MIMO Antenna Design: A Comprehensive Study of Antenna and Isolation Enhancement Techniques for 5G Communication

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Abstract: The Fifth-Generation (5G) wireless technology lying in millimeter-wave band ranging from 30 to 300 GHz proves a better successor from its previous wireless communication in terms of data rates, geographical coverage, spectrum available, latency, multi-application facility and energy consumption. 5G has been given a specific range of band in the spectrum to be deployed globally. However, we all know the relation between the frequency and wavelength is inverse in nature. This is the major impact on the 5G communication, as the wavelength is shorter compare to 3G, 4G which were deployed at lower microwave region. Fading and absorption are the main cause for the degradation in performance of 5G. In order to alleviate these drawbacks, MIMO (Multi-Input Multi-Output) seeks attraction by the researcher. As in MIMO, number of antennas will be deployed in both transmitter and receiver sides which reduces the multipath fading and increases the channel capacity. But, implementing the MIMO is itself imposes diverse challenges in terms of design. This survey paper provides an extensive study of various design approaches along with distinguish mutual coupling enhancement techniques which are present to improvise the performance parameters of MIMO Antenna Design such as ECC, CCL etc for 5G Communication.

Keywords: Multiple-Input Multiple-Output (MIMO) Antennas, Envelope Correlation Coefficient (ECC), Channel Capacity Loss (CCL), Mean Effective Gain (MEG), Mutual Coupling, 5G Technology.

I. Introduction

The wireless communication technology has seen a tremendous evolution in terms of performance and hardware aspect in last four decades. Each successor wireless technology came as a possible solution to the hurdles which were not able to overpass by its predecessor technology. As an answer to the low data rates, coverage issue, mobile user accommodation, latency etc, 5G evolved. The Fifth-Generation technology is appealing technology having potential to surpass numerous concern which can even trouble in near future. Not only fast connectivity, higher capacity and high bit rate will be achieved but also the door to the virtual world will open for mankind which eventually lead to the advancement of mankind. With the deployment of 5G, there is no uncertainty that there will be massive transformation in the various sector such as healthcare, education, industry. The Third-Generation Partnership Project (3GPP) is governing body for finalizing the standards for 5G. It has mentioned key scenario for 5G; namely eMBB, mMTC and uRLLC [1] depicted in fig.1. For these scenarios, 5G can be operated at three different frequency bands to cater broad coverage, fast

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A Survey on Implementation of Swarm Evolutionary Algorithms to Vehicular Communication

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***Abstract*- Rapid metropolitan city development and population growth have resulted in an exponential increase in the number of cars used by commuters. The already overwhelming issue of traffic congestion is being made worse by this. Highway construction additions are no longer appropriate short-term, expensive, or short-sighted solutions. Concentrating on the frequently utilized controlling traffic signals and fewer time schedules is one efficient approach to allocating road resources. It may not be the most simple or practical approach to find a suitable or optimum plan for the prior by using brute force. Adaptive and swarm intelligence methods are two examples of algorithms that were influenced by nature. Numerous of these methods have been applied during the past two decades to various smart city applications, such as controlling traffic signals (CTS). The use of swarm and adaptive intelligence methods to CTS is thoroughly reviewed in this work. The collection of objective(s), issue modeling, choice variables, optimization, and the encoding solution is used to classify the work that was surveyed. The study suggests interesting future directions for research and examines where research is headed is heading based on Genetic Algorithm (GA) discovered by the performed review.**

Key Terms: Swarm Intelligence; Split-Level Optimization Single and Multi-Objective; Evolutionary Computation Algorithm; Controlling Traffic Signals; Traffic Junction.

1. INTRODUCTION

Urban city dwellers are expected to travel utilizing either their automobiles or public transportation. The majority of passenger vehicles are seen in Figure. 1.

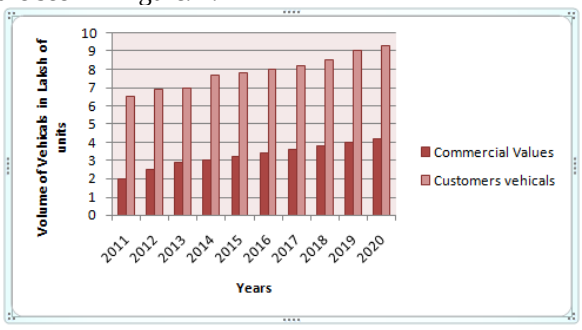

Fig. 1 Most of the vehicles used for passenger travel between 2011 and 2020

Additionally, from 2011 to 2020, commercial vehicles were utilized worldwide. Around 226.5 lacks passenger automobiles and 9.82 lakh commercial vehicles were in use on the world's roads in 2020 alone [2], [3].
The United States has wasted 305 trillion dollars due to traffic congestion alone, according to a recent report by INRIX Global Traffic [4]. Around the world, traffic congestion has grown to be a major issue. The conventional methods of building new crossings and widening existing roads are not only expensive, but they also seem like inadequate short-term fixes.

Intersections and linkages make up the majority of an urban traffic system. This system regularly experiences traffic congestion, which presents serious difficulties. The reduction of these difficulties not only enhances the commuter experience but also lessens several issues including environmental pollution. Signalized and non-signalized junctions make up the majority of urban traffic networks. A signalized junction, as the name suggests, makes use of traffic lights, whereas a junction without signals, often referred to as an unregulated junction, will not. In actuality, each kind of crossing is used in city traffic systems, This causes varying connection flow fluctuations and road traffic characteristics. The authors of [5] carried out a thorough study of junction monitoring systems and looked at how drivers behaved (vehicles, drivers, and pedestrians). A detailed look

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Measurement

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Time-differenced double difference method for measurement of Navigation with Indian Constellation (NavIC) receiver differential phase bias

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Abstract

The pseudo-range (PR) and carrier phase (CP) observations of Global Navigation Satellite System (GNSS)/Navigation with Indian Constellation (NavIC) receivers are influenced due to various errors like ionosphere delay, troposphere delay, receiver and satellite clock error, multipath, integer ambiguity, receiver hardware noise etc. However, the real-time positioning and navigation applications are in quest of high-quality carrier phase measurements with zero bias. The GNSS/NavIC receiver hardware noise is one of the critical error sources that degrade the quality of carrier phase measurements. And it can be measured by computing the differential phase bias or carrier phase bias employing the double-difference method. This research article proposes a novel approach called Time Differenced Double Difference Carrier Phase (TDDDCP) for estimating differential phase bias or carrier phase bias of NavIC receiver. Moreover, the proposed TDDDCP technique has the advantage over the Double Difference Carrier Phase (DDCP) because it requires data from only one satellite with two zero base length receivers for which the differential phase bias is to be measured. The experimental results show that the differential phase bias value differs for different satellites, ranging from −0.3904 m to 0.3168 m. The bias-free carrier phase observations based on position coordinates (X, Y, Z) found improved precision of standard deviation of 0.4176 m, 0.645 m, and 0.328 m, respectively.

Introduction

The GNSS (Global Navigation Satellite System) provides continuous positioning and timing services for vehicles, ships, airplanes, time synchronization, geodesy, guidance, control of an Unmanned Aerial Vehicle (UAV) and precision agriculture etc. [1], [2], [3], [4], [5], [6], [7]. The GNSS/NavIC(Navigation with Indian Constellation) receiver records carrier phase and pseudorange observations of signals for precise positioning [8], velocity [9], and time [10] estimation. The carrier phase observations are more accurate than code phase pseudorange observations. But, the carrier phase observations are degraded by the receiver hardware noise

NavIC Pseudorange Bias Estimation and Analysis Using Double Difference Method with Different Baseline Lengths

Publisher: IEEE

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Abstract: NavIC (Navigation with Indian Constellation) is an essential and indigenous positioning system developed by ISRO (Indian Space Research Organization) for all the location... **View more**

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Abstract:
NavIC (Navigation with Indian Constellation) is an essential and indigenous positioning system developed by ISRO (Indian Space Research Organization) for all the location and navigation requirements in India. Before the deployment of NavIC in navigation and communication devices, it requires measuring and analyzing the residual bias remains in pseudorange and carrier phase observations when removing the atmospheric errors, satellite and receiver based errors. In this article we analyze the bias in NavIC pseudorange measurements on L5 band (1176.45 MHz) by using Double Difference (DD) method with different base lengths viz. zero base length, 1 meter base length, 3.56 meter base length, 5 meter base length, 7 meter base length and 9 meter base length. For all baseline lengths, the experiments were carried out in static position by using two multi-GNSS receivers at Kurnool (15. 79°N, 78.07°E), India. The pseudorange bias results were presented for a Geostationary orbit(GEO) satellite, IRNSS-1G (I07) and a Geosynchronous orbit (GSO) satellite, IRNSS-1D (I04). The satellite IRNSS-1C (I03) was considered as a reference in DD computation because of its highest elevation angle. The outcome of this research work shows that the pseudorange bias on L5 is in the range of - 0.606 m to 7.169 m and -0.019 m to 4.331 m for I04 satellite and for I07 satellite. Further the pseudo range bias increases significantly as the baseline length increases for both I04 satellite and I07.

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Healthcare Monitoring Wearable Microstrip Patch Antenna for Elder People with Acceptable SAR

Publisher: IEEE

Vutukuri Sarvani Duti Rekha ; Ramarao Gude ; N B Bobinath ; Ashok Kumar ; Samanth S ; Sankararao Majji **All Authors**

Abstract: The increasing number of uses for implantable electronics has stimulated a wave of new developments. Wireless communication systems have advanced swiftly and widely in th... **View more**

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Abstract:

The increasing number of uses for implantable electronics has stimulated a wave of new developments. Wireless communication systems have advanced swiftly and widely in the recent decade. Wireless communication devices have a physical form factor that is determined by the size of the components used to construct them. These textile-based wearable antennas are soft, pliable, and easy to wear for long periods of time. Commercial substrate microstrip antennas were bulky and uncomfortable to wear. Because of this, there is a significant need for antennas made of textiles that may be worn. Due to its compact design and low weight, the microstrip patch antenna (MPA) is a strong contender in this field. The focus of this study is on five key aspects of microstrip patch antenna design: miniaturisation, narrowband multi resonance effect, multiband operation, frequency tuning characteristics, and bandwidth expansion. The Specific Absorption Rate (SAR) is determined for most of the suggested wearable antenna designs. The specific absorption rate (SAR) is the measure of how quickly a human body absorbs electromagnetic radiation while in contact with an antenna. A safe SAR value for a wearable antenna is one that falls below the established limits. Therefore, the best way to set up a health monitoring and tracking framework that allows an individual to be located is through wearable devices embedded in clothing. Wearable antennas are designed and connected to garments as a sort of wearable technology for the purpose of tracking and remotely monitoring the user.

