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Abstract Index

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Integral State Feedback Control Using Linear Quadratic Gaussian in DC-drive System

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The electric motor is one of the technological developments which can support the production process. DC motor has some advantages compared to AC motor especially on the easier way to control its speed or position as well as its widely adjustable range. The main issue in the DC motor is controlling the angular speed with uncertainty and disturbance. The alternative solution of a control method with simple, easy to design, and implementable in a multi-input multi-output system is integral state feedback such as linear quadratic Gaussian (LQG). It is a combination between linear quadratic regulator and Kalman filter. One of the advantages of this method is the usage of fewer sensors compared with the original linear quadratic regulator method which uses sensors as many as the state in the system model. The design, simulation, and experimental study of the application of LQG as state feedback control in a DC-drive system have been done. Both performance and energy were analyzed and compared with conventional proportional integral derivative (PID). The gain of LQG was determined by trial whereas the PID gain is determined from MATLAB autotuning without fine-tuning. The load test and tracking test were carried out in the experiment. Both simulation and hardware tests showed the same result which LQG is superior in integral absolute error (IAE) by up to 74.37 % in loading test compared to PID. On the other side, LQG needs more energy, it consumes higher energy by 6.34 % in the load test.

Keywords: DC motor, speed control, integral state feedback, LQG.

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Gain Enhancement of Double-Slot Vivaldi Antenna using Corrugated Edges and Semicircle Director for Microwave Imaging Application

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Microwave imaging, such as images for radiological inspection in the medical profession, is one of the applications utilized in ultra-wideband (UWB) frequency ranges. The Vivaldi antenna is one of the most popular antennas for this purpose. The antenna is utilized because of its simple, lightweight, and compact design, as well as its excellent efficiency and gain capabilities. In this work, we present a high-gain Vivaldi antenna for microwave imaging applications. The proposed Vivaldi antenna is designed using a double-slot structure method with the addition of corrugated edges and a semicircle director aimed at improving the gain. The antenna is designed to operate at frequencies ranging from 3.1 to 10.6 GHz. Based on the modeling findings, the suggested antenna attain a bandwidth of 7.5 GHz with operating frequencies from 3.1 GHz to 10.6 GHz for a VSWR of less than two. In comparison to a typical single slot antenna, the suggested antenna provides a substantial boost in gain performance. The increase in gain is proportional to the frequency of operation. The constructed antenna has a lower bandwidth than the simulated one, with operating frequencies of 3.5 GHz – 3.75 GHz and 4.25 – 10.89 GHz, respectively, and useable bandwidths of 250 MHz and 6.64 GHz. All these results suggest that the antenna is suitable for microwave imaging applications.

Keywords: Vivaldi Antenna, Ultrawideband (UWB), Microwave Imaging

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Analytical Performance of Low Noise Amplifier Using Single-Stage Configuration for ADS-B Receiver

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Automatic dependent surveillance-broadcast (ADS-B) is an equipment of a radar system to reach difficult areas. For radar applications, an ADS-B requires a low noise amplifier (LNA) with high gain, stability, and a low noise figure. In this research, to produce an LNA with good performance, an LNA was designed using a BJT transistor 2SC5006 with DC bias, VCE = 3 V, and current Ic = 10 mA, also a DC supply with VCC = 12 V, to achieve a high gain with a low noise figure. The initial LNA impedance circuit was simulated using two elements and then converted into three elements to obtain parameters according to the target specification through the tuning process, impedance matching circuit was used to reduce return loss and voltage standing wave ratio (VSWR) values. The LNA sequence obtains the working frequency of 1090 MHz, return loss of -52.103 dB, a gain of 10.382, VSWR of 1.005, a noise figure of 0.552, stability factor of 0.997, and bandwidth of 83 MHz. From the simulation results, the LNA has been successfully designed according to the ADS-B receiver specifications.

Keywords: LNA, ADS-B, single-stage.

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Optimization of Low Site Density Area for 4G Network in Urban City

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The development of telecommunications is currently growing rapidly, especially in urban areas. To obtain optimal data services for users, the performances of 4G network services must continue to be optimized. It is known that many users are scattered in urban areas, but sometimes it is not balanced with an even distribution of the site in this area. This condition occurs because the distribution of the site is not evenly optimal distributed, either due to licensing constraints, limited land access for site development, or in terms of plans that have not been made. Balanced with the requirement of a 4G network, which is required, this "empty space" condition or low site density condition must find a solution or optimize it. Many optimization methods can optimize the area with low site density possibility. This study will optimize the area by adding a new site proposal based on coverage planning. We need to analyze Reference Signal Received Power (RSRP) coverage signal distribution using Atoll Planning Software. After optimization, the RSRP level below or equal -80 dBm increased from 75.195% to 94.08%. Furthermore, the percentage calculation for inadequate coverage (below -80 dBm) decreased from 24.816% to 5.931%. This RSRP signal level also shows that the condition after optimization with a new site can improve the signal level condition from areas with low site density possibility.

