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Abstract Index

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Design and Realization of Band Pass Filter in K-Band Frequency for Short Range Radar Application

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Short range radar (SRR) uses the K-band frequency range in its application. The radar requires high-resolution, so the applied frequency is 1 GHz wide. The filter is one of the devices used to ensure only a predetermined frequency is received by the radar system. This device must have a wide operating bandwidth to meet the specification of the radar. In this paper, a band pass filter (BPF) is proposed. It is designed and fabricated on RO4003C substrate using the substrate integrated waveguide (SIW) technique, results in a wide bandwidth at the K-band frequency that centered at 24 GHz. Besides the bandwidth analysis, the analysis of the insertion loss, the return loss, and the dimension are also reported. The simulated results of the bandpass filter are: VSWR of 1.0308, a return loss of -36.9344 dB, and an insertion loss of -0.6695 dB. The measurement results show that the design obtains a VSWR of 2.067, a return loss of -8.136 dB, and an insertion loss of -4.316 dB. While, it is obtained that the bandwidth is reduced by about 50% compared with the simulation. The result differences between simulation and measurement are mainly due to the imperfect fabrication process.

Keywords: Short Range Radar, Band Pass Filter, Microstrip, Substrate Integrated Waveguide, K-Band.

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Robot Manipulator Control with Inverse Kinematics PD-Pseudoinverse Jacobian and Forward Kinematics Denavit Hartenberg

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This paper presents the development of vision-based robotic arm manipulator control by applying Proportional Derivative-Pseudoinverse Jacobian (PD-PIJ) kinematics and Denavit Hartenberg forward kinematics. The task of sorting objects based on color is carried out to observe error propagation in the implementation of manipulator on real system. The objects image captured by the digital camera were processed based on HSV-color model and the centroid coordinate of each object detected were calculated. These coordinates are end effector position target to pick each object and were placed to the right position based on its color. Based on the end effector position target, PD-PIJ inverse kinematics method was used to determine the right angle of each joint of manipulator links. The angles found by PD-PIJ is the input of DH forward kinematics. The process was repeated until the square end effector reached the target. The experiment of model and implementation to actual manipulator were analyzed using Probability Density Function (PDF) and Weibull Probability Distribution. The result shows that the manipulator navigation system had a good performance. The real implementation of color sorting task on manipulator shows the probability of success rate cm is 94.46% for euclidian distance error less than 1.2 cm.

Keywords: robot manipulator, robotic arm, inverse kinematics, proportional derivative, pseudoinverse jacobian, forward kinematics, denavit hartenberg, color sorting.

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Speech Enhancement Using Deep Learning Methods: A Review

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Speech enhancement, which aims to recover the clean speech of the corrupted signal, plays an important role in the digital speech signal processing. According to the type of degradation and noise in the speech signal, approaches to speech enhancement vary. Thus, the research topic remains challenging in practice, specifically when dealing with highly non-stationary noise and reverberation. Recent advance of deep learning technologies has provided great support for the progress in speech enhancement research field. Deep learning has been known to outperform the statistical model used in the conventional speech enhancement. Hence, it deserves a dedicated survey. In this review, we described the advantages and disadvantages of recent deep learning approaches. We also discussed challenges and trends of this field. From the reviewed works, we concluded that the trend of the deep learning architecture has shifted from the standard deep neural network (DNN) to convolutional neural network (CNN), which can efficiently learn temporal information of speech signal, and generative adversarial network (GAN), that utilize two networks training.

Keywords: speech enhancement, deep learning, neural networks, speech signal processing, non-stationary noise.

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Structural, Magnetic, and X-Band Microwave Absorbing Properties of Ni-Ferrites Prepared Using Oxidized Mill Scales