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MANUSCRIPT

Implementation of all-optical 3-dB and 10-dB directional coupler for switching applications

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Received: 23 February 2022 / Accepted: 8 May 2023

Abstract
The design of an all-optical 3-dB and 10-dB directional coupler that functions as an optical switch if applied a control signal by fusing two photonic crystal waveguides with a coupling wavelength of 14*a* is accomplished by fusing two waveguides at the center. This fusion is responsible for optical power transfer between the waveguides. The proposed structure was optimized using finite difference time domain and operates at a wavelength of 1550 nm, excluding some wavelengths that were calculated using photonic band gap. It can be used in a variety of telecommunication devices, including multi/demultiplexers for wavelength-division-multiplexing systems, splitters, and optical switches.

Keywords Photonic crystals · All-optical · Directional coupler · Photonic band gap · FDTD method · Optical switch

1 Introduction

Electronic devices have become nearly ubiquitous in the information processing industry over the past few decades, being used for virtually all applications. Moore's law dictates that the number of transistors and data density on a chip doubles every 18 months on average. This trend may continue for a decade or two, but it cannot continue indefinitely. Fundamental physical constraints on electronics have increased, including transistor size restrictions, the requirement for higher frequency operation, and power consumption, that are all becoming increasingly serious issues. At network nodes, where higher operational frequencies are required, the difficulties are exacerbated. As a result of their inherent limitations, electronic equipment cannot operate at high frequencies or with large bandwidths. On the other hand, the optical domain is unaffected by extremely high frequencies. The current trend in telecommunications networks is to reduce reliance on electronics and increase reliance on optics. Nonetheless, because optics are capable of handling high frequencies, small sizes, and wide bandwidths, it is critical that electronics be phased out wherever possible in favor of optics. Nowadays, electronic transistors consume a negligible amount of energy (a few femto-joules) per logic operation. In addition to power consumption, signal processing is complicated by fundamental physical constraints imposed by optics. Due to their extraordinary ability to regulate light, photonic crystals (PCs) have piqued the interest of numerous researchers [1–13]. The photonic band gap (PBG), and that is the frequency range in which light cannot propagate in personal computers, is one of their primary characteristics. When a defect is added to periodic arrays, a defect mode is observed in the PBG. If we repeatedly introduce errors into the computer, light will propagate across a line defect. This is referred to as PhC waveguides, and they have been examined by a large number of researchers. Directional couplers (DC) are made up of two optical waveguides that are brought close enough together to interact optically in

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MATERIAL SCIENCE AND TECHNOLOGY

DESIGN AND IMPLEMENTATION OF FIBONACCI NUMERAL CODES FOR CROSSTALK NOISE AVOIDANCE

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Abstract:

In this paper, we address the issue of crosstalk and try to reduce it using various methods. We also propose a series of Fibonacci coding methods for preventing crosstalk and contrast these with several of the most widely used crosstalk prevention strategies methods using the XILINX VIVADO TOOLS and simulate the codes for the reduction of crosstalk.

Keywords- Crosstalk avoidance code, forbidden pattern free codes (FPF), forbidden transition free codes (FTF).

I. INTRODUCTION

Noise in digital systems has grown to be a serious issue that affects the system. One of the main problems in Deep Sub-Micron (DSM) [1] design is cross-functional and cross-crosstalk, which becomes significant with reducing characteristic dimensions of VLSI production techniques and considerably decreases the speed and increases the power needs of an IC. The primary focus of the work presented in the first half of this monograph is cross-talk minimization with bus encoding. One of the best methods for minimizing the effects of on-chip capacitance interference while also improving the power and speed efficiency of the bus link is this method. This method encrypts information prior to transmitting through a bus and evade unwanted crossover situations, which boosts bus performance and/or lowers energy consumption.

Crosstalk avoidance codes (CACs) that have little or no storage are the initial group to be discussed. Because all these codes are created from a predefined codebook and are only affected by the data being supplied at the time, simpler CODECs are needed. From 3C-free to 1C-free codes, we examine a variety of memory-less CACs, providing performance review and code design features.

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We demonstrate that even these methods are more effective than common crosstalk-avoiding methods. We go through several CODEC development methods that make it possible to build CODECs that are modular, quick, and have minimal overhead. Memory-based CACs is the second collection of codes that are displayed. These codes are more space-efficient than memory-less ones

II.BACKGROUND

For Deep Sub-Micron (DSM) processes, it is seen that CI (Interconnect Capacitance) is significantly higher than CL (Load Capacitance). Using the power consumption and delayed models, the bus's power consumption can be determined as a result of the overall distortion throughout the entire system. Worse delays are constrained by the highest interference in each line the bus undergoes, and this determines the maximum range of the transport. Decreasing noise has been shown to significantly boost network performance [2]. In the domain of bus connections, a variety of approaches have been brought out to minimize crosstalk. Some strategies concentrate on lowering energy usage, strategies concentrate on cutting down on delays, and strategies concentrate on both. The use of insulated strands to safeguard each piece of information is the simplest way to address the multi-distortion problem. Different time shifts are added to various parts of the bus to create this purposeful skewing. No neighbor connections switch at the exact moment because the bus wires switch between having regular timings and shifting times. Duration can change using either a repeater or double timers

Design and Implementation of Forbidden Transition Free CAC design

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Abstract- When sending data between Processing Elements, one of the major reliability difficulties is the occurrence of crosstalk fault between metal wires. Based on the observed that the transition patterns on the channel, crosstalk fault is caused by coupling capacitances between the wires. For the transmitted metal wire in the System on Chips channels, the opposite Transition pattern among these patterns has the worst crosstalk effect. Unauthorized Pattern Opposite Transitions can be effectively omitted using Forbidden transition Free Crosstalk Avoidance Codes (FTF-CACs). Modern FTF-CAC, however, contains ambiguity in its mapping method. Due to this issue, some data words are given more than one code word. In order to address this issue, this study proposes an FTF-CAC termed Fibonacci numeral codes. By using the bus encoding and decoding methods it reduces crosstalk faults in the opposite transitions the buses. A mapping algorithm and a system of numbers without ambiguity that can produce each dataword can have a unique codeword recorded, as well as extra wires. Evaluations show that the suggested numerical system may be used to wires with any conceivable channel width and that it has better overheads than the recently announced FTF-CAC, which results in a significant increase in reliability.

***Keywords*:** *FTF-CAC, VSLI, Crosstalk, Reliability and Overhead.*

1. Introduction

Designers can now pack a huge number of processing elements on a single chip because to advancements in Very Large-Scale Integration (VLSI) technology in recent years [1]. Cables are used to exchange data packets between these data processing components [3]. The accuracy of the data being sent could be in danger due to a number of issues [1]. Crosstalk fault develops as a result of coupling capacitances between long and close wires. Crosstalk defect results in undesirable voltage fluctuations, delays, or accelerations of rising/falling transitions on the victim wire accelerations of transitions from rising to falling on the victim wire [4]. Timing errors, inaccurate data transfer, greater power consumption, and decreased reliability are the results of these repercussions [5]. Recent studies have found that transition patterns are what generate crosstalk fault, and the transition patterns that form on the wires to determine the fault's severity [6]. For instance, the channel's worst crosstalk impacts, often referred to as opposing transitions, are imposed by the transition pattern "01" that is followed by "10"[6]. In the literature, there have been a number of mechanisms at various design abstraction levels to address crosstalk errors. shielding, crosstalk-aware layout design, and some physical level approaches to address the crosstalk errors in wires include intentional

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Vehicle Monitoring System using Arduino

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ABSTRACT

In Today's world, transport is essential to the public and with the rise in population accidently increased in the vehicle usage, this leads to more accidents. Most of the accidents occur due to the consumption of alcohol, the speed of the vehicle exceeds, or when the driver felt drowsy. There are many sensors that are used to detect. In this project we are using the alcohol sensor and eye blink sensor. These sensors are connected to the Node MCU ESP8266. Node MCU ESP8266 has the inbuilt Wi-Fi. These are placed on the PCB. The speed of the vehicle slows down when it detects the abnormal condition of the driver. The buzzer gives the beep sound when it detects the drowsiness of the driver and senses the alcohol detection. And also a notification message is sent to the mobile, by using the blynk application.

Keywords-- Accidents, Alcohol, Abnormal Condition, Blynk Application, Drowsy, Eye Blink, Speed, Vehicle Exceeds

INTRODUCTION

The increasing demand in vehicles resulted in rise of traffic and road accidents. The people's lives are in grave danger. This is due to the lack of high-quality emergency services in our country. This project introduces an automatic car accident alarm system. This concept is a system that can identify accidents in a fraction of the time and delivers basic information to the owner or registered mobile numbers, including geographic coordinates, time, and angle of the car accident. This alert message is transmitted to the rescue crew in a timely manner, allowing vital lives to be saved. In the unusual instance where there is no casualty, a switch is provided to stop the message from being sent, saving the medical rescue team valuable time. When an accident happens, an alarm message is sent to the rescue team and the police station automatically [1]. The message is conveyed over the internet via the Wi-Fi module. The information from the MEMS sensor can also tell you the angle of the car's rollover. This programme gives the best possible answer to substandard emergency services given in the event of a road accident. Over the last decade, the use of automobiles has increased linearly, increasing the risk of human life. This is due to a lack of adequate emergency facilities. Over the last decade, the use of automobiles has increased linearly, increasing the risk of human life. This is majorly because of the lack of adequate emergency facilities. In this research, we use an alarm system to aid in the improvement of the accident system's emergency system. This technology recognises the condition of the driver and sends the message to the rescue crew. If there is no causation, a switching system is employed to turn it off. This application aids in the provision of a workable solution to a terrible emergency situation [2].

