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Abstract Index

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Oxygen Level System Development in WSN and IoT-Based Factory

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The health of workers is essential to factory productivity. The lack of oxygen experienced by factory workers for a prolonged duration can disrupt the brain system. One solution to this problem is to build manufacturing facilities with well-maintained airflow, especially oxygen. The system can flow air from outside the factory into the factory based on the measurement of the oxygen level. In this research, an airflow system using the internet of things (IoT) and wireless sensor network (WSN) technology was developed to ensure no oxygen shortage in the factory space. The system comprises three main parts: an oxygen level sensor, a fan controller circuit, and a cloud-based communication system. The oxygen level sensor can measure the volume of oxygen in the factory room and is also connected to the fan controller to control the airflow to the radio-frequency (RF) communication factory room. Oxygen level monitoring data are also sent to the cloud server so that the condition of the factory space can be monitored remotely using internet computers and mobile devices. Performance tests that have been carried out show that the system can increase the oxygen level by 82% from its pre-installed condition. The system built is easy-to-install, low-power, and reliable, with a data loss value of only 1.67%. WSN implementation at the factory does not require a lot of wiring, thus making the system cheaper.

Keywords: factory space, IoT, lack of oxygen, system, WSN

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Dual-band Via-less Band-pass Filter Based on Cascaded Closed Ring Resonator

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A band-pass filter (BPF) is an essential part of a wireless communication system as it functions to reduce interference and noise. Many structures have been proposed to achieve a high-quality BPF. Typically, these structures utilize vias. However, vias has several drawbacks, including impedance discontinuities, increased resistance values, and complex structures. In this study, we propose a dual-band BPF based on a cascaded closed ring resonator (CCRR) without using vias. Specifically, the proposed structure consists of multiple CCRRs connected at the corner pattern and incorporates capacitive coupling to the input impedance. Additionally, the CCRR configuration has dual sizing to achieve dual-band performance. Subsequently, the proposed BPF is simulated and fabricated using Duroid Rogers RT 5880 with dielectric constant $\varepsilon r = 2.2$, dissipation factor $\tan \delta = 0.0009$, and thickness $h = 1.575$ mm. The measurement results demonstrated that the dual-band BPF operated at a resonant frequency of 2.50 GHz with a transmission coefficient (S21) value of -2.18 dB in the first band. In the second band, a resonant frequency of 3.70 GHz was obtained with an S21 value of -1.43 dB. The bandwidth in the first band was 160 MHz, and in the second band, it was 110 MHz. Moreover, based on the measurement results, the reflection coefficient (S11) in the first band was -11.05 dB, while in the second band, it was -23.3 dB. The excellent agreement between the simulation and measurement validates the proposed method.

Keywords: dual-band, band-pass filter, CCRR, via-less.

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2.4 GHz Rectifier Antenna for Radiofrequency-based Wireless Power Transfer: Recent Developments, Opportunities, and Challenges

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The use of radio frequency (RF) energy for wireless power transfer (WPT) has gained significant attention in recent years due to its potential for powering electronic devices without the need for wires or batteries. A key component of RF-based WPT systems is the rectenna, which converts RF energy into usable DC power. This article provides an overview of recent developments, opportunities, and challenges in the design of 2.4 GHz rectennas for RF-based WPT applications. We have researched major online libraries extensively for studies regarding the 2.4 GHz rectenna. As a result, 35 high-quality studies published between 2010 and 2023 were gathered. In the discussion section, we begin by presenting the basic principles of antenna design and the key parameters that affect its performance, such as the antenna characteristics, rectifier capabilities, and nonlinearity properties of the rectifier. We then highlighted recent advancements in rectenna design, including novel approaches for improving efficiency and power transfer capability, such as the involvement of hybrid solar cell-rectenna structures, transistor-based rectifiers, and bridge rectifiers. Finally, the article concludes by identifying future opportunities, research directions, and open challenges in the design and optimization of rectennas for RF-based WPT, including the development of compact, low-cost, and high-performance rectennas for a wide range of applications. Overall, this article provides a comprehensive overview of the state-of-the-art of 2.4 GHz rectenna design for RF-based WPT and highlights the exciting opportunities and challenges for this rapidly growing field.

Keywords: 2.4 GHz, rectifier, antenna, rectifier antenna (rectenna), radiofrequency (RF), wireless power transfer (WPT), RF-based WPT, energy harvesting.

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Compact Coplanar Waveguide Antenna Using Arm Patch for Software Defined Radio

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This article proposes a compact coplanar waveguide (CPW) antenna with a semicircular patch and patch arm above the feed line. The method used in this antenna research is experimental, with antenna parameter optimization, fabrication, and measurement steps. The antenna was 40 mm × 46 mm × 0.8 mm and was printed on an FR4 substrate. Antenna optimization was carried out with CST Studio Suite to obtain optimal results. Based on return loss measurement results, the proposed antenna has an operational frequency of 2 GHz–7 GHz. The antenna arm has a significant effect on the operational frequency of the antenna, as proven by a parameter study of the antenna arm. Parametric studies were carried out on the antenna by investigating the influence of geometric parameters on the frequency characteristics. Optimization results were printed then measured by a Vector Network Analyzer (VNA) and a spectrum analyzer. The fabricated CPW antenna has a wider operating frequency than the simulation. An omnidirectional radiation pattern was observed at 2 GHz–4 GHz. The antenna has been used as a transmitter and receiver at 2.4 GHz, 3 GHz, and 4 GHz. The antenna is able to receive the signal emitted from the signal generator.

