greatly affect the output response of the SEPIC converter. Therefore, fuzzy logics are employed in order to adjust the output voltage in the SEPIC converter when there are changes in input voltages and various loads. Based on the test results, the fuzzy logic on PID controller has a better output response than the PID controller, because the output of SEPIC converter uses proposed controller, has a slight voltage deviation and recovery time than the PID controller**.**

Keywords: SEPIC converter; PID; Fuzzy logic; Voltage deviation; Recovery time

036

Comparison of Ensemble Kalman Filters with Unscented Kalman Filters for Estimating Motion of Moving Projectile Shooter

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Abstract: The projectile is the part of the bullet that glides through the air toward the target due to the thermal expansion that occurs in the sleeve. In the military field, one of the projectiles that are often used in firearms over war vehicles on land is a 12.7 × 99 mm caliber projectile. In this study, the conditions used are projectiles fired from tanks that move straight toward the target by providing variations in firing angle and variations in tank speed. In a very fast projectile motion, we need an estimator to determine the trajectory of the projectile. Estimation methods used are Ensemble Kalman Filter and Unscented Kalman Filter because the model in this study is non-linear. Where the two methods will be compared to find the optimal estimation results. Estimation results are said to be optimal if it produces an error value of less than 10%. The simulation results show that the Unscented Kalman Filter can provide more accurate results than the Ensemble Kalman Filter in estimating projectile trajectories. This is indicated by the level of accuracy of Unscented Kalman Filter of 99.9995% at position x, 99.8381% at position y, and 93.1034% at position z

Keywords: Proyektil; Ensemble Kalman Filter; Unscented Kalman Filter

037

Characterization of Speed Based On Fuel Input Ratio On Generator Set Dual Fuel (Gasoline - Biogas) Using Artificial Neural Networks

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Abstract: Energy consumption in Indonesia has increased, it makes the role of renewable energy more developed with one of the renewable energy sources being intensified is biogas, especially for household scale. The gasoline-biogas dual fuel generator set saves the use of gasoline as fuel and reduces production costs. The gasoline-biogas mixture ratio affects engine performance, one of which is the rotational speed, for this reason it is necessary to have an artificial neural network software to find the best ratio in order to get the generator set rotational speed characterization with the best engine performance value. A total of 300 variations of data were processed using 75% ANN for training with the number of hidden nodes 100 net.trainParam.goal value = 0.0001, net.trainParam.lr = 0.01, and net.trainParam.epochs = 1000, and 25% for the test, producing values RMSE training 10.4812 at node 55 and RMSE value of test 5.8301 with the results of 3445.87 rotational speed get the best ratio at 0.012 L / minute gasoline and Biogas 5 L / minute.

Keywords: Artificial Neural Network; Gasoline-Biogas

038

UNUSAITS AUV Navigation and Guidance System with Nonlinear Modeling Motion using Ensemble Kalman Filter

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Abstract: This paper presents the results of the development of navigation and guidance system of Autonomous Underwater Vehicle (AUV). AUV has an equation of motions with 6-DOF for both translational and rotational motions. This study developed trajectory estimation of a nonlinear 6-DOF model. Ensemble Kalman Filter (EnKF) was implemented to nonlinear model as to have a small position error. The application of EnKF was done with two simulations, that is, by generating 200 and 300 ensembles for UNUSAITS AUV. The main contribution of this paper is Navigation and guidance system for nonlinear models of 6-DOF UNUSAITS AUV The simulation results showed that the one by the EnKF method reached an accuracy of 99% with a position error of about 0.01% - 0.35%, whereas, the other by generating 300 ensembles showed higher accuracy with x position error of 0.011 meters, y position error of 0.007 meters, and z position error of 0.015 meters.

Keywords: AUV; Trajectory estimation; Navigation; EnKF

039

Design of Sliding Mode Control for Linearized Touristant ASV Model

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Abstract: An Autonomous Surface Vehicle (ASV) is an unmanned vessel that can automatically navigate itself in water and can be controlled from land. It is necessary to control the speed of ASV by designing a controller. In this paper, the study used an ASV Touristant prototype with a length of 3 meters, a height of 1.3 meters and a diameter of 1.5 meters. The motion is described by a 3-DOF (surge, sway and yaw) linear model resulting from the linearization of the 3-DOF nonlinear model. The objective of this paper is to compare the performance of the Sliding Mode Control (SMC) over the linearized ASV model in the presence of disturbance and in the disturbance-free case. In the disturbance-free case, the steady state error is approximately 0.2% with a settling time of about 8 seconds. The overshoot from the response of all motions is 0%. In the presence of disturbance, the steady state error is about 0.22% with a settling time of about 9 seconds. The overshoot of the response of all motions is 0%.

Keywords: Autonomous surface vehicle; Sliding mode control; Linear models; Control System

040

Estimation of UNUSAITS AUV Position of Motion Using Extended Kalman Filter (EKF)

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Abstract: One of the underwater robots is an Autonomous Underwater Vehicle (AUV). AUV is relatively flexible for ocean observation because it does not need cables and can swim freely without obstacles. This paper presents the results of the development of the AUV navigation and guidance system through the estimated trajectory. The AUV motion system has 6 degrees of freedom (DOF). The Nonlinear model of six degrees of freedom, applied to AUV, was linearized using Jacobian.matrix. The resulted linear system was then implemented as a platform to estimate the trajectory. One of the trajectory estimation methods is the Extended Kalman Filter (EKF) method. This paper implements the EKF method to estimate AUV trajectory for turning and rotating motions. The simulation results show that the EKF method has an accuracy of more than 97% with a position error of within the range of 0.05% - 3% and x position error of 0.0007325 meters, y position error of 0.014337 m meters.

Keywords: Estimation Position; AUV; 6-DOF; Extended Kalman Filter (EKF)

041

Comparative Study of Fuzzy-PID and Fuzzy-PI Control Systems on DC Motor Speed for Four-Wheeled Mobile Robotic

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Abstract: The main purpose of this paper is a comparative stage of the control system, to prove the best control method, the fuzzy-PID or fuzzy-PI control system (Apple to Apple) to control the speed of a DC motor. A simulation controller is needed to determine the characteristics of the plant used. The plants used are four DC motors which act as actuators in the FWMR. The model used is the transfer function model that has been discovered through the identification system process. Fuzzy-PID and fuzzy-PI control methods will be compared and selected based on the control system performance index. The results of performance control system response index values prove that the Kd parameter is also needed in reducing the overshoot value and speeding up the system response. Comparative research of the fuzzy-PI control method on DC motor rotational speed control results in 14.26% overshoot and 0.494s steady time. The fuzzy-PID control method gives 0% overshoot and 0.353s steady time. The fuzzy-PID control method is the best compared to the fuzzy-PI or PID control method on a DC motor rotational speed control system.

Keywords: DC Motor; Fuzzy-PID; Fuzzy-PI; Four-Wheeled Mobile Robot

042

Trajectory Estimation of Autonomous Surface Vehicle using Square Root Ensemble Kalman Filter

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Abstract: Indonesia is an archipelago and maritime country. Thus, Indonesia has the potential to develop marine tourism. In order to attract tourists to enjoy the sea view, it is necessary to provide a safe transportation with a small risk. One of the vehicles that can be used to support the marine tourism is an unmanned ship or Autonomous Surface Vehicle (ASV). ASV can move without any crew and it can be controlled from distance. This study uses a Touristant ASV with a length of 4 meters, a diameter of 1.5 m and a height of 1.3 meters. The contribution of this paper is the estimation of a Touristant ASV trajectory via its nonlinear model under some noises by using Square Root Ensemble Kalman Filter (EnSRKF) method. The noises are wind velocity and sea wave. We have conducted simulations by using 400 and 500 ensembles. The results show that the error in x position is 0.02 meters, a y position is 0.031 meters, and an xy position is 0.015 meter, with an accuracy of above 96%

Keywords: autonomous surface vehicle; nonlinear models; square root ensemble Kalman filter; position estimation

Information and Computational Engineering

043

Sleepiness Detection for the Driver Using Single Channel Eeg With Artificial Neural Network

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Abstract: People move from one area to another through land, sea, or air transportation. Land transportation includes buses, trains, bicycles, and cars. The duration of time needed to drive is not short, even when using a car; the time can be used to sleep for the passengers, but not so for the driver. Driving is a very monotonous job that results in fatigue and drowsiness. Fatigue and drowsiness can have a big effect on safety and security on the road. It can be prevented by using technological capabilities. Development of drowsiness detection uses the reading mechanism of electroencephalogram (EEG) with the classification of artificial neural networks. The method of the artificial neural network used is ANN Backpropagation. ANN Backpropagation method is a supervised artificial neural network. The data used in this study wass the value of eSense attention, theta waves, low alpha waves, and high alpha waves obtained from brain wave sensor output. The research framework used included data collection, data processing, data analysis, and conclusions. The architecture used in this study was 4 input neurons, 8 first hidden layer neurons, 4 second hidden layer neurons, and 1 output neuron. The other parameter was logsig-logsig-tansig for the use of the activation function, the learning rate of 0.1, and momentum of 0.85. The process was managed and produced the best output in the form of Mean Absolute Percentage Error (MAPE) of 0.02%. The results of the classification of drowsiness detection have an error rate of 10% and an accuracy rate of 90%.