Detection of Drowsiness and Techniques for Drivers

The drivers who do not take a break are at a higher risk of becoming drowsy. According to a study, accidents are caused by drivers feeling drowsy, who need a break, which suggests that drowsiness causes more road accidents than drunk driving. Attention assist can detect inattentiveness and drowsiness over a wide speed range, notify drivers of their current state of fatigue and driving time since the last break, and, if a warning is issued, indicate

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Design and Implementation of Crosstalk Noise Avoidance by using Advanced Test Adapted Shielding for high speed vlsi circuits

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***Abstract*— The Crosstalk noise is existing in VLSI circuits because of the electromagnetic coupling in between the wires unfriendly, it affects the VLSI circuits accurate performance. This makes interconnect testing a vital issue in responsibility analysis that causes additional space and hardware operating overhead[2]. In this project, we have a tendency to gift a completely unique methodology that we have a tendency to talk over with advanced Test Adaptive Shielding (TAS), so as to boost testing challenges and in addition to optimize crosstalk noise. Boosting of circuit performance is done by test structure at Test adapted shielding which includes the insertion of modified shield lines. The Hardware which is being developed for test data is sensible to ignore the aggregation faced by victim lines due to crosstalk noise. The main methodology of TAS method is to reduce he over use of power, complex nature ,fault detection. The projected technique will implement in ASIC, VERILOG HDL .**

Keywords: Crosstalk, Advanced Test Adaptive Shielding(ATAS), Encoder and Decoder, Multiplexer, Comparator.

I. INTRODUCTION

Very Large-Scale Integration (VLSI) refers to an integrated circuit or technology with many devices on one chip. where it is a smaller size electronic device designed from material of semiconductor which includes many very small elements, such as transistors, diodes, capacitors & resistors[10]. This is the emerging technologies which obeys the "Moore's law".

Moore's law states that the numeric count of transistors on a microchip double about every two years. It was the observation made by Gordon E. Moore in the year of 1965.A large single VLSI chip can contain over one billion transistors. That observation holds true even today. As we want smaller size in designing for easy usage. So, it evolves many challenges in designing. The major challenges in VLSI chip designing are noise, crosstalk and power dissipation. In small chip design there are many interconnects are present[8]. As the distance between each component decreases there may be high chance of crosstalk noise occurrence. Crosstalk is the unwanted transfer of signals between communication channels. Crosstalk is an undesired effect caused by the electric or magnetic fields of one telecommunication signal to another telecommunication signal adjacent in circuit[4].

The crosstalk can be reduced by increasing the space between the interconnecting wires. But it may not efficient as the size of the designing should be small. So, our method is adding the shield wire in between the interconnecting wires. This extra shield wire reduces crosstalk and improves reliability.

II. PRIOR METHOD

Previously there are some methods for reduction and elimination of crosstalk. They are like increasing the distance in between the interconnecting wires. But it may not work effectively as it increases the size of the chip, which occupies more space and it is difficult to maintain.

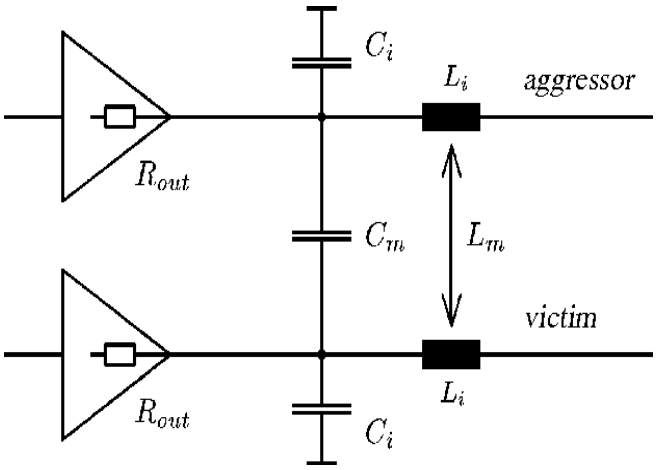

Fig. 1.

Another method to reduce crosstalk noise, is by increasing the victim load of the capacitance. i.e., high the victim load, then the resistance will be reduced, this causes the victim load to maintain a strong static voltage. So that the victim will not be affected by the aggressor[6].

Several methods are used to reduce the crosstalk elimination problem. The main purpose of the RLC based filtering circuits is to minimize the peaks which are showing up due to cross talk and some of them work in encoding and decoding schemes to reduce the crosstalk elimination problem to encode the data before connecting to the signals to the long nets[3]. Crosstalk noise is a major issue for signal to noise ratio which is the presentation of wavelength multiplexing. Based on the considering the worst case and crosstalk noise in different SNR ONoC architectures we can choose required architectures which satisfies the certain performances and requirements.

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LOW POWER DESIGN OF 4x1 MUX USING MGDI TECHNIQUE

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Abstract:
In The use of portable systems is expanding quickly, which has encouraged microelectronics research and development, particularly in power consumption. Low-power technology has emerged as a significant technological component because batteries cannot keep up with microelectronics speed. A Low-power architecture design, or MGDI is the lowest design technique that is ideal for quick, low power circuit models utilizing a small number of transistors. It is a quite change in Gate Diffusion Input (GDI). Using the 180nm which is dependent on MGDI technology, primitive cells AND, OR, and XOR gates, entire circuits like full-adders, full-subtractors, and a 4x1 MUX can be built. The fundamental drawback of GDI is that it cannot use the bulk junction since it is not enough biased. The merits of MGDI are that it minimizes the number of transistors and chip area, resulting in low power consumption. So, it is easy to create complex circuits utilizing the MGDI approach. Here, GDI was initially used to construct the multiplier.

Keywords- *Modified gate diffusion input(M-GDI), Bulk junction.*

1. INTRODUCTION

Modified-GDI or MGDI is most recent minimal power design technique that aids in the resolution of most issues [1, 2]. This method enables simplest top-down approach by using minimum cell libraries and is suited for quick low-power circuits with fewer transistors, enhancing the level of logic swing and static-power characteristics [3-5]. Only two transistors are required in building AND gate using MGDI technique. MGDI technique uses limited number of transistors than conventional logic technique [6].

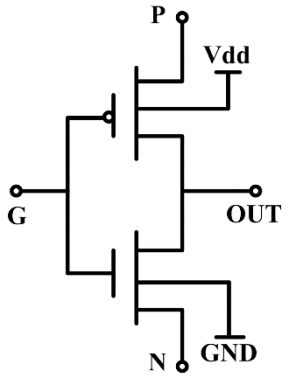

Fig 1.1: MGDI basic cell

The majority of the NMOS transistors are connected to Ground (low constant voltage). All the existing CMOS development procedures are compatible with mod-GDI cells. This arrangement of MGDI cells helps in reducing both sub-threshold and gate leakage when compared to the static CMOS switch. MGDI outperforms GDI cell drawbacks. With the help of technology level scaling, or the linear body coefficient 'Y' in the lowest equation, the influence of the VDD (source voltage) on transistor threshold voltage is not necessary. We can eliminate the drawbacks of CMOS and PTL approaches by constructing low-power digital combinatorial circuits with the aid of the MGDI technique. With this method, digital circuit size, propagation latency, and power consumption can all be decreased while logic design complexity is kept to a minimum [7, 8]. In this project we are going to discuss about the building of 4x1 MUX using MGDI technique. The design of the gates AND and OR will be done in this endeavor. Additionally, 4x1 Multiplexer designs are developed using these gates, which have the advantages of low power consumption, little latency, and a compact layout.

There are several designer levels, covering architectural, circuit, layout, and processing technology levels, where the increasing requirement for low-power very large-scale integration (VLSI) can really be satisfied [9, 10]. Through the proper choice of a logic style for the implementation of Combinational circuits, there is a significant potential for power efficiency at the circuit level of design [11–13]. This is because the major variables affecting energy dissipation, switching capacitance, transition

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Complex Frequency Block Domain Analysis and Efficient Implementation for Computational Active Noise Control

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Abstract

This paper provides a detailed description of active noise control (ANC) algorithms using the frequency-domain filtered-x least mean-square (FDFxLMS). In the ANC system, the traditional FXLMS algorithm is offered inefficient performance where a large number of filter coefficients are used by the secondary path estimate and the adaptive controller. In this paper, a filtered complex least mean square (FBFXCLMS) dependent frequency domain block solution is proposed to reduce the ANC system's computational complexity for higher control filter order coefficients and enhance the convergence performance.It is implemented using an overlap-save technique based on convolution and correlation operations, which offers substantial computational improvements for higher-order adaptive filters as compared to the time domain FxLMS algorithm.The complex adaptive filter algorithm is guided inversely proportional to that bin's signal power, individual step size for each frequency bin.Systematic computer simulations are conducted to demonstrate the precision relative to the time domain FXLMS algorithm for the proposed frequency-domain block FXCLMS algorithm.The proposed solution findings, in comparison to the time domain FxLMS algorithm, have provided fast convergence and stability.

1. Introduction

The acoustic noise problems are becoming more apparent in the current scenario as increased noise-related sound sources are generated from factories (fans, blowers, exhaust pipes, engines), household machinery, cars, and public spaces. Another similar form of noise is mechanical vibration, which is typically created issues in the fields of transport and production [4-5]. Most people prefer to live internationally with ease and composure, but with the advent of new technologies, acoustic pressures (sound) fill the atmosphere. Human life has been affected as a result, and it faces several health concerns.In the conventional approach to acoustic noise control, passive strategies like enclosures, obstacles, and silencers are used to reduce unwanted

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IoT based Social Device Network with Cloud Computing Architecture

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***Abstract*—** Internet of Things (IoT) is an emerging technology that is taking the current technology to the next phase of connectivity by connecting any device to the internet. It may be a mobile phone device, a speaker or even a connected vehicle. The number of IoT-based devices people use is increasing day by day. The quantity of smart gadgets people purchase on both offline and online platforms has increased to a significant number in the past few years. This research article proposes social networking between IoT devices, by the interconnection of IoT devices based on a Cloud computing method. Through cloud computing, number of Edge platform-based, IoT devices can be connected to a common cloud called Fog computing, which in turn connects to the Cloud network. The social networking of IoT devices enables users to switch and share data between their IoT devices. Various computational programs and block chain techniques develop applications that allow the host network to communicate with IoT devices with secure access to the data shared by all IoT devices connected to the Cloud without any data loss or security breach.