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This study aims to evaluate the structural, magnetic, and microwave absorbing properties at the X-band region of oxidized mill scales as by-product derived from a steel making process by means of a facile solid-state reaction. The oxidized mill scales were heated at 600 °C for 4 h followed by mixing with NiO. A calcination process took place at 900 °C and sintering process were conducted at 1260 °C with a milling process conducted in between the heating process. X-ray diffraction (XRD) and scanning electron microscope (SEM) equipped with energy dispersive spectrometer (EDS) were employed to evaluate the structural properties of the Ni-ferrites samples. Remacomp measurement were conducted to evaluate the magnetic properties and vector network analyzer (VNA) to measure its microwave properties. A single phase of NiFe2O4 was confirmed by XRD data. The site occupancies derived from the Rietveld refinement shows that the Ni:Fe:O ratio deviates from the 1:2:4 ratio as that suggests vacancies formed in the Ni2+ and Fe3+ that lowers the unit cell density to 5.08 g/cm3 that further confirmed by EDS measurement. The coercivity of 11 kOe is also higher than the bulk NiFe2O4 prepared by the chemical grade raw materials. The reflection data of the microwave properties at X-band of 8-12 GHz do not shows significant absorptions. This study suggests that the selected preparation method yields a single phase, however with the significant crystallographic defects and has less ‘soft’ magnetic properties compared to NiFe2O4 prepared using chemical grade by previous study.

Keywords: Spinel ferrites, mill scales, soft magnets, magnetic materials.

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Modifications of Liquid Electrolyte for Monolithic Dye-sensitized Solar Cells

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Dye-sensitized solar cells (DSSC) has been well known as a highly competitive photovoltaic technology owing to its interesting characteristics, such as, low-cost, simple, and convenient to modify both chemically and physically. One way to reduce the production cost of DSSCs is to conduct a structural modification in the form of a monolithic structure by using a single conductive substrate to accommodate both photoelectrode and counter

electrode. However, the photovoltaic performance of monolithic DSSCs is typically still lacking compared to its conventional DSSCs counterparts that uses sandwich structure. One of the crucial factors that determine the photovoltaic performance of a monolithic DSSC is its electrolyte. In this work, the performance of monolithic DSSCs were studied through modifications of the electrolyte component. Two types of commercial liquid electrolytes that have different chemical properties were used and combined into various compositions, and the resulting DSSCs performances were compared. The stability of the monolithic cells was also monitored by measuring the cells repeatedly under the same condition. The result showed that during the first measurement the highest performance with a power conversion efficiency of 1.69% was achieved by the cell with a higher viscosity electrolyte. Meanwhile, the most stable performance is shown by the cell containing lower viscosity electrolyte, which achieved an efficiency of 0.66% that measured on day 35.

Keywords: DSSC, monolithic DSSC, liquid electrolyte, photoelectrode.

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Design and Implementation of IoT-Based Water Pipe Pressure Monitoring Instrument

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The water pressure monitoring system in the PDAM pipeline networks has been successfully developed for operation and maintenance of water leaks in a real-time manner. This research aims to design a water pressure monitoring system in operational piping networks to identify anomalies as early as possible. The system is built using a microcontroller, a 1.2 MPa fluid pressure sensor and a control system equipped with a GSM wireless communication module, an Analog to Digital Converter module with 16-bit resolution, a real-time clock peripheral, an OLED display 128 × 64, and a micro SD card. The developed system was tested in a pressure range of 0.200 - 0.800 bar with 30 repetitions with a RMSE of 0.058 bar. This system has a deterministic coefficient of 0.885 against a standard manometer. The system implemented in the field successfully sends data to the server with a success rate of 96.0%. Data is displayed on a monitoring dashboard that can be accessed via a computer or smartphone.

Keywords: water pressure, pressure monitoring, PDAM, water leakage, IoT.

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Improving Neural Network Based on Seagull Optimization Algorithm for Controlling DC Motor

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This article presents a direct current (DC) motor control approach using a hybrid Seagull Optimization Algorithm (SOA) and Neural Network (NN) method. SOA method is a nature-inspired algorithm. DC motor speed control is very important to maintain the stability of motor operation. The SOA method is an algorithm that duplicates the life of the seagull in nature. Neural network algorithms will be improved using the SOA method. The neural network used in this study is a feed-forward neural network (FFNN). This research will focus on controlling DC motor speed. The efficacy of the proposed method is compared with the Proportional Integral Derivative (PID) method, the Feed Forward Neural Network (FFNN), and the Cascade Forward Backpropagation Neural Network (CFBNN). From the results of the study, the proposed control method has good capabilities compared to standard neural methods, namely FFNN and CFBNN. Integral Time Absolute Error and Square Error (ITAE and ITSE) values from the proposed method are on average of 0.96% and 0.2% better than the FFNN and CFBNN methods.

