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Abstract Index

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Subscriber Growth Forecasting of LTE Network 1800 MHz FDD at Denpasar City using Monte Carlo Simulation

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LTE is the 8th technology officially developed by the 3rd Generation Partnership Project (3GPP). The LTE technology is a solution that is used by engineers to resolve the problems of improving the quality of communications services. The LTE technology able to deliver up to 300 Mbps and 75 Mbps for downlink and uplink, respectively. This study aims to determine the maximum subscriber connected for LTE network technology with capacity planning at 1800 MHz Frequency Division Multiplexing for subscriber growth forecasting in 2025 at Denpasar city. The simulation used Atoll radio network planning software with the Monte Carlo method. Monte Carlo was used to investigating the increase in user throughput according to customer distribution, path loss, and services provided. This simulation is based on traffic data from traffic maps, lists of subscribers and user penetration and cellular services. Monte Carlo simulation shows the results in 2017 which 99.8% of users were successfully connected and only 0.2% of users were rejected. For forecasting in 2025, 99.3% of users are successfully connected, and only 0.7% of users are rejected.

Keywords: LTE Network, Frequency Division Multiplexing, Capacity Planning, Monte Carlo Simulation.

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Design Analysis of Microstrip Rectangular Patch Array Antenna 16×1 on X-band Radar

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Radar has been widely used for various purposes such as monitoring atmospheric precipitation. For that purpose, it gives more accurate results than satellites do. Previous research has developed navigation radar that alters its functions into an atmospheric precipitation monitoring radar. To improve the development of the radar, an antenna system will be developed in this research. The purpose of developing this antenna is to obtain better data reception results. This antenna is a microstrip rectangular array antenna that works on X-band with a frequency of 9.41 GHz. Microstrip antenna is chosen since it has several advantages such as small dimensions and relatively low costs. The designed antenna gain ≥ 12 dB, bandwidth of 60 MHz, and horizontal polarization. Antenna fabrication produces a microstrip rectangular 16 x 1 array antenna using the mitered bend method at a frequency of 9.4 GHz with a reflection coefficient of -22.8 dB, VSWR of 1.2, gain of 13.21 dB, unidirectional radiation patterns and horizontal polarization.

Keywords: Weather radar, precipitation monitoring, microstrip rectangular array, X-band, mitered bend.

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Bidirectional Network in Hybrid Coarse Wavelength Division Multiplexing/Time Division Multiplexing (CWDM/TDM) on NG-PON2 for 40 Gbps

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In this research, we propose hybrid Coarse Wavelength Division Multiplexing/Time Division Multiplexing (CWDM/TDM)-Passive Optical Networks (PON) scheme for optimizing the new

technology of Gigabit-PON (GPON) called Next Generation-PON Stage 2 (NG-PON2). The simulation of using this scheme proved that Q-Factor increase and Bit Error Rate (BER) decreased, significantly. We use CWDM scheme for downstream while TDM is used for upstream, and we assimilate both of them with new configuration in bidirectional cable setting. CWDM is used due to low nonlinearity effect like Kerr effects. It has the same working principle based on (Time Wavelength Division Multiplexing-PON) TWDM-PON by differentiating the use of wavelength, it can be easily implemented on existing PON technology, and can be used in single-mode optical fiber (SMF) with greater bandwidth and much cheaper operational costs. From the calculations and simulations, it can be analyzed that the network Hybrid of CWDM / TDM-PON able to work on bit rate of 40/10 Gbps on the number of users 32, 64, and 128, with Q-Factor value is above 6 equal to International Telecommunication Union of Telecommunication (ITU-T) standard. The number of users 32 with two cable lengths of 10 and 20 km have value of Q-Factor 25.960 and 14.815 respectively, while64 users with the same cable length have Q-Factor value of 15.808 and 13.046 respectively. In addition, 128 users with the same cable length have BER value of 17.778 and 12.944 respectively.

Keywords: CWDM, TDM, WDM-PON, 40G, NG-PON2.

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Audio Watermarking Combined with Compressive Sampling Based on QIM and DST-QR Techniques.

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Abuse is not only done to copy or distribute data but also to the digital copyright labels. There is a way to protect data by inserting or hiding a piece of certain information, namely a watermarking technique. In this paper, we propose audio watermarking with Quantization Index Modulation (QIM) method as an embedding process combined with Compressive Sampling (CS), Discrete Sine Transform (DST) and QR decomposition. Binary image is used as a watermark inserted in host audio. DST is used for transformation process from time domain to frequency domain, while QR is used to decompose one-dimension matrix into two-dimension matrix. Meanwhile, CS is used to obtain the compressed watermark file which is done before the embedding process. QIM method is used to embed the watermark file to the audio host file. Simulation results indicated that the proposed audio watermarking technique has good robustness against some attacks such as Low Pass Filter (LPF), resampling and linear speed change. In addition, it provides good performance in terms of imperceptibility with Signal to Noise Ratio (SNR) > 20 dB and capacity C = 689 bps.

Keywords: Audio watermarking, Quantization Index Modulation (QIM), Discrete Sine Transform (DST), QR, Compressive Sampling (CS).

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CDF-based Flow Detection for Network Flow Sampling and Packet Capturing.

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Providing an appropriate level of flow collection, relying on packet capturing or flow sampling method, is extremely hard due to various practical limitations and resources requirements. To address this challenge, this paper investigated a CDF (Cumulative Distribution Function)-based flow detection to decide between “known” and “unknown” flows. Therefore, a combined flow collection can be achieved to improve the collection’s efficiency by sampling only the known flows and capturing the remaining unknown flows. As a preliminary experiment, detecting known and unknown flows was conducted over a long period by calculating the empirical CDF distance between each flow’s rate and overall packet’s rate distribution, called as FPR (Flow-to-Packet Ratio), with a threshold (FPR_{min}) based on a significant level of observed data. The result shows that unknown flow is detected for most of the recommended significant level values.

Keywords: flow detection, cumulative distribution function (CDF), flow sampling, and packet capturing.

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Infinite Latent Feature Selection Technique for Hyperspectral Image Classification.

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The classification process is one of the most crucial processes in hyperspectral imaging. One of the limitations in classification process using machine learning technique is its complexities, where hyperspectral image format has a thousand band that can be used as a feature for learning purpose. This paper presents a comparison between two feature selection technique based on probability approach that not only can tackle the problem, but also improve accuracy. Infinite Latent Feature Selection (ILFS) and Relief Techniques are implemented in a hyperspectral image to select the most important feature or band before applied in Support Vector Machine (SVM). The result showed ILFS technique can improve classification accuracy better than Relief (92.21% vs. 88.10%). However, Relief can extract less feature to reach its best accuracy with only 6 features compared with ILFS with 9.

Keywords: classification, feature selection, hyperspectral carbon, Infinite Latent Feature Selection (ILFS), SVM.

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