Keywords— Energy, Cloud computing, Fog computing, IoT devices, social networking, Cloud data, Sustainable development.

I. INTRODUCTION

Cloud computing model is in use for years from now, all internet data that we browse, or store is based on the cloud network, for example the mail we send and receive that's been stored in a online data base that we access from any place and time is based on Cloud computing. To be more specific about the cloud algorithm, a centralized ticket booking system, where a certain number of tickets is accessed from anywhere and anybody to book ticket for a movie or a train without any cross-lap booking is possible through Cloud Computing architecture. This project based on social connectivity of IoT devices is achievable though the same Cloud data with some interlinking feature and networks.

The dependency and usage traffic of IoT devices and the transformative development of innovation towards the IoT devices are summarized [1]. The growth of IoT devices also led to network operations in business too, this may also lead to security a growing concern, regulations for the use of IoT devices are also framed by various governments of the world for the apt balance of technology and security [2]. This rise to security issues may require centralized independent blockchain security for the IoT devices [3].

With minor drawbacks IoT devices are taking the daily users to mere future with its development and easy to access features. As discussed before IoT devices connect every smart device to cloud [4]. Not only for individual users the IoT devices has taken the enterprise marketing to more sophisticated reachability. By the use IoT devices MNCs take their product advertising to the hands of each individual based on their interests though the collection of data from the cloud [5].

Cloud Computing is the data provider for the IoT devices without a centralized cloud IoT devices would not be able to come this far. Mobile computing that provides easy access of data to the devices that are connected to the cloud and which is giving productivity through Internet connected devices [6]. For reliable and affordable connectivity of devices to the cloud for robust performance, parallel processing and power efficiency smart grid services are required [7] [8]. Same as that Internet Cloud computing has also has some security issues with the handling of data, the security issues with cloud computing and the evaluations of the challenges in making Cloud network a secure is studied and addressed by researchers [9], [10].

The Cloud is not an imaginary data based, the Cloud computing is based on Servers of collection of hard drives that is connected to the Internet through Web services, the connectivity to the servers from the client is possible though network connectivity[11]. Social Networking services are in the internet through years, these networks ensure connectivity among people globally by connecting through networks [12]. This social networking helps people to share data among the people from various places of the world through a common cloud [13][14].

There many literatures based on the connectivity of devices to the cloud and security issues was also been addressed by various researches in field. The Connectivity of IoT devices and their development in various fields are also described in the literature but the social connectivity between the devices in the Edge user state was not widely studied or disclosed by the researchers in previous studies. This research motivates the researchers to enable and develop social connectivity of IoT device based on the Cloud computing architecture.

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Radar Based Object Detection using Ultrasonic Sensor

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ABSTRACT

Aurdino-controlled radar is the subject of this project. A servo motor and an ultrasonic sensor are the essential components of this RADAR system. Components of the system primary role of the system is to detect something. Objects that fall within the specified parameters Ultrasonic sensors are built inside the servo motor. It rotates 180 degrees and uses software to show a visual representation. It's referred to as Processing IDE. A graphical representation of the data is provided by the Processing IDE. The angle or location of the object is also indicated, as well as its distance. This system has already been implemented. It is controlled via Aurdino. An Aurdino UNO board is all that is required to control the system. The sensor's interface with the display device, as well as the ultrasonic sensor during our study of we used current navigation and obstacle detection. Ultrasonic sensors are successfully used in a wide range of inventions and systems. This RADAR system's major applicability is in a range of fields. Navigating, putting, detecting items, mapping, spying, or tracking, as well as a variety of other uses these low-cost systems are also suited for use indoors.

Keywords-- Arduino, Navigation, Object Detection System, Obstacle Detection, Ultrasonic Sensor

INTRODUCTION

RADAR is a radio-flood grounded object identifying innovation that decides the reach, elevation, bearing, and speed of items. Radar frameworks are accessible in an assortment of sizes and execution circumstances. At landing strips, some radar frameworks are used for air business control, while others are utilized for long-range observation and early-cautioning frameworks [1-3]. A slug directing framework's heart is a radar framework. Little portable radar frameworks that might be kept up with and oversaw by a solitary individual, as well as frameworks that take up different enormous lofts, are accessible. A few nations created radar in confidential ahead and during World War II [4]. The term RADAR was continued by the United States Navy in 1940 as an abbreviation for Radio Discovery and Surveillance. as well as running Since likewise, the term radar has come the normal thing radar in English and different dialects, eliminating all upper casing. Radar has a wide range of tasks in the second world, including the control of air affairs. control, Radar stargazing, air guard, and antimissile frameworks; marine radars for finding achievements and different vessels; aircraft anti-impact frameworks; sea observation frameworks, outer space reconnaissance and meeting frameworks; meteorological rush checking; altimetry and flight control frameworks; directed projectile objective finding frameworks; and ground-puncturing radar for land compliance Digital sign handling is utilized in super advanced radar frameworks, which can value significant data from authentically high commotion

Objective and Aim of Work

The ideal of this design is to produce an effective ultrasonic radar system able of covering a specific area. Since its commencement, ultrasound vision technology has been used in a variety of operations, including home security systems, robotics, distance measurement, tank location sizing, product lines and adjacency detection [5]. These numerous operations have allowed for the

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Smart Life Saver System for Scuba Divers using GSM Module

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ABSTRACT

Wellbeing related issues and boundaries are of most extreme critical to man and are fundamental for his reality. The correspondence between submerged and land is a profoundly difficult one. Radio transmissions that movement through air pass on quickly in water. Acoustic or sonar, sent by submerged gadgets, generally bounces off the surface while never getting through. This causes failures and different issues for an assortment of uses, for example, sea investigation and submarine-to-plane correspondence. This paper presents a framework for giving constant distant well-being checking of an individual's condition with upgrades of an SMS alert through Global System for Mobile correspondence (GSM). This task focuses on the plan and execution of a minimal expense; however, proficient and adaptable individuals observe and ready framework involving Global System for Mobile correspondence (GSM) innovation. In this venture heartbeat and temperature of the body are estimated by sensors and performs hindrance recognition utilizing IR, which conveys the messages to the Control unit and showcases on Liquid Crystal Display (LCD), and cautions through bell when he is in peril utilizing crisis switch.

Keywords- Arduino UNO, Buzzer, Communication, Communication medium, Frequency ball, GSM, Heartbeat sensor, , IR sensor, Receiving medium, transmitting medium, Temperature Sensor

INTRODUCTION

The primary goal of this paper is to develop a gadget to screen the strength of scuba jumpers. Water information correspondence is a possible Technology to acknowledge submerged correspondence [1]. As of now, there are loads of endeavors at utilizing submerged vehicles, lightweight planes and moorings for the spatial and transient estimations in Oceanography research. Sensor information gathered by these stages is typically inside recorded and afterward sent using a link or remote correspondence [2]. Customary acoustic connections are generally data transmission restricted to low paces of spot each second. Optical techniques are presented to give an elective answer for high data transmission correspondences undersea. This gadget gives total security to scuba jumpers by continually checking the beat rate and internal heat level. Alongside the life coat, the transmitter side is scuba jumpers. They are interface by temperature and heartbeat sensor to screen their temperature and rate [3-5]. The sign is communicated through water medium to the control room, and the existence of scuba jumpers is saved. The recurrence space normal for information correspondence through water channels is exploratory water is estimated and analyzed. The outcomes show that the kind and given molecule size of the specialists will fundamentally influence its water properties, and the recurrence area part of the water correspondence sign will be impacted by the specialist's focus [6]. By having a separate transmitter and recipient module in the water between the modules can send the ocean specialist's biomedical circumstances and connections to the checking end accessible on the boat. The transmitter is on scuba jumpers, and the beneficiary side is on the land side, which is the control room. The information's gathered from the transmitter side Arduino and shipped off the beneficiary side to the control room through a recurrence leading ball. The recurrence directing ball is dropped on the water,

OTP BASED SMART FINGERPRINT for WIRELESS LOCKING SYSTEM USING ARDUINO

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ABSTRACT:

The protection of private property is a top priority in today's society. A new security system that employs biometric data and a mobile number to enable access only to authorized people has been presented as a solution to this problem. Comparing this technique to more conventional approaches like using actual keys or door knobs, it offers a higher level of protection and the ability to manage access to doors. Biometric technologies are susceptible to a variety of errors and might not be appropriate for those with physical limitations. An alternative to this is a speech recognition access control system that enables users to access door systems using their mobile phone and a Bluetooth connection. This system is excellent for usage in secure businesses, banks, and residences since it uses a distinct fingerprint, one-time password (OTP), and global arrangement for mobile communications (GSM) technology.

Keywords: Arduino Nano, GSMSIM900A, Buzzer, Servomotor, Fingerprint Sensor, IR-sensor, LED, Keypad.

1. INTRODUCTION: Ensuring security and safety is a top priority in today's competitive world, and with the increasing risk of personal information theft, Establishing secure personal identification techniques is an important step to ensure safety and reliability that can distinguish between authorized and unauthorized use. While password authentication and RFID authentication systems are commonly used, they are considered unreliable due to the ease of password hacking and the potential loss of ID cards. As a result, biometric authentication, which uses behavioral or psychological characteristics to identify a person, has gained popularity. The proposed system in this paper utilizes fingerprint, one-time password (OTP), and Global System for Mobile communication (GSM) technologies to develop a secure and reliable system. Fingerprint biometric technology is the preferred authentication method due to its accessibility and high reliability compared to other biometric methods. During the door access process, the user's enrolled fingerprint is verified, and if it matches, access is granted, and an OTP is generated and sent to the user's registered mobile number via GSM. This eliminates the need for users to remember passwords or carry ID cards, which can easily be lost.