Keywords: Sleepiness, Electroencephalograph, Driver, Artificial Neural Network

044

Unmanned Vehicle Using Received Signal Strenght Indicator (RSSI) in Instant Beverage Industry

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Abstract: Unmanned Vehicle like Forklift traffic in the warehouse of Instant Beverage Industry is not permanent and may change anytime depending on piles of pallets. The alert for moving forklift is just the horn, so the operators must be cautious while passing in the aisles. To minimize human error which may cause forklift collision, and to accelerate the picking and delivery activities using the forklifts, an alert system in the form of flexible and accurate traffic LED is really needed. The traffic LEDs of the forklift are designed to be flexible which can move alongwith the forklift. So, the LED can alert forklift operators faster as they work automatically when there are other forklifts passing around. This traffic LEDs utilizes wireless technology in the form of WI-FI signal. Changes in WI-FI signal strength will indicate the presence of a transmitter towards the receiver. Then the signal is changed into the radius of the object. The distance of the forklift approaching at a certain radius will activates the "proceed" LED on one of the forklifts and the "stop" LED at another forklift. Hence, the forklift traffic can run smoothly and safely. The ESP8266 module has a fairly accurate RSSI measurement which has low presentation error, no more than 10%. However, the Wi-Fi network scanning time a little bit longer to make RSSI conversions to the actual distance, so that the action-taking process of the prototype becomes slower. For further research, it is expected that there will be components / tools that can convert RSSI faster so that the development of distance measurement technology using Wi-Fi signals can be improved.

Keywords: ESP8266, Forklift, Received Signal Strength Indicator

045

Blended Learning Development Using Self-Paced Learning Through Video Online Learning

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Abstract: Major advances in information technology have an impact on the world of education. It could be proven by the development of the blended learning learning method. The blended learning method combines multimedia technology and traditional forms of learning to achieve the expected competencies. This learning method provides flexibility for students to choose the time and place to access unlimited learning modules. In this study, the development of a blended learning method was proposed in the information system department of Nahdlatul Ulama University in Surabaya. This research was conducted using traditional approach that begins with requirements, analysis, design, and implementation. The results showed that the development of self-paced blended learning in the form of web learning education that accommodates learning videos that could be utilized for the learning process.

Keywords: blended learning, self-paced learning, learning videos

046

Early Detection of Superficial Basal-Cell Carcinoma Skin Cancer with Extraction Method ABCD Feature Based on Android

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Abstract: Basal Cell Carcinoma (KSB) is a deadly skin cancer that has become one of the most common diseases. This disease generally occurs in areas of the skin that are often exposed to sunlight such as the face and neck. Basal cell carcinoma usually appears after more than 40 years of age, although it can also be found in children and adolescents rarely. If not treated immediately, basal cell carcinoma will spread locally, resulting in substantial tissue damage which causes impaired function. So we need the right steps in handling it.

The purpose of designing this application is to detect basal cell carcinoma skin cancer on an Android-based device. In Paper, the authors discusses ways to overcome this problem by using the ABCD Feature extraction and K -Nearest Neighbor (KNN) as a classification. This application has a user friendly application display because it was developed using a platform that can be used by all circles of science, so users do not need a qualified IT skills. The results of this study are beneficial to the community, which can be used by the community and can find out whether or not KSB is detected or not. From the results of tests that have been done, the results of feature extraction accuracy get an accuracy of 91,6%.

Keywords: BCC, ABCD Feature, KNN

047

Real-time Players Movement Monitoring on Basketball Game using UWB Multidrop Ranging and Trilateration

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Abstract: Player movement data is used by the coach or team manager to analyze the condition of each player and plan the best strategy for the match. In general, localization of existing players uses a GPS or either an image processing. However, GPS has a drawback that it cannot be used indoor, while the image processing requires high-speed cameras and also affected by its attacking angle and lighting factors in capturing players positions. UWB (Ultra-Wide Band) is a low energy radio signal modulation technology for short-distance communication with high bandwidth in most radio wave spectrums. Applications of UWB radio have been used in everyday life, including positioning. DWM1000 is one of the devices that use UWB technology. This research applies DWM1000 in such position monitoring of basketball players movement in the field. DWM1000 is a point to point ranging device, therefore for multiple node positioning, a multidrop technique is used between the three anchor nodes and five player nodes. In addition, to overcome incomplete ranging and outlier positioning data, a moving average filtering is applied in the trilateration software as pre-processing.

Keywords : basketball, movement, monitoring, UWB, localization

048

Automatic Detection of Breast Cancer in Mammographic Image Using the Histogram Oriented Gradient (HOG) Descriptor and Deep Rule Based (DRB) Classifier Method

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Abstract: Breast cancer is a cell disease in the breast glands that evolve abnormally and become benign or malignant tumors. Breast cancer is a common disease in developing countries and refers to malignancies that can be life-threatening. Mammographic imaging examination is performed to determine the mass of the breast lump to be analyzed for its malignancy. In this research, digital image processing is performed to diagnose breast cancer using mammographic images and feature extraction data with Histogram of Oriented Gradient (HOG), which is further classified using Deep Rule Based (DRB) Classifier. This research was conducted by dividing the data 90% for training data and 10% for testing data. Data are classified into three classes, consisting of normal, benignant, and malignant. The best accuracy obtained is 92.00%.

Keywords: Mammography Image, HOG Descriptor, DRB Classifier

049

Prediction of DNA Hepatitis C Virus based on Recurrent Neural Network-Back Propagation Through Time (RNN-BPTT)

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Abstract: Hepatitis C Virus (HCV) is one virus that has a high mutation rate in the world. To predict the mutation, can be used fundamental analysis and technical analysis. Fundamental analysis relies on external factors such as attributes attached to the primer and the isolate. While technical analysis learns the movement of the mutation itself by relying on graphs and mathematical formulas. This study combines fundamental analysis and technical analysis in predicting HCV mutations. Application of Recurrent Neural Network (RNN) method as a form of technical analysis and fundamental analysis is applied in the form of including some fundamental factor data as training datasets. RNN is a neural network that has a feedback connection to the neuron itself, or a previous neuron. RNN is able to reactivate actual data values in the past to be re-entered with actual data values at the moment. This study used Elman network architecture with Back Propagation Through Time learning algorithm (BPTT) and used Linear normalization. The problem when predicting HCV mutations is how to determine the best learning rate value. Therefore the fundamental approach will also be incorporated into the neural network. On the backward process, to calculate the value of weight correction is to multiply the value of learning rate with hidden neuron value. We propose that each neuron has an adaptive learning rate according to the condition of the neuron. Where each input neuron from this study is the result of the HCV primer climmer in preliminary research. Each primer has attributes that can be developed as decision support. Test results show the smallest error of the prediction process by RMSE are 0.0163000, with accuracy prediction value are 99%.