Keywords: low site density, optimization, coverage, new site, RSRP.

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Prediction Of Myers-Briggs Type Indicator Personality Using Long Short-Term Memory

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Personality is defined as the mix of features and qualities that make up an individual's particular character, including thoughts, feelings, and behaviors. With the rapid development of technology, personality computing is becoming a popular research field by providing users with personalization. Many researchers have used social media data to automatically predict personality. This research uses a public dataset from Kaggle, namely the Myers-Briggs Personality Type Dataset. The purpose of this study is to predict the accuracy and F1-score values so that the performance for predicting and classifying Myers–Briggs Type Indicator (MBTI) personality can work optimally by using attributes from the MBTI dataset, namely posts and types. Predictive accuracy analysis was carried out using the Long Short-Term Memory (LSTM) algorithm with random oversampling technique with the Imblearn library for MBTI personality type prediction and comparing the

performance of the method proposed in this study with other popular machine learning algorithms. Experiments show that the LSTM model using the RMSprop optimizer and learning speed of 10-3 provides higher performance in terms of accuracy while for the F1-score the LSTM model using the RMSprop Optimizer and learning speed of 10-2 gives a higher value than the proposed machine learning algorithm so that the model MBTI dataset using LSTM with random oversampling can help in identifying the MBTI personality type.

Keywords: Long short-term memory, myers–briggs type indicators, personality, prediction, random oversampling.

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SIMONIC: IoT Based Quarantine Monitoring System for Covid-19

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COVID-19, which has become a global pandemic since March 2020, has tremendously affected human life globally. The negative impact of COVID-19 affects societies in almost all aspects. Implementing quarantine monitoring, also social distancing and contact tracing are a series of processes that can suppress the new infected COVID-19 cases in various countries. Prior works have proposed different monitoring systems to assist the monitoring of individuals in quarantines, as well as many methods are offered for social distancing and contact tracing. These methods focus on one function to provide a reliable system. In this paper, we propose IoT-based quarantine monitoring by implementing a geofence equipped with social distancing features to offer an integrated system that provides more benefits than one system carrying one particular function. We propose a system consisting of a low cost, low complexity, and reusable wristband design and mobile apps to support the quarantine monitoring system. For the geofencing, we propose a GPS-based geofence system that was developed by taking advantage of the convenience offered by the Traccar application. Meanwhile, we add the notification for social distancing feature with adaptive distance measurement RSSIbased set up in the android application. Based on the experiment we did to validate the system, in terms of wristband-to-smartphone communication, scanning interval in smartphone and advertising interval in wristband is best to set in 7 s for both. For social distancing notification and geofence, we measure the system performance through precision, recall, accuracy and F-measure.

Keywords: IoT-quarantine monitoring system, IoT-social distancing system, Traccar-based geofence, SIMONIC, low-cost wristband.

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Customer Decision Prediction Using Deep Neural Network on Telco Customer Churn Data

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Customer churn is the most important problem in the business world, especially in the telecommunications industry, because it greatly influences company profits. Getting new customers for a company is much more difficult and expensive than retaining existing customers. Machine learning, part of data mining, is a sub-field of artificial intelligence widely used to make predictions, including predicting customer churn. Deep neural network (DNN) has been used for churn prediction, but selecting hyperparameters in modeling requires more time and effort, making the process more challenging for the researcher. Therefore, the purpose of this study is to propose a better architecture for the DNN algorithm by using a hard tuner to obtain more optimal hyperparameters. The tuning hyperparameter used is random search in determining the number of nodes in each hidden layer, dropout, and learning rate. In addition, this study also uses three variations of the number of hidden layers, two variations of the activation function, namely rectified linear unit (ReLu) and Sigmoid, then uses five variations of the optimizer (stochastic gradient descent (SGD), adaptive moment estimation (Adam), adaptive gradient

algorithm (Adagrad), Adadelta, and root mean square propagation (RMSprop)). Experiments show that the DNN algorithm using hyperparameter tuning random search produces a performance value of 83.09 % accuracy using three hidden layers, the number of nodes in each hidden layer is [20, 35, 15], using the RMSprop optimizer, dropout 0.1, the learning rate is 0.01, with the fastest tuning time of 21 seconds. Better than modeling using k-nearest neighbor (K-NN), random forest (RF), and decision tree (DT) as comparison algorithms.