While fingerprint duplication is a potential issue, the secondary security measure of sending an OTP to the user's registered mobile number helps to overcome this problem. The proposed system can also be expanded to include multiple locks instead of individual door locks. This solution is beneficial for individuals with physical disabilities, as it provides a reliable access control system that can be used by all users, regardless of their physical abilities.

2. Literature Survey:

A system known as an access control system limits access to a certain area or resource by physically barring anyone without the necessary access credentials from entering. In the Nineveh ruins, key and lock devices were found, and with the advent of computers, access control has advanced to encompass computer software and programmes. Voice recognition is an exciting new form of access control that offers a secure and reliable way to identify speakers. It utilizes complex algorithms to accurately decode and recognize human speech, making it a very effective security measure. Verifying a speaker's identification in a system is the process of authenticating a speaker and consists of two stages: enrollment and verification.

Based on Adaptive-Network-Based Fuzzy Inference Systems, Wahyudi et al. (2007) developed an Intelligent Voice-Based Door Entry Control System (ANFIS). The study looked at different technologies used to restrict unauthorised access to secure facilities, including PIN pads, traditional and electronic keys, identity cards and dual control systems. A speaker's identity by speech analysis can be verified visually. This is called speaker verification. The research showed the design and development of a voice-based door access control system which can provide advanced security solutions for buildings.

A door automation system was created by G. L. Muthuselvietal and Kamelia et al. (2014) utilising a voice recognition system, an 8051 microcontroller kit, and relays. The processing's primary purpose was to show system status on a Liquid Crystal Display (LCD). An Android smartphone served as

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Adaptive Highway Networks: An IoT Solution for Improving Road Safety at Turnovers and U-Turns

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Abstract: *Highway construction is a crucial component of any region's infrastructure, and it is carried out in several different ways nowadays. Adaptive Highways Network (AHN) uses sensors and microprocessors for automatic design. Innovative highway design employs roadside controls and intelligent vehicles for traffic management and control. The Automated Highway System enhances highway safety, operational efficiency, and other vehicle and user characteristics. This innovation has enhanced the architecture of highways and reduced vehicle emissions. AHS, or Smart Road, is a projected intelligent transportation system technology for driverless automobiles on specific roadways. It is commonly employed to alleviate traffic congestion since it reduces following distances and permits more vehicles on the road. Together, the car and the roadway strive to avoid barriers, boost traffic flow, and decrease congestion. The AHS concept integrates vehicle intelligence, intelligent highway infrastructure, and vehicle-to-infrastructure communication technology.*

Keywords: Adaptive Highways Network (AHN), Internet of Things

I. INTRODUCTION

The Adaptive Highways(AHN) Network redefines the link between vehicles and roadway infrastructure. AHS refers to lanes on a limited-access highway where vehicles with specific equipment operate automatically. AHS employs vehicle and road control technologies to transfer driving responsibilities to the vehicle. The Adaptive Highways Network is a transportation infrastructure geared toward the future. AHS technology creates a new interaction between transportation modes and road networks. Autonomous vehicles employ an automatic control system. Advanced computing, microelectronics, sensors, and civil engineering are required to design an autonomous highway system. New intelligence-based methods are being implemented to connect highways and automobiles. This scientific device is operated by mechanical and radio controls. The purpose of automated highway systems is to boost the capacity of fully managed traffic networks. The AHN will contribute to innovative solutions that increase mobility in a controlled manner by applying low-pollution, high-safety, and high-efficiency technologies to a separate infrastructure or on current roads. Such transit systems will be incorporated into future transportation scenarios. Future transportation needs will be supplied by innovative transport solutions. In our opinion, new transport system concepts will increase the efficiency of road travel in urban areas while also contributing to the goal of achieving zero accidents and eradicating nuisances.

Utilizing sensor, computer, and communications systems in vehicles and along roadways, full automation would be achieved. In locations where road extension is physically impossible, politically untenable, or prohibitively expensive, fully autonomous driving could permit closer vehicle spacing and higher speeds, improving traffic capacity. Automated controls may increase road safety by reducing driver error, the leading cause of collisions. Further potential benefits include improved air quality (due to more efficient traffic patterns), increased fuel efficiency, and spin-off technologies. Monitoring external infrastructure with the aid of communication, sensor, and obstacle-detection technology. Together, the car and roadway strive to avoid barriers, boost traffic flow, and decrease congestion. The AHN concept integrates vehicle intelligence, intelligent highway infrastructure, and vehicle-to-infrastructure communication technology. The Adaptive Highways Network has been essential in the management of transportation networks in industrialised cities. AHN will be advanced by lane departure warning. first system to regulate the lateral movement of a vehicle. Adaptive

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Biometric Voting System using LABVIEW

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ABSTRACT

There are various methods to avoid fraudulence in the voting system. The main aim of the biometric voting system using LABVIEW is to improve the Indian voting system. By implementing the Bio-metric process, we can make the polling process more secure and efficient than the existing one. Every resident of India has a right to cast a vote and to utilize this right the election process should happen fairly and efficient. The election commission of India has a prime responsibility to implement the most efficient methods for voting. The political race commission of India has various sorts of casting a ballot framework; for example, emit expressive dance paper technique, and presently Electronic Voting Machine (EVM's) and Voter Verified Paper Audit Trail (VVPAT) casting ballot machines. The ongoing democratic framework has EVMs which can be hacked without any problem. There are many methods adopted to avoid malpractices. Here we're using Global System for Mobile communication (GSM) module for sending messages to the citizens who cast their vote, that "your vote cast successfully, thank you," and also send alert notifications to assigned police in charge near the polling booth if the voter tries to reattempt to cast a vote. The person at the station must put their finger on the digits so that the veteran can get the digit identification card. This data is sent to the LABVIEW Control Unit for verification. The LABVIEW control unit receives and compares data from the reader with data already collected during voting registration. Individuals will be allowed to vote if information related to fingerprint information is contained in the database. Individual votes are prohibited unless a warning message is displayed in the dialog box.

Keywords-- Biometric, Election commission, Mobile communication, Political race, Voting

INTRODUCTION

Voter registration is one of the most critical activities of an electoral body (EMB), but it is very costly in terms of time and resources. Reliable voter registration justifies the electoral process prevents election fraud, and ensures that all voters vote only once. Improper voter registration can lead to copy, and manipulation can cause problems in the electoral process and question the election results. Numerous nations are confronting difficulties in making exact citizen enlistments and are thinking about improving the elector enrollment framework through biometrics. These changes expect to increment trust in the discretionary cycle by enabling every qualified resident, lessening extortion types like misrepresentation, and expanding numerous democratic. This guide covers essential points and considerations for all stakeholders involved in discussions about applying biometrics in elections, such as pre-election voter registration and polling place at the polling place on Election Day.

Unique finger impression confirmation is one of the most seasoned known biometric strategies yet, at the same time, the most generally utilized due to its effortlessness and outstanding records of exactness. Each individual is brought into the world with various examples on the fingers and these examples are utilized to recognize and separate two unique people. The finger impression acknowledgment strategy has been embraced to supplant the traditional technique as it requires less

Implementation of Ripple Carry Adder using Full Swing Gate Diffusion Input

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***Abstract*—In modern VLSI technology, power consumption is a key factor in all design decisions. Today's electronics sector has made low power a central feature. Power dissipation has changed dramatically as a result of the demand for low power, taking on equal importance to performance and space. Numerous electronic design systems depend heavily on low-power VLSI design. Important considerations include voltage leakage, power consumption, circuit efficiency, and implementation area to take into account while building any combinational or sequential circuits. Subtractors and multipliers are mostly built with the address when creating high-speed adders. Therefore, increasing adder efficiency is crucial for all CPUs. There are relatively few VLSI design strategies that provide the necessary extensibility both in terms of power and area, despite several attempts to optimize the power and space used by the multiplier module. Designing a ripple carry adder employing full swing gate diffusion input technology is possible. It is a novel approach to a low-power digital combinational circuit that enables a reduction in the size, area, and power requirements of digital circuits while keeping a low level of complexity in the logic architecture.**

Keywords—*Ripple carry adder, Full swing gate diffusion input (FSGDI), CMOS implementation, Carry-propagation delay, power consumption optimization, Tanner EDA (Electronic Design Automation).*

I. INTRODUCTION

Many complicated components may now be integrated onto a single chip owing to contemporary Very Large-Scale Integration (VLSI) technology, which has increased levels of integration. The ability of digital circuits to optimize has grown to be of particular importance to the nanotechnology community. This is so that size and performance of the digital circuits may be improved while still lowering their size. Therefore, the objective of this is to develop an Arithmetic and Logic Unit (ALU) that performs arithmetic operations that are to be performed by employing simple gates with little latency, minimal power consumption, as well as little space [1]. Numerous logic design strategies are created to enhance the performance of logic circuits that were previously built using conventional CMOS technology. PTL (Pass Transistor Logic) is one kind of logic that is well-liked in low-power applications. Pass-transistor design is well-suited to the circuit that incorporates considerable quantities of EX-OR gates and MUX, such as arithmetic units, since PTL versions of these operations seem to be more effective than traditional CMOS versions. The complexity in top-down logic design is the fundamental issue with PTL. As a result, the Gate Diffusion Input Logic (GDI), is a modern technique that enables the majority of the issues to be resolved. It allows for the logic function to be implemented with fewer transistors because of the low-power design method. The GDI method was first put out for manufacturing in twin-well CMOS and Silicon on Insulator (SOI) technologies. Despite looking like a typical CMOS inverter, both the PMOS and NMOS transistors have unique source and drain diffusion inputs. On the one hand, the drain and source inputs of p-type and n-type transistors are almost connected to a power supply and ground terminals respectively in a traditional implementation. The diffusion terminal, on other hand, provides an external feed for the GDIL cell. Compared to static CMOS and conventional PTL approaches, this approach was more appropriate for designing typical digital circuits with a substantially lower footprint and better power characteristics [2], [3]. The ability to perform a large variety of activities using GDI cells is one of its main benefits. Compared to static CMOS gates, the GDI gates are more flexible and dense, and they have extremely low leakage currents [4].The modified Gate Diffusion Input (MGDI) Technique fixes the GDI technique's flaw of degrading the entire swing voltage. A fundamental GDIL cell is changed for the creation of an enhanced GDIL cell that connects the p-type substrate to a voltage supply (VDD) and gives an n-type terminal to ground which solves issues with GDI. MGDI method is preferred over CMOS because it uses less power, propagates signals more quickly, has simpler circuit architecture, and takes up less space [5]. The GDI basic cell is changed in some way to produce a modified GDI cell with fewer transistors, reducing power consumption and increasing