Keywords : String prediction, Recurrent Neural Network (RNN), Back Propagation Through Times (BPTT), DNA HCV

050

Single Speaker Recognition Using Deep Belief Network Gender Classification Voices

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Abstract : Recently, the algorithm of machine learning are used to able to train, enhance, characterize and anticipate the data results accurately. In a way to training, the process on the algorithm can be able to produce an appropriate model based on that data; it's like supervised and unsupervised data. In this paper, we tried to trace the gender (male and female) from acoustic data i.e., pitch, median, frequency etc. The gender that would like to implement is classified on the basis of the intensity of their utterances. To analyze the utterances, the voice intensity measuring by the hamming window to make a normalize curve to obtain the peaks of the utterances where peaks are found from each frame of speech utterance when it is divided into frames of the length of 20 milliseconds. At certain amplitude levels it can be considered to find a peak. As well as making decisions about gender use a thresholds that are adapted are adjusted. If the area of an utterance is above the threshold the gender type is a female otherwise male. After that, we handle the feature learning from the utterance into deep belief network as a machine learning tool to predict single speech by gender classification voices with optimization (taboo search) to train several neurons in the initial weight vector for the accuracy of female and male voices 75.67% and 80.83% precisely.

Keywords : machine learning, deep belief network, gender classification, predictive algortihm

051

Subarray Design with Two Rectangular Elements for Massive MIMO System Development

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Abstract: Wireless communication for the future will use 5G standards, supported by an antenna system with Massive MIMO technology incorporating subarrays. A subarray microstrip antenna that has small element spacing will result in mutual coupling effects. This paper proposes design of a two rectangular subarray antenna with coaxial feeding for massive MIMO development and analysis the effect of mutual coupling at varying spacing element. Antennas are designed and simulated, namely a single antenna, a two element antenna arrayed in the E-plane and a two element antenna arrayed in the H-plane. The simulation results show that the mutual coupling of the two antenna elements arrayed in the E-plane for all element spacing is less than -20 dB, which means the mutual coupling effect can be ignored. Whereas the mutual coupling of the two antenna elements arrayed in the H-plane for all spacing elements is greater than -20 dB, which means the value of the mutual coupling must be considered. The bandwidth of the two element subarrays on E and H-plane is 77.3-88.5 MHz depending on the element spacing, which is still below 100 MHz required for 5G application.

Keywords: Antenna, design, rectangular, mutual coupling, return loss, Massive MIMO

052

Early Detection of Diabetes Mellitus using Statistical Texture Feature in Finger Nail Image

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Abstract: The aim of the study was to determine range number of statistical texture of finger nail feature that could be classified into Pre-Diabetes, Normal and Diabetes status. The research used three steps i.e pre-processing, feature extraction, and distribution of frequency group. Pre-processing included resize, cropping and grayscaling. Feature extraction used to obtain mean, variance, skewness, kurtosis and entropy based on statistical texture of finger nail feature. Furthermore, determined range number of texture image of finger nail used distribution frequency as grouping process. Based on the results showed that range number of mean of Pre-diabetes data was 137 -145, Normal data was 119 – 126, and Diabetes data was 127 – 135. Variance of each categories i.e Pre-diabetes data was 3734 – 4614, Normal data was 3802 – 4486, and Diabetes data was 3175 – 3892. Range number of skewness showed that Prediabetes data was 1,21 – 1,44, Normal data was about 0,8 – 1,02 and Diabetes data was 1,22 – 1,42. Kurtosis obtained Pre-diabetes data was (-0,44) – (-0,07), Normal data was (-0,56) – (-0,08) and Diabetes data was (-0,24) – 0,31. Also, Entropy range number for Pre-diabetes data was 5,39 – 6,07, Normal data was 5,46 -5,69 and Diabetes data was 5,27 – 5,49. As the conclusion, there was different range number of mean. Skewness and variance had overlapping range number between prediabetes and diabetes data. Kurtosis and entropy had overlapping data in all categories. Combination of two or more features of finger nail image need to improve for getting best quality programs of Diabetes Melitus detection.

Keywords: diabetes mellitus, texture feature, statistical texture feature, finger nail image

053

Building Crack Due To Lombok Earthquake Classification Based on GLCM Features and SVM Classifier

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Abstract: Cracks classification on buildings caused by nat-ural disasters such as earthquakes can be done manually by analyzing walls, beams, columns, and floors based on visual inspection of cracks diameter, depth, and length. The manual assessment method requires experts in structural engineering who have enough knowledge and experience in building damage assessment. To facilitate and overcome these problems, a crack classification system is developed by using a digital image process-ing approach (pattern recognition) that can classify cracks into the mild, moderate, or severe categories using GLCM features and SVM classifier. Based on the experimental results that the proposed method has appropriately worked for classification of two crack classes (mild and severe) indicated by 94.44%5 of accuracy, 88.89% of precision, and 100.00% of recall. While for three crack classes (mild, moderate, and severe) obtained the accuracy 81,48%, recall 81,41% and precision 88,09%. Further-more, the proposed system also shows robust performance against large variability of crack and non-crack images, and the SVM classifier outperforms over the statistical-based classifier (LDA and QDA).

Keywords: Cracks, Image Analysis, GLCM, SVM, classifi-cation

054

Early Detection Of Skin Basal Cell Carcinoma Nodular Using Ectraction Methods ABCD Feature Comparison With Dematofibroma Data

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Abstract: Cancer is one of the biggest causes of death now, cancer is also a disease that is very difficult to cure and still relatively difficult to treat, the skin can also be a medium that can cause cancer. Prevention and detection of skin cancer early is one of the best ways to reduce the greater risk that can be caused by the disease, in this paper will explain the making of applications to detection cancer skin Carcinoma Basal Cell type nodular using Image Processing with tested by comparing the feature dermatofibroma and Basal Cell Carcinoma features. In this paper the system is made based on Android to support input features by comparing the 4 criteria of the feature, that is Asymmetry, Border, Color, and Diameter. The extraction method used in the feature xtraction is the ABCD feature with classification using K-Nearest Neighbor.

Keywords: Basal Cell Carcinoma, Image Processing, Dermatofibroma, ABCD Feature, K-Nearest Neighbor.

055

Opinion Spam Detection in Product Reviews Using Self Training - Semi Supervised Learning Approach

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Abstract: The review of a product can influence a buyer's decision to buy the product. In addition to influencing buyer decisions, fake reviews can also confuse buyers who are looking for product information from honest and genuine reviews. We need a system that can filter spam to reduce the negative influence on product selling and product review writings. Spam that will be detected is the type of brand only spam and not a review. Those types get the initial label through manual labeling. Manual labeling requires a lot of time and effort. Therefore, in this paper, we proposed a self-training semi-supervised learning approach. This method labels spam from the prediction of the labeled training data. The best results were obtained with a scenario without stemming, merging of review centric features and bigram, SMOTE borderline1 oversampling and Polynomial SVM kernel that has accuracy 86.33%.

Keywords: bigram, Oversampling SMOTE, Review Centric Features, Semi -Supervised Learning, Self Training, Support Vector Machine

056

Face Recognition in Kindergarten Students using the Principal Component Analysis Algorithm

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Abstract: In kindergarten, it is important to know the activities of each student to evaluate how individual student learns and adapts to school environment. Manually tracking individual student activities during class is hard for kindergarten teachers. In this paper, we propose face recognition in the kindergarten students as a first step to trace and record individual student activities. A video of kindergarten students is converted into digital images. Faces are detected using Viola-Jones method. The extraction feature on the images is done using the Principle Component Analysis (PCA) method. We implement Euclidean Distance to recognize student's face. Our experiments use 70 images as data training. The data training consists of 5 different images from 14 students. The experiment results show 91.42% accuracy by testing 14 new images of the students.

Keywords: Face Detection, Viola-Jones, Face Recognition, Principle Component Analysis (PCA), Euclidean Distance

057

Size, Topology, and Shape Optimization of Truss Structures using Symbiotic Organisms Search

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Abstract: Truss structures are common in the building industry. One way to contain construction costs is to implement structural optimization. Optimization has to consider cross-sectional size, area, topology, and node coordinates as design variables. However, each truss structure has numerous complex constraints and variables that make optimizing this structure complex and difficult. The metaheuristic method is efficient and effective in solving large and complex problems. This paper tested three metaheuristic algorithms: particle swarm optimization (PSO), differential evolution (DE), and symbiotic organisms search (SOS). Each algorithm was used to optimize a 10 -bar planar truss structure and a 15-bar planar truss structure. SOS was found to have the best optimization results, convergence behavior, and consistency.