Keywords: Antenna, CPW, Software-Defined Radio (SDR), UWB.

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Determinants of Pepper Quality Based on The Percentage of Foreign Objects Based You Only Look Once (YOLO)

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The presence of foreign objects in pepper seeds is one of the things that affect the quality of pepper seeds. Farmers in Bangka sell pepper to pepper collectors. The collectors in this area still inspect the pepper using manual methods without the help of other tools, so there are still foreign objects such as

dry leaves or pepper stalks. This method is often inefficient because the precision of each person is different. In this case, we propose to determine the quality of pepper based on the percentage of foreign objects automatically in accordance with the determination of pepper quality standards regulated in the national quality standard (SNI). The authors use YOLOv3 for object detection which is one of the fastest and most accurate object detection methods, outperforming other detection algorithms. However, YOLOv3 requires a heavy computer architecture. Therefore, YOLOv3-tiny, a lighter version of YOLOv3, can be a solution for smaller architectures. This study found that YOLOv3-tiny model has a reasonably high network performance value: precision value of 0.99, recall value above 70%, and F1 score above 80%. While determining the quality of pepper according to the standard quality of pepper (SNI) the value obtained must be below 2%. Then a comparison was made between the detection system and the manual calculation of objects. It was found that in the sample of 26 pepper seeds, the system detected 8.97 seconds faster than manual calculation.

Keywords: Pepper, YOLOv3, TinyYOLOv3, image detection.

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Bacterial Classification Using Deep Structured Convolutional Neural Network for Low Resource Data

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Bacterial identification is an essential task in medical disciplines and food hygiene. The characteristics of bacteria can be examined under a microscope using culture techniques. However, traditional clinical laboratory culture methods require considerable work, primarily physical and manual effort. An automated process using deep learning technology has been widely used for increasing accuracy and decreasing working costs. In this paper, our research evaluates different types of existing deep CNN models for bacterial contamination classification when low-resource data are used. They are baseline CNN, GCNN, ResNet, and VGGNet. The performance of CNN models was also compared with the traditional machine learning method, including SIFT+SVM. The performance of the DIBaS dataset and our own collected dataset have been evaluated. The results show that VGGNet achieves the highest accuracy. In addition, data augmentation was performed to inflate the dataset. After fitting the model with augmented data, the results show that the accuracy increases significantly. This improvement is consistent in all models and both datasets.

Keywords: Bacterial classification, Deep learning, Convolutional neural network (CNN), *E-coli*.

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Bell Pepper Leaf Disease Classification Using Fine-Tuned Transfer Learning

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Leaf diseases of plants are common worldwide. Using image processing, farmers could spot diseases in pepper plants more rapidly and get advice from plant disease experts. In this paper, researchers developed a Transfer Learning classification model for bell pepper leaf disease, with the Transfer Learning model trained on images of healthy and diseased bell pepper leaves. Classification of healthy and diseased bell pepper leaves has been carried out, and fine-tuned Transfer Learning has been applied using several pre-trained CNN models. To achieve the best outcome, four pre-trained models, including MobileNet, VGG16, ResNetV250, and DenseNet121, and three Fully Connected (FC) layer architectures were tested. The Fully Connected (FC) layer with four Transfer Learning architectures achieved the best accuracy value of 99.33% on DenseNet121 architecture with one layer and Cohen's Kappa value of 0.9865.

Keywords: CNN, Transfer Learning, fine tuning, bell pepper.

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Design and Development of Mini-Compact Wilkinson Power Divider for X-Band Man-Pack Surveillance Radar

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This paper presents the design and development of a mini-compact Wilkinson Power Divider (WPD) operating at 9.3 GHz, with a wide bandwidth of 200 MHz, for the Man-Pack Surveillance Radar (MPSR) application. The design of the WPD was carried out using Advanced Design System (ADS) software with a microstrip feeding technique. The substrate material used in this design was Duroid Roger 5880, which has a thickness (h) of 1.575 mm, dielectric constant (εr) of 2.20, and loss tangent (tan δ) of 0.0009. A WPD was designed, developed, and measured. The simulation results obtained included return loss (S_{11}) -37.50 dB, (S_{22}) -26.59 dB, (S_{33}) -26.09 dB, insertion loss (S_{21}) -3.61 dB and (S_{31}) -2.55 dB, and isolation (S_{32}) -12.89 dB. Overall, the simulation result parameters worked at a frequency of 9.3 GHz. Furthermore, when the WPD measurement produces a measured return loss of (S_{11}) -28.69 dB, (S_{22}) -28.5 dB, (S_{33}) -29.95 dB, insertion loss (S_{21}) -6.61 dB, and (S_{31}) -7.55 dB, and isolation (S_{32}) -21.89 dB. The dimensions resulting from the realization were 20.5 mm × 20 mm.

Keywords: wilkinson power divider, man-pack surveillance radar, X-band, mini-compact strain, DFT, exchange-correlation, thermoelectric, bandgap.

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