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Internet of Things-Based Digital Helmet Design and Deployment

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***Abstract*—Around 1.3 million traffic accidents occur worldwide each year. In that two-wheelers are blamed for about half of all accidents. Driving while intoxicated, driving recklessly, and being fatigued from long distances are the main contributors. The answer to this issue aims to develop an exciting smart helmet that prevents and detects mishaps. The ignition switch is automatically set to the off position if a helmet isn't worn. Sensors are being used to make this smart helmet. In this instance, a touch sensor is being used to identify whether a motorcyclist is wearing a helmet or not., and an alcohol(MQ-3 gas)sensor is being used to assess whether the rider is inebriated or not. The ignition locks on its own and sends a message to the d mobile number and certain contacts if the rider is drunk or takes off the helmet during the voyage. The smart application uses Blynk-2.0 cloud communication technology, the mobile application automatically transmits the accident location to the police and the emergency contact information in the event of an accident. The accident vehicle's location is tracked using an affixed GPS device.**

Keywords— Cloud blynk 2.0, Global Positioning System (GPS), MQ-3 Sensors, IR Sensor, Liquid Crystal Display (LCD), DC 120V fan, Buzzer, Node MCU-ESP8266.

I. INTRODUCTION

Thousands of people are now seriously concerned about traffic accidents since so many young people are either killed or injured in them.The majority of those killed in traffic accidents were between the ages of 15 and 34, according to the research.A head injury is the main factor in the majority of fatal motorbike accidents.The rider should put on a smart helmet to preserve life and avoid a brain injury.Without the smart helmet, a vehicle's ignition will not turn on.The helmet is a requirement for motor vehicles under the 1988 Motor Vehicles Act (section 129).Every individual riding a two-wheeled vehicle must wear a helmet to secure their life, according to government rules.This technologically advanced helmet shields the wearer from the majority of negligence, including operating a vehicle without the necessary understanding of traffic regulations, maintaining a bike in good working order, and using a phone while driving, among other things.The failure to provide prompt and appropriate medical care as well as society's quick action in alerting the police and hospital are some of the primary causes of the increased fatality rate in accidents. In this scenario, numerous lives have been lost.Here, saving lives during prime time is important. Stop allowing time to claim anyone's life. The Smart helmet complies with government standards and aids in traffic enforcement.Riders on two-wheelers can utilize the equipment with total safety.[1]Motorcycles, also referred to as motorbikes or two-wheelers, are frequently utilized as alternative forms of transportation since they are less expensive than four-wheelers, but they are also the most dangerous.Driving too quickly or when intoxicated can also result in accidents.[20]Safety on the roads and security on bikes are people's top priorities in light of the astonishing IoT technology and rising urbanization.The failure to wear a helmet contributes to thousands of accidents every day, many of which result in fatalities or significant property damage.A helmet is one type of protective equipment used to shield the head from harm.The helmet specifically helps the skull protect the brain. Sometimes it's unable to locate the scene of the accident. A smart helmet can locate the scene of accidents,[18] saving lives and enhancing the safety of two-wheelers. The system is divided into three application categories: mobile, helmet, and automobile. When a mobile application notices an accident, it immediately contacts the cops and emergency contacts through the data with the accident site [2].Numerous safety regulations and guidelines have been established by the government for motorists to follow, yet many of them are rarely followed. The main goal of this endeavor is to create internet-connected smart helmets that increase two-wheeler riders' safety. The advanced MQ3 alcohol sensing,[25] IR sensor, and fall detection modules are included in the suggested smart helmet system. The MQ3 alcohol sensor is used in the circuit to prevent the bike from starting when the user has taken a significant amount of alcohol[15] If a motorcycle accident occurs, information is sent to the registered number using the GSM(Global System for Mobile Communication) and GPS (Global Positioning System) [23].Two basic safety elements are found in motorcycle helmets. The exterior shell, which is commonly composed of plastic, fiberglass, or Kevlar, comes first, followed by the inner shell, which is normally constructed of polyphenylene foam. The rigid external shell's main function helps to stop the helmet or head from being penetrated and to stop the soft inner liner's structure from remaining stable during an impact [21]. Bikers using helmets suffered far fewer wirehead and neck accidents than motorcyclists without helmets[3].Every

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MATERIAL SCIENCE AND TECHNOLOGY

MONITORING VEHICLE NOISE AND POLLUTION WITH A SMART IOT SYSTEM

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Abstract: The ozone layer is deteriorating due to pollution in India and other parts of the world, which also greatly increases air pollution. The project's objective is to create a carbon monoxide detection system that can measure values in any application as well as track and monitor CO levels. The Internet of Things (IoT) connects things (physical objects like lights, phones, and cars) to the Internet by acting as a bridge connector to the current Internet infrastructure.Currently, only after receiving a fitness certificate (FC) from the RTO office can the vehicle's emissions be verified utilizing pollution control stations positioned across various cities. Health certificates for private vehicles are valid for 15 years, after which they must be renewed every 5 years. The fitness certificate is provided for two years and then renewed annually when it comes to vehicles. Until FC is fitted, this method prohibits us from identifying emissions brought on by car maintenance.Blynk is a cloud-based IoT analytics platform that allows you to gather, view, and analyze live data streams. This article focuses on using an MQ7 Gas sensor to prevent accidents caused by vehicle-generated carbon monoxide.
Keywords—Internet of Things;NODEMUC ESP8266;MQ7 Gas Sensor;CO;

I. INTRODUCTION

Environmental issues are becoming increasingly severe. Asthma attacks can be brought on by ground-level ozone and particulate matter from automobiles, buses, and trucks. More than half of the carbon monoxide in the atmosphere may be attributed to transportation. The health of people could be endangered by this carbon monoxide [1].Air pollution increases the risk of cancer and contributes to chronic obstructive pulmonary disease (COPD) Pollution from vehicles [2]and trucks can also harm public health in large metropolitan areas. One of the main sources of air pollution, accounting for 70% of all air pollution, is the release of harmful gases from moving cars. Monitoring pollution levels and identifying polluting vehicles are necessary for controlling air pollution. Cities may benefit from using the Internet of Things to track vehicle-related air pollution as well as collect and analyze information on the degree of pollution along various city routes.Vehicle pollution is becoming a big issue in today's age. The incidence of automotive pollution has surged in recent years due to the exponential growth in the number of automobiles. The pollution created by vehicles disrupts the overall ecological balance that exists in nature because it is hazardous not only to humans but also to the entire environment. Vehicular pollution is the outcome of massive urbanization and population growth over the last decade. The automobile industry is becoming the backbone of economic development in emerging countries such as India, yet pollution created by autos is also a risk. [4]

Gas sensor technologies are still in development and have yet to attain their full capability and application potential. Some systems are extremely accurate, but they are also prohibitively expensive for large-scale adoption. On the other hand, low-cost solutions can be implemented using a sensor network, and the issue of false positives may be reduced by using data multiplicity. A huge number of outputs from various sensors can be compared for a more accurate analysis. As a result, wireless sensor networks provide strong new methods for monitoring air quality.This experiment indicates a promising path for monitoring engine emissions, particularly CO2 emissions. A gas sensor is used to detect motor vehicle pollution. This enables data tracking to be done cheaply and in real-time. The car's owner may easily determine the emission level ahead of time. The goal of this system is to reduce CO emissions in the atmosphere while also developing a tiny car pollutant-detecting device that could be installed on the vehicle itself. Sensors monitor the vehicle's smoke ratio, and the data is stored on the owner's phone, where it may be submitted to officials when they inquire about the vehicle's emissions report, such as when they visit a hill station.

Winters are no longer cold, and glaciers are melting faster than before due to changed weather patterns. It could be quite useful to have a carbon monoxide gas detector on hand. Knowing the proper level of pollution in the environment might help us plan for future problems and follow their sources to avert them [5].

Air and noise pollution are primarily brought on by transportation. Air pollution is responsible[13]for about 100000 premature adult deaths per year. 40 million people are exposed to air that exceeds WHO air quality guideline values for at least one pollutant in the 115 largest cities of the European Union (EU). The largest cause of climate change and the source of CO2 emissions from fossil fuels is transportation. Due to a rise in transport volumes that exceeded improvements in the vehicle economy, transportation accounted for roughly 35% of all energy consumption in the 25 EU countries in 2004, leading to a 20% net increase in greenhouse gas

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Modeling and anatomization of three-input photonic crystal-based XOR/XNOR gates for photonic integrated circuits

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ARTICLE INFO

Keywords:
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ABSTRACT

The optimized representation of an effective all-optical 3-input XOR/XNOR gate is designed with T-shaped 2-D photonic crystals (PhC) composed of silicon (Si) material embedded in an air background. Both XOR/XNOR logic gates are implemented in a single layout, with a phase change between the input signals applied. The beam interference concept is used to design the layout and simulation results are evaluated using finite-difference-time-domain (FDTD) method. This layout has a contrast ratio (CR) of 13.37 dB and 11.81 dB for XOR and XNOR gates respectively. Several other parameters such as response time, transmission efficiency, insertion loss etc., are calculated resulting in good outputs by optimizing the radius and refractive index that can be employed in photonic integrated circuits.