Keywords: Seagull Optimization Algorithm, metaheuristic, DC motor, neural network.

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Low-Cost Multimodal Physiological Telemonitoring System through Internet of Things

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The objective of this study is to develop and test a patient telemonitoring system. This study was encouraged by the high number of health workers fatalities in Indonesia due to physical contact without proper protection. Based on the symptoms of COVID-19 it consists of electrocardiogram (ECG) sensors, body temperature sensors, respiratory rate sensors, and pulse oximeter. The physiological data were captured by the sensors and collected by a microcontroller then it sends the data to a cloud system so that health workers can access the data. The experiments were performed to test both the offline and online protocol to compare data sent via a direct connection and data sent via Wi-Fi. In the offline testing, there were several limitations observed such as the low sampling frequency of the ECG signals that reduce the fidelity of the signals. Such problems were also observed on respiratory rate data. Furthermore, the system is also very prone to subjects' movement-related noise. The measurements of peripheral oxygen saturation (SpO2) and body temperature, on the other hand, have been detected the slight change up to 0.1% and 0.5o C respectively. In the online testing, the data transmission to the cloud is sent per 30 seconds so that morphologically the ECG signal data are not representative. The system requires a lot of improvements and future study should be directed to improve signals acquisition and processing while maintaining the concept of low-cost. Design improvement should also include a better attachment design to the human body as well as greater data transmission for the online system.

Keywords: telemedicine, COVID-19, electrocardiography, oxygen saturation, respiratory, body temperature, web application.

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Performance Evaluation of DSRC-Zigbee Heterogeneous Network for Intelligent Transportation System

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Transportation is one of the primary needs of human beings that cannot be avoided, with the increasing vehicle can lead to a congested road situation which can lead to less safe road safety. An Intelligent Transportation System (ITS) can be used to increase road safety. This system uses a Dedicated Short-Range Communication (DSRC) protocol for network access due to its low latency transmission time. Unfortunately, there is research shows that DSRC has a performance issue in a dense area or increased network load. This problem is mostly solved with a heterogeneous network DSRC-LTE but utilizes mobile phone networks that dynamically change can lead to inconsistent and unpredictable network performance. There is some research about ZigBee for ITS shows that it is decent enough for non-critical applications. Thus, the authors try to utilize Zigbee to create the DSRC-Zigbee heterogeneous network so that the network is independent for the ITS application. The proposed heterogeneous network is a fixed model due to its simple architecture. OMNeT++ and Simulation of Urban Mobility (SUMO) are used to evaluate the performance of the network in an urban area with various scenarios. The simulation result shows that the proposed heterogeneous network is capable to improve the messages dissemination rate by 15.78% and 1.22% in a certain scenario compared to the homogeneous network DSRC only.

Keywords: Zigbee, DSRC, Heterogeneous Network, Simulation, OMNeT++, SUMO

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A Review of Smart Energy Metering System Projects

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The rule of thumb dictates that for any country to have a stable and sufficient power supply, there must be at least a thousand Megawatts of electricity for every one million population. However, many developing countries generate far less than the population demand. Despite not generating enough, enormous electrical power loss, energy theft, and unpaid bills are major problems bedeviling the power distribution companies. A fundamental process in the electricity cycle is energy metering from power generation to distribution and consumption. For decades now, manual (or

conventional) energy meters are used to estimate every end-user's energy consumption. But there are lots of setbacks to these meters. These meters were unable to solve the problems of power loss and theft, giving necessity to developing a metering system that will serve as a solution to all issues emanating from the consumer end. The past decade saw many developments of such meters, where all are based on the internet of things (IoT) technology. Such meters are called – by the early developers – a smart energy metering system (SEMS), or simply, a Smart Meter. While there have been several reviews on SEMS, most were found to be based on the instant billing capabilities of SEMS, system development, and the wireless communication protocols of the systems. This review focuses on individual components of SEMS with particular attention to the different types and modes of sensors used for other applications. It analyzes various SEMS designs, microcontrollers, sensors, modules, transducers, communication protocols, data storage accuracy, and maximum power capability. Also discussed are the achievements and weaknesses of the designs, some future research challenges, and open issues in the implementation of SEMS.

Keywords: energy, internet of things, microcontrollers, sensors, smart meters.

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