Keywords: metaheuristic algorithms, truss structure, optimization

058

Induction Motor Stator Fault Detection Using Discrete Wavelet Transform Based on Statistical Parameters

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Abstract: The aim of the paper is to identification the stator faults in induction motors. Stator fault affects other fault, especially in electrical systems such as the appearance of sparks on the rotor shaft, reducing rotor rotation, and increase in temperature which causes the stator to burn. Therefore, an early detection system is needed to determine stator fault. In this research, the identification stator fault conditions using current signal analysis. Furthermore, the current signal is extracted using Discrete Wavelet Transform (DWT) based on statistical parameters. The experimental results are the signal decomposition level from Detail Coefficient 1 (D1) to Detail Coefficient 5 (D5) and Approximation 5. The decomposition signal results in the Detail Coefficient 4 (D4) is a significant difference signal in stator normal condition and stator fault condition. The results of the signal Detail Coefficient 4 (D4) obtained are very difficult to identify. Therefore, the statistical values used are RMS, Kurtosis, and Variance which show the differences in the values of each stator condition. The experimental results can identify the normal stator condition and 5 to 60 turn fault stator windings.

Keywords: Induction Motor, Stator, Discrete Wavelet Transform, Statistical

059

Simulation Of Two Dimensional Navier-Stokes Equation On Circular Body And Merapi Shape Barrier

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Abstract : The numerical solution of the Navier-Stokes equa-tion has been succeeding acquired by finite difference method. The numerical scheme is applied in several cases, internal flow, flow around a circular object, last but not least is flow simulation around the Merapi mountain model. The fluid which studied in this research is viscous and incompressible. In this paper, we introduce a convenient and robust method for defining geometries in the computational domain. The discussion in this simulation involving: how fluid particle movement affect each other, and how the fluid interacts with the geometry of an object and the wall of a channel. There are a consistent physical phenomenon that can be observed such as: Pressure diffusion, Fluid particles compression and Fluid particles dragging effect near the object, finally increases velocity due to the consequence of continuity equation.

Keywords : Navier-Stokes equation, finite difference, ob-ject's geometry.

060

Autonomous Car Simulation Using Evolutionary Neural Network Algorithm

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Abstract : Automation with artificial intelligence (AI) has widely implemented in robotics, transportation and manufacture. AI has become a powerful technology that change human life and help human more flexible doing something. AI has many branches of knowledge, i.e. machine learning and deep learning. Nowadays, study and discussion about AI is closer to machine learning and deep learning implementation. In this paper, it will show a result of simulation of an autonomous car using the evolutionary neural network algorithm which combines genetic algorithm and neural network to get the best result, the best route choice and to know the direction . The purpose of the simulation is to test the model that we develop, so the evolutionary neural network algorithm that implemented to the autonomous car be able to deliver the best solution before it implements in the real machine or car technology. Genetic algorithm combines with a neural network to reach evolution condition to get the best model solution. The evolution process is achieved through crossover, mutation and selection process, so the implementation of the evolutionary neural network algorithm will give the best result from the iteration of the experiment. The result of our experiment shows that evolutionary neural network algorithm give the best result within 3 layer configuration, with iteration average is 14.5 reach check point 3 in the simulation. Based on the simulation, our car model can find out the right direction.

Keywords : artificial intelligence, machine learning, genetic algorithm, neural network, autonomous car

061

Underwater Image Enhancement: Combining the Polarization and the Dark Channel Prior Approaches

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Abstract: Growing interest to the underwater image enhancement was observed in the recent years, particularly for several research applications. Polarization method as hardware approach and Channel Prior (DCP) as software approach have been separately implemented in this topic. In several literatures on the underwater image enhancement, these both approaches were reported to provide positive contributions. But from studies done, reports on the effort to combine both above mentioned approaches for underwater image enhancement were seldom found. The method to carry out this study was using simulator tank, which included turbid water to simulate the natural turbid water. The result express that polarizer to be an important variable in getting raw image for further image processing using DCP. Furthermore, the result indicated that integrating both methods was beneficial to gain more visible underwater image for further research.

Keywords: Polarization, Dark Channel Prior, Underwater, Image Processing, Image Enhancement

062

Water Leak Detection and Shut-off System on Water Distribution Pipe Network Using Wireless Sensor Network

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Abstract: The growing clean water needs in Malang City, East Java, Indonesia encourages the government to improve the performance of water supply services, including minimizing the amount of water loss distributed to customers due to pipe leakage. Water flow monitoring and leakage systems based on the wireless sensor network could be used to present information on the water flow in a pipe and to shut-off a valve if there is a leak. The data then could be sent to the server to be displayed on a website. The developed system was able to read the water volume with an average error value of 2.23% of the measured total volume and determine the leakage pipeline with a leakage measuring limit of 30mL/sec. The system also had a maximum transmission distance between nodes of 170 meters and it was able to present monitored nodes data into a website. With a small error value and the large transmission range, it was expected that the pipeline leak could be detected sooner and precautionary measures could also be taken.

Keywords: Wireless Sensor Network, Leakage, Monitoring, database, server

Design and System

063

Spare Part Supplier Selection Model Using Decision Tree Classification Techniques: J48 Algorithm

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Abstract: Spare parts are goods that consist of several components that form a single unit and have certain functions. Supplier selection is a strategic activity in purchasing management in the supply chain. Supplier selection models represent only one or more of several areas in supply chain management. To facilitate companies in selecting suppliers, a supplier selection model is needed to make it easier for companies to select suppliers and make it easier to see strategic directions in supply chain management to take several criteria from suppliers to achieve priorities desired by the company. This research was conducted at a manufacturing company engaged in car spare parts with rubber raw materials. In this study the problems that occur are the difficulty of the company in selecting suppliers based on criteria that are in accordance with the company and the delay in the receipt of raw materials, and the lack of raw materials supplied from each supplier. This study aims to classify suppliers based on desired criteria by the company and to design a supplier selection model in the long term. This study uses data mining techniques using the J48 algorithm or decision tree. The J48 algorithm is produced by a supplier selection model with 2 rule selection models to classify efficient suppliers and inefficient suppliers. The accuracy of the Decision Tree model is 90.8547%, the kappa statistic value is 0.8084, the MAE error value is 0.1256 and the MSE error value is 0.1478. From the J48 algorithm the biggest gain is the criteria for quality, price, delivery, and warranty and complaint services.

Keywords: Supplier Selection Model, Efficient Supplier, Decision Tree, J48 Algorithm

064

Design of Level Control System in Storage Tank Using Ultrasonic Sensor on Mini Plant for Purification of Salt

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Abstract: Along with the growth and development of industry in Indonesia, national salt is needed increase anymore. Automatic Coagulant Mixing Machine of Poly Aluminum Chloride is an innovation automatic mixing tool that serves as an effort to improve the quality of farmer salt into industrial. This system can be done by adding coagulant poly aluminum chloride which in mixed automatically by using recrystallization process. Recrystallization is a crystalline formation of a solution or fused from an existing material. In this final project is designed salt mixing tool with aquades water and salt level control in the storage tank. In this final assignment research using ultrasonic sensors HC-SR04 and Atmega 8525, then displayed into LCD 4x20.Dengan uncertainty level is ± 0.37645189, with 95% confidence level. Ultrasonic sensor HC-SR04 works adjust the volume in salt water pouring tanks. With the response of the control system when set point = 12 Cm takes 26.2 seconds to reach steady state, rise time (Tr) 23.5 seconds, Overshoot (Mp) 13Cm, Settling time (Ts) 1.6 seconds and steady state error 1 Cm.

Keywords: Ultrasonic HC-SR04; level; salt

065

Design and Simulation of Herbal Medicine Milling System

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Abstract: Herbs are herbal medicines produced from traditional plants such as ginger, turmeric, meet comedy, and others. In Indonesia itself has a wealth of plants medicines and herbal remedies from various tribes spread in various regions. Research showing that 49.53% of Indonesia's population uses good herbal medicine to borrow for health care because of illness. Residents who consume herbal medicine as many as 95.6% are stated to enjoy the of drinking herbal medicine. Survey also shows that of the people who use herbal medicine, 55.3% consume herbal medicine in liquid form, while the rest (44.7%) is consumed herbs in the form of powder, pills, capsules and tablets. Based on the calculation, obtained minimum power of engine is 7.737 HP and the age bearing of design is 49103,08 working hours. Beside that, simulation was done and gotten responses with three variations in the value of B. The resulting system response with fast settling time and low oscillation. It got stable response with source of engine torque.