Keywords: Customer churn, data mining, machine learning, deep neural network.

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Microcontroller-Based Lead-Acid Battery Balancing System for Electric Vehicle Applications

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In application of lead-acid batteries for electrical vehicle applications, 48 V of four 12 V batteries in a series configuration are required. However, the battery stack is repeatedly charged and discharged during operation. Hence, differences in charging and discharging speeds may result in a different state-of-charge of battery cells. Without proper protection, it may cause an excessive discharge that leads to premature degradation of the battery. Therefore, a lead-acid battery requires a battery management system to extend the battery lifetime. Following the LTC3305 balancing scheme, the battery balancing circuit with auxiliary storage can employ an imbalance detection algorithm for sequential battery. It happens by comparing the voltage of a battery on the stack and the auxiliary storage. In this paper, we have replaced the function of LTC3305 by a NUCLEO F767ZI microcontroller, so that the balancing process, the battery voltage, the drawn current to or from the auxiliary battery, and the surrounding temperature can be fully monitored. The prototype of a microcontroller-based lead-acid battery balancing system for electrical vehicle application has been fabricated successfully in this work. The batteries voltage monitoring, the auxiliary battery drawn current monitoring, the overcurrent and overheat protection system of this device has also successfully built. Based on the experimental results, the largest voltage imbalance is between battery 1 and battery 2 with a voltage imbalance of 180 mV. This value is still higher than the target of voltage imbalance that must be lower than 12.5 mV. The balancing process for the timer mode operation is faster 1.5 times compared to the continuous mode operation. However, there were no overcurrent or overtemperature occurred during the balancing process for both timer mode and continuous mode operation. Furthermore, refinement of this device prototype is required in the future to improve the performance significantly.

Keywords: Battery balancing system, electric vehicle, LTC3305, microcontroller, NUCLEO F767ZI, voltage imbalance.

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Design of Flexible 3.2 GHz Rectangular Microstrip Patch Antenna for S-Band Communication

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This paper presents the design, simulation, realization and analysis of flexible microstrip patch antenna for S-band applications. The proposed design also adopts the conformal structure by utilizing flexible substrate. Conformal or flexible structure allows the antenna to fit with any specified shape as desired. The antenna patch dimensions is 43 mm × 25 mm without SMA connector. The patch is etched on the flexible dielectric substrate, pyralux FR 9111, with a relative dielectric constant of $\varepsilon r = 3$ and the thickness of substrate, h = 0.025 mm. The antenna is designed to resonate at 3.2 GHz. The return loss (RL) of the simulation is -35.80 dB at the center frequency of 3.2 GHz. The fabricated antenna prototype was measured at different bending angles scenarios including 0º, 30º, 60º, and 90º. The measurement of antenna prototype shows that the center frequency is shifted to the higher frequency of 3.29 GHz, compared to the simulation result. Among these scenarios, measurement at bending angle of 90º gives the best performance with RL = -31.38 dB at 3.29 GHz, the bandwidth is 80 MHz, and the impedance ZA = 48.36 + j2.04 Ω. Despite a slight differences from simulation results, the designed antenna still performs well as expected.

Keywords: Microstrip patch antenna, rectangular shaped antenna, conformal antenna, flexible

antenna, S-band communication, flexible substrate, pyralux FR 9111.

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Franklin Collinear Antenna 2 Levels Different Sides using Array Method 4 Stacking Units 360° with Integrated Reflector and Power Combiner for ADS-B S-Receiver Mode

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In this study, an antenna system that could cover the 360° detection area using the microstrip method was created. The antenna design proposed uses the franklin collinear method with the addition of an array of arms to the left and right of the antenna and the addition of reflectors as a gain enhancer. The four antenna array units are combined using a power divider (combiner) as a unifying antenna. Antenna design with end fire radiation pattern cannot be used in receiving the ADS-B antenna system, because it works only in certain sectors with certain beamwidth, so it needs to be modified by adding an array of 4 units that make up 360◦ radiation of directional diagrams. The addition of the reflector is done by testing the optimum width. The most optimum width is obtained by the width of the side addition on the side of the antenna aperture cross section width of 80 mm. Based on the results of experiments that have been carried out for the design of receiver antennas for ADS-B applications that are required in the form of a radiation pattern in all directions using the reflector technique, the most appropriate gain increase is to use a phase difference for the antennas that are closest both left and right by 90o in ¼ λ conditions in the integration process using a 4 way power combiner. Response return loss at frequency 1.0752 GHz and 1.109 GHz is -15 dB, it means antenna has 33.8 MHz bandwidth with maximum response return loss at -23.22 dB and gain of 7.586 dBi, this antenna design is very suitable for use in the ADS-B application. Design and simulation at this antenna used CST software.