1. Introduction

In this digital era, all the devices are manufactured using semiconductor technology which has limitations in terms of low switching time, high power dissipation, high input power, bandwidth, interconnection delays. As a result, optical communication quickly gained popularity as electrons are replaced with photons that helps to transfer information. When compared to electronic computers, optics became a major solution because of its simultaneous data processing costs and faster processing speed. A large number of networking operations, such as data encoding, switching, computing, data regeneration, buffering, demultiplexing (Alipour-Banaei et al., 2017; Serajmohammadi and Absalan, 2016; Mehdizadeh and Soroosh, 2016) and addressing have been developed using optical signals. As a result, optical devices have become major role in current electronic production with various approaches such as semiconductor optical amplifiers (SOA) (Oliveira et al., 2018), SOA with ultrafast nonlinear interferometer, SOA Mach-Zehender Interferometer (Oliveira et al., 2019), semiconductor laser amplifier, Four wave mixing (FWM) (Heydarian et al., 2021), Photonic crystals (PhC), plasmonics (Abdulnabi and Abbas, 2019) and others which have a limitation of diffraction but can be overcome by PhCs.

PhCs are periodic nanostructures of varying refractive indices (RI) that regulate the light flow (Asghari et al., 2019), first detailed by Yablonovitch and John in 1987. 2-D structures are the most commonly used because they allow easy working of fast devices such as resonators, waveguides, switches and logic gates. Because of various important characteristics such as compact size, high bandwidth and low power dissipation (Lee et al., 2008; Rama Prabha et al., 2020), these PhCs have been chosen for applications in telecommunication systems and integrated all-optical devices. Many approaches have been approved in PhCs like waveguides (Rao et al., 2021; Shaik and Rangaswamy, 2017; Shaik and Rangaswamy, 2017), PhC ring resonators (PhCRR) (Bouaouina et al., 2020; Saranya and Rajesh, 2017; D'Souza and Mathew, 2016; Younis et al., 2014), self-collimation, optical amplifier, plasmonics (Anguluri et al., 2021; Swarnakar et al., 2021) etc., out of which PhCs have been preferred and been created by incorporating line or point defects into a structure where light transmission is permitted within the bandgap of a desired frequencies.

Logic gates (LGs) are significant components of all-optical signal processing networks and systems including fiber optic networks as they have low latency (Muthu et al., 2020). In order to design any fundamental logic structures, the basic LGs must be used. These are the fundamental building components of digital integrated circuits. The majority of LGs has two binary inputs and yields a single output, which is either 1 or 0 in nature. A small number of LGs are employed in some electronic circuits, but millions are used in microprocessors and in other

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Modeling and anatomization of three-input photonic crystal-based XOR/XNOR gates for photonic integrated circuits

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1. Introduction

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An All Optical 2 × 1 Multiplexer Using a Metal-Insulator-Metal based Plasmonic Waveguide for Processing at a Rapid Pace

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Abstract: This study proposes, designs, and simulates a unique plasmonic Y-shaped MIM waveguide based 2 × 1 multiplexer (MUX) structure utilising opti-FDTD software. Two plasmonic Y-shaped waveguides are positioned facing one another inside a minimum wafer size of 6 µm × 3.5 µm in the 2 × 1 MUX configurations that is being described. The design parameters are adjusted until the plasmonic multiplexer performs as required under optimal conditions. Extinction ratio and insertion loss are two performance metrics that are calculated for performance analysis of the design, which indicate the potential to be applied in plasmonic integrated circuits.

Keywords: multiplexer; MIM waveguide; Y-shaped Waveguide; finite-difference time-domain (FDTD); plasmonic waveguide

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1. Introduction

The operating speed issue with its counterpart, the electrical circuits, has been widely addressed by all-optical systems [1,2]. As the bandwidth and bit rate of electronic-based processing and computing systems approach their limits, future optical communications and networks will require all-optical data processing. Researchers used a variety of techniques to create all-optical devices, including Kerr materials, Mach-Zehnder interferometers, the self-collimation approach, optical rings resonators, photonic crystals, and plasmonic waveguide [3–9]. This raised the need for photonics since it severely controls light and only requires a very minimal input power to switch on [10–16]. In addition to being faster and compact, these optical circuits are equivalent electrical circuits in size. The diffraction limit of photonic circuits has enabled a new field, plasmonics [17], which integrates photonics with electronics at the nanoscale and has attracted a lot of attention due to its reduced diffraction limit and higher frequencies, which allow for faster data transmission. The generation, detection, and manipulation of optical signals at the material interface are the main goals of plasmonics [18]. The primary drawbacks of plasmonic circuits include their limited propagation length, high heat emission, and difficulty in changing a signal's direction within the circuit [19]. In order to reduce these losses, plasmonic waveguides are used in these circuits to optimise both the length of surface plasmon propagation and confinement. Additionally, the fact that they can work in the visible to far-infrared range while using less power and a faster processing speed is drawing a lot of interest [20–22].

Numerous plasmonic waveguide types have been studied by researchers, including Metal-Insulator-Metal (MIM) [23–25], Insulator Metal Insulator (IMI) [26–29], and hybrid waveguides [30–32]. Plasmonic MIM waveguides, which have a dielectric core and

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Design of Three-valued Logic Based Adder and Multiplier Circuits using Pseudo N-type CNTFETs

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ABSTRACT: This work presents a novel technique to develop the three-valued logic (TVL) circuit schematics for very large-scale integration (VLSI) applications. The TVL is better alternative technology over the two-valued logic because it provides decreased interconnect connections, fast computation speed and decreases the chip complexity. The TVL based complicated designs such as half-adder and multiplier circuits are designed utilizing the Pseudo N-type carbon nanotube field effect transistors (CNTFETs). The proposed TVL half adder multiplier schematics are developed in HSPICE tool. Additionally, the delay and circuit area for the half- adder and multiplier circuits are investigated and compared to the complementary circuits. The memory usage and CPU time for the proposed circuits are also analyzed. It is observed that the proposed circuit designs show the improved performance up to 43.03% on an average over the complementary designs.

Keywords: VLSI, Ternary logic, CNTFET, Pseudo N-type CNTFET, and HSPICE.

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1. INTRODUCTION

Conventionally, the VLSI digital systems are performed with the conventional logic in Boolean space [1]. Recently, the TVL is used to design the digital circuits because it offers reduced chip-area, low interconnect complexity, reduced digits needed to represent a number, low power dissipation, etc over the conventional logic. The TVL designs using the traditional complementary metal oxide semiconductor (CMOS) technology requires multi-threshold transistors [2]. However, the multi-threshold voltage CMOS transistors are acquired by biasing the bulk terminal. Using the bulk biasing technique to design the TVL circuits is time consuming and complex task. Hence, the researchers looked for alternative technologies such as quantum-dot FETs, reversible logics, single-electron transistors and CNTFETs [3-8]. Out of them, using CNTFET technology is optimistic way to develop the TVL digital logic circuits because the multi-threshold CNTFETs can be obtained by changing the diameter of CNT [2]. Moreover, the CNTFET technology offers 10 times more energy efficiency compared to CMOS technology while designing the circuits.

Using CNTFETs, various TVL digital logic circuits such as basic gates, universal gates, adders, multipliers are presented in existing literatures [7-18]. All these existing designs are developed using complementary CNTFETs. The complementary designs utilize additional transistors that increase the chip complexity [7]. Hence, in this work, the Pseudo N-type CNTFETs are utilized to design TVL circuit schematics. Using Pseudo N-CNTFETs, various TVL circuits are developed in [19]. In [19], only the basic gates and MIN circuit designs are presented. From the analysis, it is noticed that the Pseudo N-type CNTFET TVL circuits shows up to 40% improvement in area with a similar delay on average over the complementary designs. It is worth noting that there are no complicated designs presented. Thus, in this work, the complicated designs such as TVL half-adder and multiplier are presented utilizing Pseudo NCNTFETs. The HSPICE tool is used for verifying functionality and analyzing the performance. Additionally, our proposed TVL adder and multiplier circuit performance are examined with complementary designs.

The major efforts of this work are four namely:

- A technique is presented to design TVL circuit schematic using Pseudo NCNTFETs.
- The numerical equations are stated to calculate CNTFET chirality vectors, diameter, band gap, and threshold value.
- The complex circuits such TVL adder and multiplier circuits are designed.
- Finally, the half-adder and multiplier designs are compared with complementary CNTFET designs.

Rest of the study is arranged as follow: the background of TVL logic and CNTFETs are presented in *Section 2*. *Section 3* presents the TVL half-adder and multiplier architectures, design, and functionality. *Section 4* describes the performances

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Rainfall and Weather Monitoring System using Internet of Things (IoT)

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Abstract:

India but also in other countries, have grown erratic and unexpected, which may have disastrous consequences for national development planning and agriculture, both of which are dependent on weather conditions. In wireless communication precipitation or rainfall is a major impact where large amount of signal attenuation is seen. The monitoring systems are essential In recent years, it has been observed that climatic and meteorological conditions, not just in to our daily lives. Therefore, in this work, we suggest a system for automatically monitoring the weather that enables users to view data in real time from any place. The Internet of Things is the foundation of the suggested system. This system's primary goal is to use sensors to sense climatic variables such rainfall, temperature, humidity, soil moisture, light intensity, and the presence of methane gas. The recorded data are shown on an LCD screen, signalled by a buzzer, and transmitted to the cloud with the aid of a Wi-Fi module. With the aid of the Blynk or ThingSpeak app, users may access cloud data and get notifications on their mobile devices.

Keywords: Rainfall, Weather, Precipitation, Arduino, IoT, Blynk, Sensors.

I. INTRODUCTION

The paper is based on IoT, in today's world, technology is very sophisticated. Different types of provinces are impacted by Internet of Things applications. The Internet of Things technologies that have been developed, aim to manage and watch over human activity. IoT is being used to track weather conditions worldwide. The Internet of Things (IoT) enables real-time access to data from anywhere. The maximum rainfall in yearly monsoon and non-monsoon sessions is predicted using the SVR and MLP ML approaches. For the purpose of forecasting rainfall, the monthly average temperature, wind speed, humidity, and cloud cover are taken as input.