Keywords: Jamu Powder; Automatic tool; 1 phase induction motor; microcontroller

066

Web-Based Flood Warning System Using Decision Tree Method

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Abstract: Flooding is a disaster that often occurs in Indonesia, especially in the Dayahkolout Region from the beginning until now, and causes very significant damage in life. Based on this problem, we need a system that is able to handle the problem. This system is designed using the Decision Tree C4.5 Algorithm method to predict potentially flooded areas based on parameters that will later be connected to the Internet of Things. The parameters used are water level, rainfall, and water discharge. Where each parameter will be connected to IoT and the results of the predictions will later be shown on the web application. From the results of testing that has been done, the C4.5 algorithm has the best performance on the 70%: 30% data partition which has an accuracy of 100%.

Keywords: Flood, Antares, Internet of Things, River, Decision Tree C4.5

067

Detection of Fire With Image Processing Using Backpropagation Method

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Abstract: Fire is a natural disaster event that is very detrimental to nature and a group of individuals. Fires can be caused by human activities because of the neglect of man himself. Examples of fires in Indonesia, namely large fires in Riau forest, cause neighboring countries such as Malaysia, Singapore to receive shipments of smoke from Indonesia due to the forest fires. In Indonesia, there have been many fire incidents with quite crowded places such as markets, offices, factories. Various ways to prevent fires are still used such as alarms, fire alarms, sensors, and others. Prevention is the average still manual or the technology used is less sophisticated. The sensor is enough to notify the alarm system but damage to the sensor will not be visible to the human head which indicates that the sensor is not a fire prevention tool that is quite effective. The author concludes that the weakness of the security system from fire prevention itself. In this case, a fire detection system will be designed, the sensor is still used, only a camera/webcam device is added as efficient use of digital security. This fire system uses the backpropagation method used to carry out object recognition and fire patterns. This system can improve safety in fire prevention. The output of this final project is a notification that will be sent by the detection system to fire on social media in the form of a telegram to the user. The fire detection system created has an accuracy rate of 98,75% and realtime accuracy got 95%.

Keywords: Fire, Sensor, Backpropagation

068

Baggage Tracing at Airports using Near Field Communication

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Abstract: This study explored the usability of Near Field Communication (NFC) as a contactless data transmission in an airport to help passenger and baggage management run efficiently, passenger use their smartphone to do frequent authorization in airport and use an NFC tag to store their baggage status and location during the process in airport. The prototype system was developed using several NFC readers and applications developed on Android-based phones. The test results show that the prototype can work according to the design.

Keywords: Near Field Communication, baggage tracing, baggage check-in, e-airport

069

Taxonomy of IoT Woodworking CNC Machine 1000 (WCM-1000) Under Environment of Industry 4.0

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Abstract: Nowdays all of industry want to increase their productivity and efficiency by using IoT and industry 4.0 technologies. Automation is the first step to make it. This paper will present the taxonomy of a piece of equipment, the WCM-1000. WCM-1ooo is a CNC machine for manufacturing tools made from wood, acrylic, and plastic. This machine is intended for small and medium industries to help improve productivity and product quality

Keywords: IoT; Industry 4.0; WCM1000; productivity; quality

070

User Experience Testing Based Reliability Analysis For Evaluating Psymo Application

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Abstract: This paper implements virtual reality to develop an innovative learning media. The application developed is named as Psymo. Psymo uses Oculus Rift and Leap Motion controller to provide the virtual world. The reliability of Psymo is analyzed based on the user experience. The user experience is tested in some students at SD Muhammadiyah 26 Surabaya. The user experience testing is measured based on three aspects i.e. interface, immersity, and convenience. The interface is about interactive color and design. It is also related to the easy navigation of the developed application. Immersity is about the sensation of real-world simulation, and user's understanding about instruction given. And convenience is related to any error, bug, and fault found in the application. By using those three parameters, this research tries to measure the user experience testing based reliability analysis for evaluating Psymo application.

Keywords: Leap Motion, Oculus Rift, Elementary school evaluation, Education, Independent learning, Psychomotor

071

Smart Lamp Control Based on User Behavior For Two Lamps Using K-Nearest Neighbour

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Abstract: The number of housing needs each year increases. And these problems have an impact on the use of electricity every year. This condition results in the expense of excess electricity. To anticipate electricity energy savings, management of electronic devices is needed. With the existence of modern technology, the concept of home itself is starting to be integrated with the automation system, one of which is a smart home. In this study an automation system will be created to record user behavior in using electronic devices. By using the K-Nearest Neighbor classification method, data on user behavior recorded will be used as a set of information processed by the system to make predictions on a device. So that the automation system can work according to user behavior. The results of system performance testing in classifying data produce an average accuracy of 97.62% for lamp one, and 98.36% for lamp two. These results are predictive results that are not necessarily accurate according to the actual conditions, due to different user behavior.

Keywords: Smart Home, User Behavior, K-Nearest Neighbor

072

Power Extraction Based on Particle Swarm Optimization For Wind Energy Conversion System

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Abstract: The use of wind energy as an electric energy generator is increasing to overcome the limitations of conventional energy and reduce the greenhouse-effect pollution. Indonesia has considerable potential for wind energy but wind energy is very dependent on fluctuating wind speeds. To improve the efficiency of a wind energy conversion system (WECS), at each wind speed, the WECS must be able to extract the maximum power so that a controller is needed. This paper presents the Particle Swarm Optimization (PSO) algorithm to extract the maximum power on the Permanent Magnet Synchronous Generator (PMSG) standalone wind turbine system through controlling the duty cycle of the buck converter. Based on the simulation result, the PSO algorithm can follow rapid wind speed changes and extracted maximum power at each wind speed. In addition, the PSO algorithm can maintain the power conversion coefficient at the optimal value for rapid wind speed changes. Compared by WECS without power extraction, the PSO algorithm has better performance and bigger output power.

Keywords: wind turbine; power extraction; PSO

073

Performance of Water Hammer Protection Systems in Pumping Station of Water Supply Utility, PT. PDAM Surabaya

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Abstract: Water hammer is a common phenomenon in piping system, especially for delivering water in a large capacity. The presence of non-return valve installed after pump's discharge that preventing reverse rotation, can causes sudden change in flow direction and causes water hammer. PT PDAM Surabaya installed fly wheel on each 4 (four) pump's shaft and a surge tank as water hammer protection system. This study is intended to evaluate performance of the protection system against water hammer. The study uses a numerical simulation of water hammer and is based on actual piping system. According to simulation result, existing protection system is capable in eliminating water hammer when one of three running pumps is fails. However, when the worst case appears (namely when all of three running pumps are fail due to electricity black out). Simulation result has maximum pressure until 36.3 bar which is bigger than pipe strength, and minimum pressure reach -0.004 bar which causes cavitation. For improving its performance, additional simulation is performing by replacing surge tank with bladder surge tank. The additional simulation result shows that bladder surge tank is able to eliminate fluctuating pressure into value smaller than its pipe strength. Maximum pressure for bladder tank is 24.658 bar which is lower than pipe strength, and minimum pressure is 0,04236 bar which is higher than its cavitation pressure. Based on the simulations, it is recommended that PT PDAM Surabaya installs bladder surge tank to prevent piping damage due to electricity black out.

Keywords: water hammer, piping system, method of characteristic, water supply

Material

Energy

074

Optimal Power Flow of the Manokwari Power Grid Regarding Penetration of 20 MW Combined Cycle Power Plant

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Abstract: Optimal power flow (OPF) is used to calculate the optimal power in to a power grid under some constraints. As a heuristic optimization method, particle swarm optimization (PSO) has been used to obtain optimal solution of penetration of 20 MW Combined Cycle Power Plant (CCPP) of PT. SDIC into 36 bus of Manokwari power grid owned by PT. PLN P2B. Results of simulation show that power loss is about 6.9749 MW by occupying the CCPP power plant at maximum of 20 MW while the minimum cost is reached in generation of 4.6298 MW of the CCPP generator when the other generators of micro-hydro and diesel power plants are work at maximum operation.