Keywords: ADS-B, antenna, microstrip, array, franklin, collinear, power combiner, reflector.

Jurnal Elektronika dan Telekomunikasi

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Author Index

Agus Ramelan "*Integral State Feedback Control Using Linear Quadratic Gaussian in DC-drive System*," 21(2): 79 - 84

Ali Rospawan, "*Microcontroller-Based Lead-Acid Battery Balancing System for Electric Vehicle Applications*," 21(2): 128 - 139

Andri Fachrur Rozie, "*SIMONIC: IoT Based Quarantine Monitoring System for Covid-19*," 21(2): 112 - 121

Andria Arisal, "*SIMONIC: IoT Based Quarantine Monitoring System for Covid-19*," 21(2): 112 - 121

Arumjeni Mitayani, "*SIMONIC: IoT Based Quarantine Monitoring System for Covid-19*," 21(2): 112 - 121

Asih Setiarini, "*SIMONIC: IoT Based Quarantine Monitoring System for Covid-19*," 21(2): 112 - 121

Bagus Edy Sukoco, "*Design of Flexible 3.2 GHz Rectangular Microstrip Patch Antenna for S-Band Communication*," 21(2): 140 - 145

Budi Prawara, "*Design of Flexible 3.2 GHz Rectangular Microstrip Patch Antenna for S-Band Communication*," 21(2): 140 - 145

Budi Prawara, "*SIMONIC: IoT Based Quarantine Monitoring System for Covid-19*," 21(2): 112 - 121

Chaeriah Bin Ali Wael, "*Design of Flexible 3.2 GHz Rectangular Microstrip Patch Antenna for S-Band Communication*," 21(2): 140 - 145

Dayat Kurniawan, "*SIMONIC: IoT Based Quarantine Monitoring System for Covid-19*," 21(2): 112 - 121

Elisma, "*Gain Enhancement of Double-Slot Vivaldi Antenna using Corrugated Edges and Semicircle Director for Microwave Imaging Application*," 21(2): 85 – 90

Fajri Darwis, "*Gain Enhancement of Double-Slot Vivaldi Antenna using Corrugated Edges and Semicircle Director for Microwave Imaging Application*," 21(2): 85 - 90

Findi Nur Witriani, "*Gain Enhancement of Double-Slot Vivaldi Antenna using Corrugated Edges and Semicircle Director for Microwave Imaging Application*," 21(2): 85 - 90

Galih Nugraha Nurkahfi, "*SIMONIC: IoT Based Quarantine Monitoring System for Covid-19*," 21(2): 112 - 121

Ganis Sanhaji, "*Franklin Collinear Antenna 2 Levels Different Sides using Array Method 4 Stacking Units 360^o with Integrated Reflector and Power Combiner for ADS-B S-Receiver Mod*," 21(2): 146 - 153

Hajiar Yuliana, "*Speech Enhancement Using Deep Learning Methods: A Review Optimization of Low Site Density Area for 4G Network in Urban City*," 21(2): 98 - 103

Hari Maghfiroh, "*Integral State Feedback Control Using Linear Quadratic Gaussian in DC-drive System*," 21(2): 79 - 84

Hendrawan Kurniadin, "*Design of Flexible 3.2 GHz Rectangular Microstrip Patch Antenna for S-Band Communication*," 21(2): 140 – 145

Hilman Ferdinandus Pardede, "*Customer Decision Prediction Using Deep Neural Network On Telco Customer Chrun Data*," 21(2): 122 - 127

Hilman Ferdinandus Pardede, "*Prediction Of Myers-Briggs Type Indicator Personality Using Long Short-Term Memory*," 21(2): 104 – 111

Hiya Nalatissifa, "*Customer Decision Prediction Using Deep Neural Network On Telco Customer Chrun Data*," 21(2): 122 - 127

Ilham Pazaesa, "*Analytical Performance of Low Noise Amplifier Using Single-Stage Configuration for ADS-B Receiver*," 21(2): 91 - 97

Joko Slamet Saputro, "*Integral State Feedback Control Using Linear Quadratic Gaussian in DC-drive System*," 21(2): 79 - 84

Joni Welman Simatupang, "*Microcontroller-Based Lead-Acid Battery Balancing System for Electric Vehicle Applications*," 21(2): 128 - 139

Ken Paramayudha, "*Design of Flexible 3.2 GHz Rectangular Microstrip Patch Antenna for S-Band Communication*," 21(2): 140 - 145