Keywords: OPF, PSO, CCPP, PLN P2B, Power grid

075

Performance of Water Hammer Protection Systems in Pumping Station of Water Supply Utility, PT. PDAM Surabaya

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Abstract: Water hammer is a common phenomenon in piping system, especially for delivering water in a large capacity. The presence of non-return valve installed after pump's discharge that preventing reverse rotation, can causes sudden change in flow direction and causes water hammer. PT PDAM Surabaya installed fly wheel on each 4 (four) pump's shaft and a surge tank as water hammer protection system. This study is intended to evaluate performance of the protection system against water hammer. The study uses a numerical simulation of water hammer and is based on actual piping system. According to simulation result, existing protection system is capable in eliminating water hammer when one of three running pumps is fails. However, when the worst case appears (namely when all of three running pumps are fail due to electricity black out). Simulation result has maximum pressure until 36.3 bar which is bigger than pipe strength, and minimum pressure reach -0.004 bar which causes cavitation. For improving its performance, additional simulation is performing by replacing surge tank with bladder surge tank. The additional simulation result shows that bladder surge tank is able to eliminate fluctuating pressure into value smaller than its pipe strength. Maximum pressure for bladder tank is 24.658 bar which is lower than pipe strength, and minimum pressure is 0,04236 bar which is higher than its cavitation pressure. Based on the simulations, it is recommended that PT PDAM Surabaya installs bladder surge tank to prevent piping damage due to electricity black out.

Keywords: water hammer, piping system, method of characteristic, water supply

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Date of Conference: 9-10 Oct. 2019

DOI: 10.1109/ICAMIMIA47173.2019.9223413

Date Added to IEEE *Xplore*: 14 October 2020

Publisher: IEEE

ISBN Information:

Conference Location: Batu, Indonesia

Metrics

Size, Topology, and Shape Optimization of Truss Structures using Symbiotic Organisms Search

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Abstract— **Truss structures are common in the building industry. One way to contain construction costs is to implement structural optimization. Optimization has to consider cross-sectional size, area, topology, and node coordinates as design variables. However, each truss structure has numerous complex constraints and variables that make optimizing this structure complex and difficult. The metaheuristic method is efficient and effective in solving large and complex problems. This paper tested three metaheuristic algorithms: particle swarm optimization (PSO), differential evolution (DE), and symbiotic organisms search (SOS). Each algorithm was used to optimize a 10-bar planar truss structure and a 15-bar planar truss structure. SOS was found to have the best optimization results, convergence behavior, and consistency.**

Keywords— metaheuristic algorithms, truss structure, optimization

I. Introduction

Truss structure optimization has become one of the "hot" issues in structural engineering for the past decades. A truss structure usually involves interconnected structural members that behave as one single object, where each member is subjected to tension or compression forces only [1]. The most widely studied methods of truss structure optimization are size and topology optimization [2]. Size optimization is used to minimize the cross-sectional area of each member of the truss structure. Topology optimization is used to optimize the number of elements while paying attention to structural stability. A trial-and-error approach is commonly used by engineers to design an optimal truss structure; however, this approach is proven to be time-consuming and cost-inefficient [1].

Truss structure optimization involves many variables and constraints, which makes it more complex and difficult. Additionally, many studies have focused only on sizing and topology, leaving the coordinates of the nodes and the shape of the structure constant. Therefore, current studies are now focusing on finding the best optimization method for truss structure design. By optimizing the size, topology, and shape of the truss structure simultaneously more efficient results can be achieved [3].

The field of metaheuristic algorithms has attracted increased attention from the field of optimization, which uses natural phenomena and randomization concepts to find optimal solutions [3]. Particle swarm optimization (PSO) [4] and differential evolution (DE) [5] are examples of metaheuristic algorithms commonly used to solve many optimization problems. Recently, symbiotic organisms search (SOS) was proposed by Cheng and Prayogo, and has been proven to deliver outstanding performance in structural optimization [6]. This research investigates the performance of SOS in truss design optimization that incorporates size, topology, and shape. The total mass of the truss structure is considered the object of optimization. Additionally, this research uses metaheuristic algorithms, namely, PSO and DE, for comparison purposes.

II. Symbiotic Organisms Search (SOS)

The SOS algorithm was developed by Cheng and Prayogo in 2014 [4]. SOS is a simple and very powerful metaheuristic algorithm, inspired by the interaction between living things known as "symbiosis." SOS applies three forms of symbiosis often seen in nature: mutualism, commensalism, and parasitism. SOS has been used to solve multiple complex and challenging problems since its discovery [7,8].

Mutualism describes the relationship between two organisms that are mutually beneficial to one another such as the relationship between bees and flowers. In the SOS algorithm, if the results of a newer organism are better than the previous organism, then the organism will be replaced by the newer organism. Based on Cheng and Prayogo [6], a mathematical model of the SOS symbiotic mutualism algorithm is found in Eqs. (1)–(3):

$$X_{inew} = X_i + rand(0,1)*(X_{best} - MV*BF_1), \quad (1)$$

$$X_{jnew} = X_j + rand(0,1)*(X_{best} - MV*BF_2), \quad (2)$$

$$MV = \frac{X_i + X_j}{2}, \quad (3)$$

where X_i is organisms that correspond to *i*-members in the ecosystem; X_j is randomly selected organism from the ecosystem; X_{inew} is new candidate for X_i ; X_{jnew} is new candidate for X_j; BF_1 and BF_2 are random numbers between one and two; and X_{best} is the global best solution.

Commensalism describes the relationship between two organisms in which only one benefits while the other does not gain any advantage or disadvantage. The relationship between remora fish with sharks is one example of commensalism. In the SOS algorithm, organism *i* (X_i) will

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interact with organism k (X_k), where X_k is taken randomly and $k \neq i$. This interaction will only renew organism i. The formula for X_{inew} in this symbiosis is shown as Eq. (4):

$$X_{inew} = X_i + rand(-1,1) * (X_{best} - X_k). \quad (4)$$

Parasitism describes the relationship between two organisms that benefits one organism while the other is harmed. The relationship between Anopheles mosquitoes and humans is an example of symbiotic parasitism. Anopheles mosquitoes carry plasmodium parasite into the human body, which can cause malaria. The organism X_i is given a similar role as the Anopheles mosquito through an artificial parasite or "parasite vector." Furthermore, the fitness value of the parasite vector will be compared with the fitness value of the X_j organism. If the fitness value of the parasite vector is better, then the position of organism X_j will be replaced by the parasite vector.

III. Problem Formulation

The objective of this study is to minimize the weight of the truss structure without violating any constraints. The constraints used in this study are static constraints and include nodal displacement, element stress, validity, and kinematic stability of structure. The mathematical formulation of this optimization problem can be performed as follows:

Find, $X = \{A_1, A_2, \ldots, A_m, \xi_1, \xi_2, \ldots, \xi_n\}$ (5)

To minimize, $f(x) = \sum_{i=1}^{m} B_i A_i \rho_i L_i$

where, $B_i = \begin{cases} 0, \text{ if } A_i < Critical\ Area \\ 1, \text{ if } A_i \geq Critical\ Area \end{cases}$

Subjected to:

g_1: Check on validity of structure

g_2 : Check on stability of structure

$g_3(X)$: Stress constraints, $|B_i\sigma_i| - |\sigma_i^{max}| \leq 0$

$g_4(X)$: Displacement constraints, $|\delta_i| - |\delta_j^{max}| \leq 0$

$g_5(X)$: Size constraints, $A_i^{Critical} \leq A_i \leq A_i^{Upper}$

$g_6(X)$: Shape constraints, $\xi_j^{Lower} \leq \xi_j \leq \xi_j^{Upper}$

where, $i = 1,2,..,m$ and $j = 1,2,...,n$,

and where A_i, ρ_i, L_i and σ_i are cross-sectional area, density, modules of elasticity, length, and stress of element i, respectively. σ_i and ξ_j are real values of nodal displacement and coordinates of node j, respectively. B_i is a topological bit, which is 0 for absence and 1 for presence of element i, respectively. The truss structure is called invalid (g_1) if during the optimization process there are loaded or support nodes being deleted.

IV. Methodology

The combination of direct stiffness method (DSM) and metaheuristics is used for this optimization. Metaheuristics is used to find the optimal size, topology, and shape of the truss structure while DSM is used to run the structural calculation. DSM as well as the metaheuristic algorithms was written using MATLAB 2017a. A flow chart of the truss optimization process is presented as Fig. 1.