Ken Paramayudha, "*Gain Enhancement of Double-Slot Vivaldi Antenna using Corrugated Edges and Semicircle Director for Microwave Imaging Application*," 21(2): 85 – 90

M. Reza Hidayat, "*Analytical Performance of Low Noise Amplifier Using Single-Stage Configuration for ADS-B Receiver*," 21(2): 91 - 97

Mawadatul Maulidah, "*Prediction Of Myers-Briggs Type Indicator Personality Using Long Short-Term Memory*," 21(2): 104 - 111

Mochamad Mardi Martadinata, "*SIMONIC: IoT Based Quarantine Monitoring System for Covid-19*," 21(2): 112 - 121

Nasrullah Armi, "*SIMONIC: IoT Based Quarantine Monitoring System for Covid-19*," 21(2): 112 - 121

Rendra Dwi Firmansyah, "*SIMONIC: IoT Based Quarantine Monitoring System for Covid-19*," 21(2): 112 - 121

Ros Sariningrum, "*Design of Flexible 3.2 GHz Rectangular Microstrip Patch Antenna for S-Band Communication*," 21(2): 140 – 145

Salita Ulitia Prini, "*Analytical Performance of Low Noise Amplifier Using Single-Stage Configuration for ADS-B Receiver*," 21(2): 91 - 97

Salita Ulitia Prini, "*Speech Enhancement Using Deep Learning Methods: A Review Optimization of Low Site Density Area for 4G Network in Urban City*," 21(2): 98 - 103

Sofyan Basuki, "*Speech Enhancement Using Deep Learning Methods: A Review Optimization of Low Site Density Area for 4G Network in Urban City*," 21(2): 98 - 103

Sopyan Setiana, "*SIMONIC: IoT Based Quarantine Monitoring System for Covid-19*," 21(2): 112 - 121

Sudirja Sudirja, "*SIMONIC: IoT Based Quarantine Monitoring System for Covid-19*," 21(2): 112 - 121

Sulaksono Priyo, "*SIMONIC: IoT Based Quarantine Monitoring System for Covid-19*," 21(2): 112 - 121

Supriyanto Praptodiyono, "*Integral State Feedback Control Using Linear Quadratic Gaussian in DC-drive System*," 21(2): 79 - 84

Taufiqqurrachman, "*Gain Enhancement of Double-Slot Vivaldi Antenna using Corrugated Edges and Semicircle Director for Microwave Imaging Application*," 21(2): 85 - 90

Teguh Praludi, "*Design of Flexible 3.2 GHz Rectangular Microstrip Patch Antenna for S-Band Communication*," 21(2): 140 – 145

Teguh Praludi, "*Franklin Collinear Antenna 2 Levels Different Sides using Array Method 4 Stacking Units 360^o with Integrated Reflector and Power Combiner for ADS-B S-Receiver Mod*," 21(2): 146 - 153

Topik Teguh Estu, "*Franklin Collinear Antenna 2 Levels Different Sides using Array Method 4 Stacking Units 360^o with Integrated Reflector and Power Combiner for ADS-B S-Receiver Mod*," 21(2): 146 - 153

Vita Awalia Mardiana, "*SIMONIC: IoT Based Quarantine Monitoring System for Covid-19*," 21(2): 112 - 121

Wahid Nova Nugraha, "*Design of Flexible 3.2 GHz Rectangular Microstrip Patch Antenna for S-Band Communication*," 21(2): 140 – 145

Yahya Syukri Amrullah, "*Gain Enhancement of Double-Slot Vivaldi Antenna using Corrugated Edges and Semicircle Director for Microwave Imaging Application*," 21(2): 85 - 90

Yana Taryana, "*Design of Flexible 3.2 GHz Rectangular Microstrip Patch Antenna for S-Band Communication*," 21(2): 140 - 145

Yaya Sulaeman, "*Design of Flexible 3.2 GHz Rectangular Microstrip Patch Antenna for S-Band Communication*," 21(2): 140 - 145

Yusnita Rahayu, "*Design of Flexible 3.2 GHz Rectangular Microstrip Patch Antenna for S-Band Communication*," 21(2): 140 - 145

Yussi Perdana Saputera, "*Franklin Collinear Antenna 2 Levels Different Sides using Array Method 4 Stacking Units 360^o with Integrated Reflector and Power Combiner for ADS-B S-Receiver Mod*," 21(2): 146 – 153

Yusuf Nur Wijayanto, "*Gain Enhancement of Double-Slot Vivaldi Antenna using Corrugated Edges and Semicircle Director for Microwave Imaging Application*," 21(2): 85 - 90