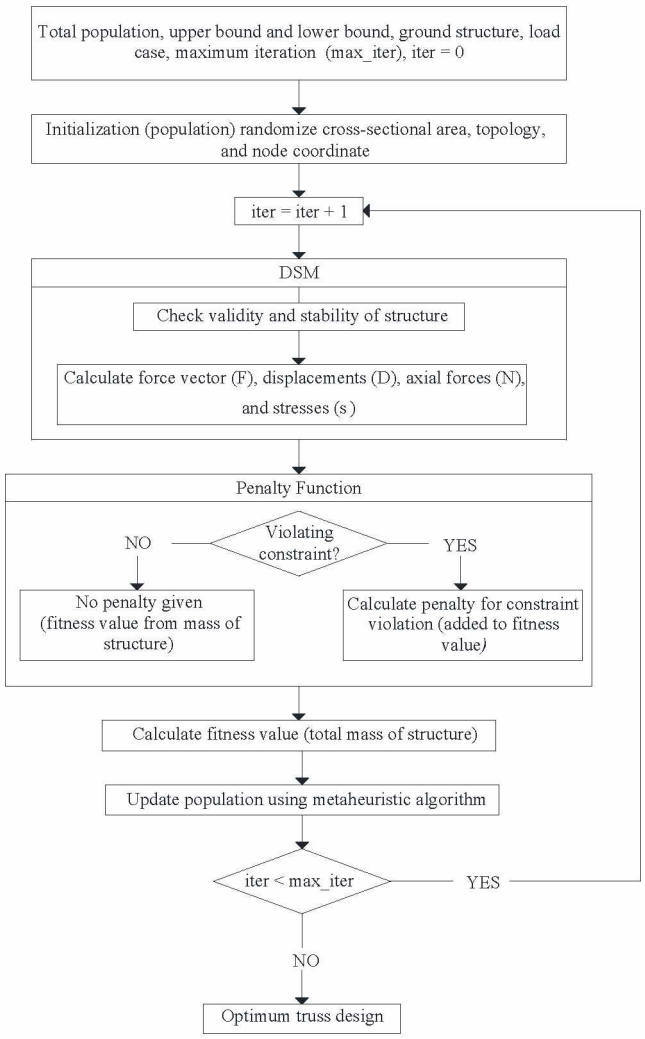

Fig. 1. Flow chart for truss optimization

DSM outputs are the displacement of each node as well as the axial force and stress of each element. These outputs are used as constraints for this optimization. Whenever a solution violates the constraint, a penalty is given to the solution. In this study, stability is reviewed in two ways. The structure is unstable when the rank of the global stiffness matrix is not same as the size of global stiffness matrix or the global stiffness matrix is not definitely positive. When there are constraint violations, a penalty value will be added to the total mass of the structure using Eqs. (6)–(8) [2]:

$$F_{penalty} = (1 + \varepsilon_1 \times C)^{\varepsilon_2}, \quad (6)$$

$$C = \sum_{i=1}^{q} C_i, \quad (7)$$

$$C_i = \left| 1 - \frac{p_i}{p_i^*} \right|. \quad (8)$$

p_i is a level of violation that is violated against the p_1^* limit, q is the number of constraints used, and ε_1 and ε_2 are parameters set by the researcher. This study refers to [2] on the values of ε_1 and ε_2 being 3. Then, the results of the $F_{penalty}$ will be multiplied by the total mass of the structure to obtain the fitness value.

V. Test Problem and Results

This paper compares three metaheuristic algorithm performances using planar and spatial bar structure problems. Each structure has their load case and discrete variables, which will be described next. The goal is to minimize the weight of the structure while not violating the constraints. All algorithms were run 30 times and with 50 populations. Structures are analyzed using a direct stiffness method. Algorithms and structural analyses were coded in MATLAB 2017a. Cognitive (C_1) and social (C_2) parameters for PSO were set to 2 and inertia weight (W) was set to 0.8.

A. Planar 10-bar truss structure

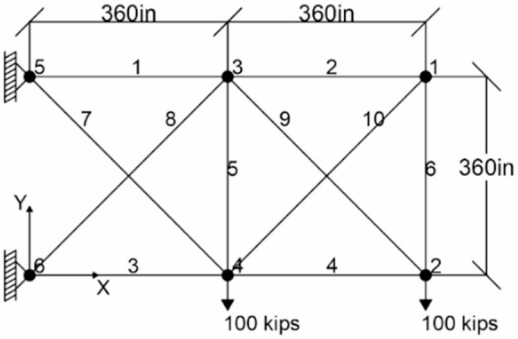

Fig. 2. Ground structure of 10-bar truss

This 10-bar structure has six nodes and twelve degrees of freedom due to X and Y directions as shown in Fig. 2. The material density is 0.1 lb/in^3 and elastic modulus 107 psi. The stress limits for compression/tension is 25,000 psi and displacement should be not more than ±2 in. There are 13 design variables in this problem: ten cross-section area variables and three geometric variables. For geometric variables, nodes 1, 3, and 5 could move between 180 and 1000 inches in Y direction. The cross-sectional areas available are:

D = [0.1, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5, 9.0, 9.5, 10.0, 10.5, 11.0, 11.5, 12.0, 12.5, 13.0, 13.5, 14.0, 14.5, 15.0, 15.5, 16.0, 16.5, 17.0, 17.5, 18.0, 18.5, 19.0, 19.5, 20.0, 20.5, 21.0, 21.5, 22.0, 22.5, 23.0, 23.5, 24.0, 24.5, 25.0, 25.5, 26.0, 26.5, 27.0, 27.5, 28.0, 28.5, 29.0, 29.5, 30.0, 30.5, 31.0, 31.5] (in^2).

Table I reports that SOS had the best result and the smallest standard deviation. The stopping criterion of all algorithms is set to 15,000 structural analyses. PSO, DE, and SOS obtain minimum weights of 2749.171 lb, 2940.873 lb, and 2705.169 lb, respectively. Figure 3 shows the iteration process of 10-bar truss structure optimization. In terms of consistency, SOS had the best convergence behavior as shown in Fig. 4.

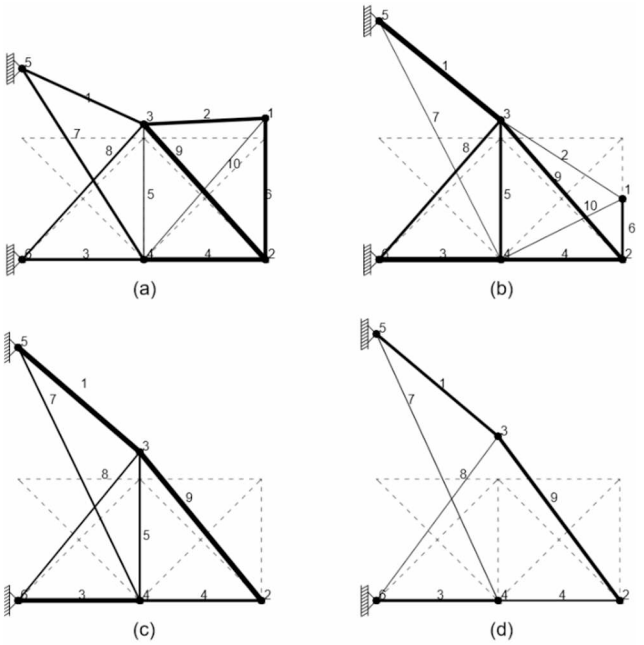

Fig. 3. Iteration of 10-bar truss structure: (a) iteration number 5; (b) iteration number 15; (c) iteration number 25; and (d) iteration number 75

TABLE I. Final Designs of Sizing, Shape, and Topology for the 10-bar Truss

Variable	GA [9]	PSO	DE	SOS
A_1	11.5	11.5	11.5	11.5
A_2	0	0	0	0
A_3	11.5	11.5	11.5	11.5
A_4	5.74	7.22	11.5	7.22
A_5	0	0	0	0
A_6	0	0	0	0
A_7	5.74	5.74	5.74	5.74
A_8	3.84	3.13	4.18	2.88
A_9	13.5	13.5	11.5	13.5
A_{10}	0	0	0	0
y_1	-	-	-	-
y_2	485.5	486.76	505.39	486.66
y_5	789.73	780.6457	760.57	789.9996
Best (lb)	2723.05	2749.171	2940.87	2705.17
Average (lb)	-	3118.027	3084.24	2848.52
Stdev (lb)	-	260.0294	100.17	85.03
Max stress (ksi)	19.1463	19.1849	19.27	19.15
Max displacement (inch)	1.999996	2	1.995376	2
No. of analyses	-	15,000	15,000	15,000
Constraint violations	None	2.44E-11	None	None

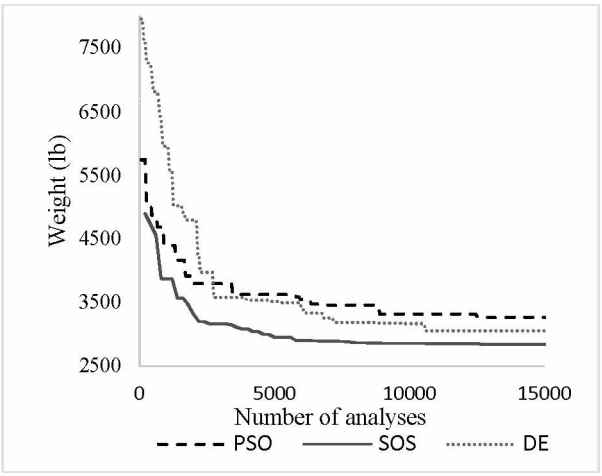

Fig. 4. Convergence behavior for the size, topology, and shape for 10-bar truss optimization

B. *Planar 15-bar truss structure*

The ground structure illustrated in Fig. 5 shows a vertical load of 10 kips applied on node 8. The allowable stress is 25 ksi and the material properties (modulus of elasticity and weight density) are the same as in the previous examples. The x- and y- coordinates of nodes 2, 3, 6, and 7, and the y-coordinates of nodes 4 and 8 are taken as design variables. However, nodes 6 and 7 are constrained to have the same x-coordinates as nodes 2 and 3, respectively. Thus, the problem includes 15 size and eight shape variables ($x_2 = x_6$, $x_3 = x_7$, y_2, y_3, y_4, y_6, y_7, y_8).

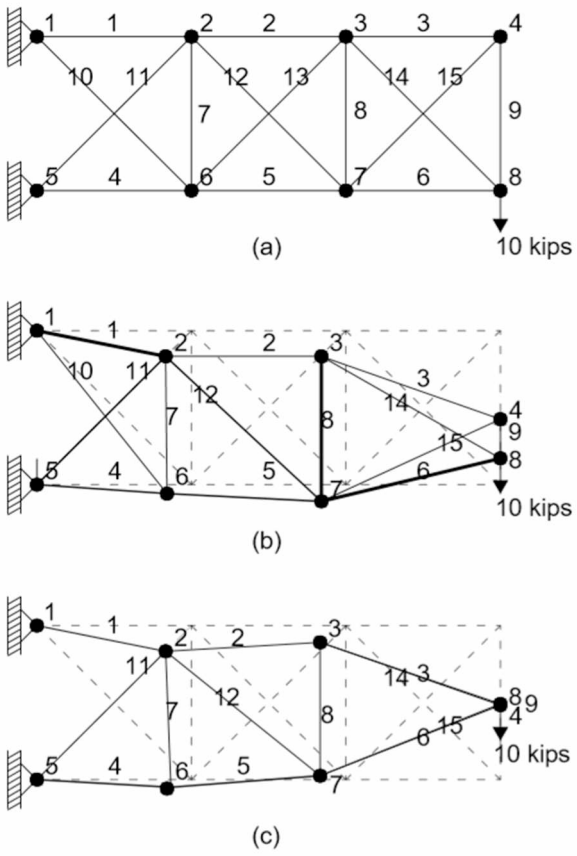

Fig. 5. (a) Ground structure of 15-bar truss, (b) iteration number 15, and (c) iteration number 250

The cross-sectional areas are chosen from:

D = [0.111, 0.141, 0.174, 0.220, 0.270, 0.287, 0.347, 0.440, 0.539, 0.954, 1.081, 1.174, 1.333, 1.488, 1.764, 2.142, 2.697, 2.800, 3.131, 3.565, 3.813, 4.805, 5.952, 6.572, 7.192, 8.525, 9.300, 10.850, 13.330, 14.290, 17.170, 19.180] (in^2).

The side constraints for the configuration variables are $100 \text{ in} \le x_2 \le 140 \text{ in}$, $220 \text{ in} \le x_3 \le 260 \text{ in}$, $100 \text{ in} \le y_2 \le 140 \text{ in}$, $100 \text{ in} \le y_3 \le 140 \text{ in}$, $50 \text{ in} \le y_4 \le 90 \text{ in}$, $-20 \text{ in} \le y_6 \le 20 \text{ in}$, $-20 \text{ in} \le y_7 \le 20 \text{ in}$, $20 \text{ in} \le y_8 \le 60 \text{ in}$.

Table II shows that SOS had the best result and the smallest standard deviation. Figure 5 shows the iteration process of 15-bar truss structure optimization. In terms of consistency, SOS had the best convergence behavior as shown in Fig. 6.

TABLE II. FINAL DESIGNS OF SIZING, SHAPE, AND TOPOLOGY FOR THE 15-BAR TRUSS

Variables	PSO	DE	SOS
A_1	1.174	0.954	1.333
A_2	0.44	0.954	0.539
A_3	0	0	0.27
A_4	1.174	1.333	0.954
A_5	0.954	0.539	0.954
A_6	0.44	0.539	0.347
A_7	0	0.141	0.141
A_8	0.347	0.22	0.22
A_9	0	0	8.525
A_{10}	0.141	0.347	0
A_{11}	0.347	0	0.347
A_{12}	0.954	0	0.539
A_{13}	0	0.539	0
A_{14}	0.44	0.539	0.347
A_{15}	0	0	0.27
x_2	100	139.5696	105.8613
x_3	220	260	221.0399
y_2	100	107.224	100.4678
y_3	140	100	106.7655
y_4	50	63.3698	58.9022
y_6	-14.7454	12.8818	-6.5144
y_7	-19.9961	20	3.4627
y_8	60	60	58.9067
Best (lb)	84.0683	78.8838	76.9757
Average (lb)	99.9911	84.0552	80.8648
Stdev (lb)	15.1098	3.2419	2.4049
Max stress (ksi)	24.3588	24.9776	24.9998
No. of analyses	50,000	50,000	50,000
Constraint violations	None	None	None

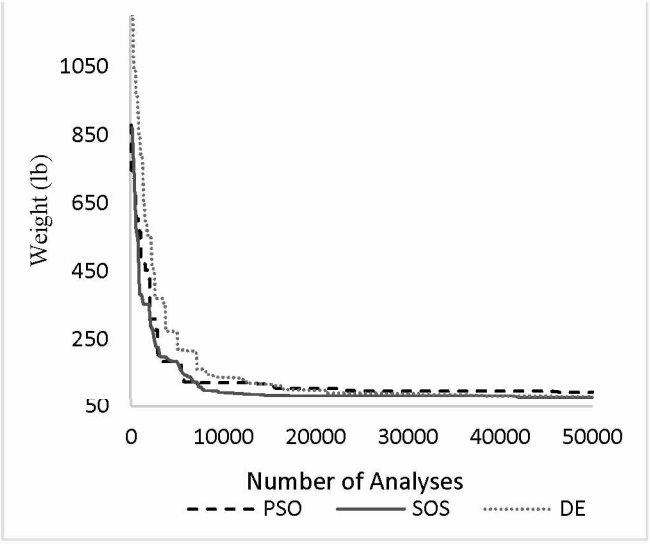

Fig. 6. Convergence behavior for the size, shape, and topology for 15-bar truss optimization

VI. Conclusion

This paper compared the optimization performance of three metaheuristic algorithms, namely, PSO, DE, and SOS, by reviewing two case studies. With the same number of analyses for each algorithm, the result showed that of the three algorithms tested, SOS performed best in terms of optimization result, convergence behavior, and consistency. SOS also had no constraint violations in either the 10-bar or 15-bar problem. In terms of optimization result, DE performed worst on the 10-bar problem and PSO performed worst on the 15-bar problem. In terms of consistency, DE has better performance than PSO on both problems.

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