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The MSE, correlation coefficient, efficiency coefficient, and mean absolute error are calculated to perform the analysis. This Project design is complex. Implementation is difficult [1]. By using DVB receivers we can retrieve rainfall rate from signal-to-noise ratio. In this the measurements of Smart LNB's, rainguages and disdrometer are compared by 1 year measurement campaign. Two years of NEFOCAST research recorded data is used to tune, test, and develop an adhoc algorithm to receive precipitation rate from smart LNB's. Smart LNB's provide the real time accurate precipitation maps [2]. The various rainfall observing systems such as tipping-bucket rain guage(TBRG) network, long-range weather radar (WR), Smart Rainfall system, available in Genoa city are compared. SRS and WR are considered in this analysis. The comparison is made by comparing 7 TBRG stations were chosen as the reference locations for the in-person observations. In locations classified by higher sensor density, the SRS RI maps exhibit a lower level of RMSE compared to the WR, all these systems are installed in accordance to ITU standards and its location [3]. Based on Spatio-Temporal scales

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Comparative Analysis of Active Noise Cancellation for Linear and Non-Linear Systems using Fx-LMS Algorithm

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Abstract— **In this developing world, noise-related situations cause an increase in pollution, in many types of noise, noise pollution occurs mainly due to some factors. They are due to construction activities, industrial types of machinery, vehicles, and aircraft, and due to various other factors that lead to hearing loss. Heart diseases, headaches, and also lead to various other health issues. The ANC is put into effect on low cost and high performance. There are many signal processing techniques for cancelling the active noise cancellation which is present in devices. There are different types of noise-control algorithms are existed and can be used in active noise cancellation. There are two types of systems: In linear systems, we use the FX-LMS algorithm and in Non-linear systems, we use the Chebyshev filter to cancel the active noise. ANC technology which is based on an acoustic solution can help to eliminate unwanted noise. Mobile phones, headphones, and airplanes all use this ANC in today's technology.**

Keywords— **Active noise control (ANC), Feed-Forward technique, Least Mean Square(LMS), Filtered X-Least Mean Square algorithm(Fx-LMS), Chebyshev filter,Matlab.**

I. Introduction

These revolutions had led to a much more increment in the number of equipment like compressors, blowers, fans, etc industrial revolution noise-related problems are becoming more prominent. Therefore, noise cancellation is necessary. Active and passive noise cancellation are the two main categories of noise cancellation techniques. High-frequency noises are cancelled by passive noise cancellation while low-frequency noises are cancelled by active noise cancellation [1]. We have used both linear and non-linear active noise-cancelling approaches in these applications. To lessen the intensity of the noise, active noise cancellation entails providing a complementary signal to the corresponding noise signal. As the name suggests, in active noise cancellation, we reduce the noise in live time and deliver the best sound experience to the observer [2]. Least Mean Square (LMS) and Filtered-x Least Mean Square are two examples of linear approaches. If we come to non-linear techniques include several algorithms like Hammerstein FXLMS, Chebyshev filtered FX-LMS and Even Mirror Fourier in Non-Linear. In these projects, we cancel the noise using the FX-,LMS algorithm and FX-LMS with Chebyshev filtering. An adaptive filter used for system identification is the FX-LMS filter. The output of the filter would be such that the erroneous signal provided to its input would steadily decrease [3]. The discrepancy between the desired response and the FX-LMS filter's output would be the error signal. The Chebyshev filter is an analog filter or digital filter that features either passband ripple or stopband ripple and a sharper roll-off than the butter worth filter. In methodology, we will know the working of ANC. And in the proposed method we will know how ANC works with the Fx-lms algorithm and Chebyshev filter.

II. Methadology of the ANC system

The Low-frequency noise has been successfully controlled with Active Noise Cancellation. Loudspeakers are typically utilized to disperse the anti-noise in the same space while a microphone is used to record the noise. Based on the interference concept, the anti-noise wave can occasionally cancel out and lower the original noise wave. To prevent harmful signal interference, the anti-noise wave is generated out of phase with the noise [4]. Due to its major advancements in noise reduction and frequently associated potential benefits for the system size, weight, construction, and cost, active noise control is expanding quickly. From the standpoint of note acoustics, this cancellation provides comprehensive information on active noise management. An oscilloscope may be needed to obtain the signal characteristics at each stage of the test, and a power source may be needed to provide the

Comparative Analysis of Active Noise Cancellation for Linear and Non-Linear Systems using Fx-LMS Algorithm

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Abstract:
In this developing world, noise-related situations cause an increase in pollution, in many types of noise, noise pollution occurs mainly due to some factors. They are due to construction activities, industrial types of machinery, vehicles, and aircraft, and due to various other factors that lead to hearing loss. Heart diseases, headaches, and also lead to various other health issues. The ANC is put into effect on low cost and high performance. There are many signal processing techniques for cancelling the active noise cancellation which is present in devices. There are different types of noise-control algorithms are existed and can be used in active noise cancellation. There are two types of systems: In linear systems, the FX-LMS algorithm is used and in Non-linear systems, the Chebyshev filter is used to cancel the active noise. ANC technology based on an acoustic solution can help to eliminate unwanted noise. Mobile phones, headphones, and airplanes all use this ANC in today's technology.

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I. Introduction

The industrial revolution has led to the development of more advanced equipments like compressors, blowers, fans, etc. Due to this, the noise-related problems are becoming more prominent. Therefore, noise cancellation becomes necessary. Active and passive noise cancellation are the two main categories of noise cancellation techniques. High-frequency noises are cancelled by passive noise cancellation while low-frequency noises are cancelled by active noise cancellation [1]. This study has used both linear and non-linear active noise-cancelling approaches in these applications. To lessen the intensity of the noise, active noise cancellation entails providing a complementary signal to the corresponding noise signal. As the name suggests, in active noise cancellation, the noise will be reduced in five time[illegible]nce to the observer [2]. Least Mean Square (LMS) and Filtered-x Least Mean Square are two [illegible]e come to non -linear techniques include several algorithms like Hammerstein FXLMS, Chebyshev filtered FX-LMS and Even Mirror Fourier in Non-Linear. In these projects, we cancel the noise using the FX -LMS algorithm and FX-LMS with Chebyshev filtering. An adaptive filter used for system identification is the FX -LMS filter. The output of the filter would be such that the erroneous signal provided to its input would steadily decrease [3]. The discrepancy between the desired response and the FX-LMS filter's output would be the error

REVOLUTIONIZING ENERGY EFFICIENCY WITH ROLLER-ASSISTED POWER HUMP SOLUTIONS

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Abstract

A nation's economy and general standard of living are significantly impacted by the development of efficient power generation technologies and sources. The ability of industries and enterprises to operate and thrive makes access to affordable and reliable energy essential for economic progress. Additionally, the efficient use of energy resources also helps to conserve the environment and attenuate the effects of climate change. Modern society has come to rely heavily on electricity it is actually hard to imagine life without it. Both renewable and non-renewable energy sources can be used to generate power. However, we must rely on renewable sources in order to generate electricity due to the rise in population and the decline of conventional sources. When a load passes a power hump, a roller mechanism is used to generate electricity. The motion of a roller rotates the shaft of a dc generator, producing electricity.

Introduction

It is impossible to imagine the present-day world without electricity as which we depend on it throughout the day. But, because of population explosion, ever increasing dependency on electricity, risk of depletion of all sorts of fossil fuels in the near future, and the pollution being caused by these fossil fuels, so it is very important to come up with the new ideas and technologies for power generation and also minimal wastage of energy, which can save the world from power crisis. One of such idea here is to minimize the wastage of energy that is happening while vehicle pass over the innumerable speed breakers on the road in towns and cities. In this the pressure caused by the vehicle is used to generate the electricity by the speed breaker, it appears that small amount of electricity generated. But the vehicular movement over the speed breakers will become so frequent day by day because of the increasing connectivity through roads and increasing dependency on vehicles for transport which can generate considerable amount of electricity which can be sufficient enough for a small area or it can be used to lit up the lights present along the roads during night times. It focuses on producing electricity using the energy lost as a result of vehicles travelling through power hump on roadways. Friction between the power hump and tyres causes a significant amount of energy to be lost, and it also aims to harness his energy through a power generation system under the speed

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Certificate
Best paper of the Session

This is to certify that Dr./Prof./Mr./Ms. S Towseef Ahmed Affiliation KL University, Vaddeshwaram Campus, G PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY, Kurnool has been awarded **Best Paper of the Session** in 5th IEEE International Conference on Emerging Smart Computing and Informatics (IEEE ESCI-2023) during 1st – 3rd March 2023. He/She presented a technical paper titled A Study on Real-Time Signal Observations Acquired by Multi-Frequency Multi-GNSS Septentrio PolaRx5 Receiver.

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MATERIAL SCIENCE AND TECHNOLOGY

Precipitation Measurements using Rain Sensor with Vertical Profile Ultrasonic Sensor

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Abstract:

We measure a rainfall by using rain gauge from the surface of the earth. The size of the raindrop at the surface of the earth is different from the as it is in the space. The raindrop size in the space is larger than it is at the earth's surface at a particular location. So the amount of rainfall collected at a specific place is different. By this can be say that we are not able to get the accurate rainfall on the surface of the earth. Rainfall is prime factor to instruct the people about heavy rainfall, signal attenuation etc. by using pluviometer, weighing rain gauge systems were being used for measuring rainfall, size of the raindrop at the location and collected data about the rainfall in the space and altitude at the same location. In this for strp size rainfall measuring Ultrasonic sensor is used along with rain sensor that acts as a vertical profile at Kurnool Location.

Keywords: Arduino, Blynk App, Rainsensor ,Ultrasonic sensor, LCD and Servomotor.

I. Introduction.

Radio waves are used by an object detection system to determine an object's range, speed, and position. The concept uses sonar technology as an ultrasonic sensor to find any object within a specific range. Radar is a system for detecting objects. It employs microwaves to calculate an object's distance, altitude, direction, or speed. The amount of rainfall obtained at a particular location is depending on the size of the raindrops, larger the raindrop more the rainfall. The smaller raindrop the less will be the rainfall. Generally, we use horizontal profile but to obtain the accurate rainfall here we use vertical profile. It enables remote monitoring and control of physical objects at a distance and in real-time, as a result of the presence of the Internet of Things. The networks of environmental sensors will be used as a research tool for next earth and environmental science systems by merging sensor technology with IoT continuously monitor using IoT cloud technology using Blynk Cloud2.0application.

2 LITERATURE REVIEW

These Polari metric measurements provide additional information regarding precipitation and aid in the characterization of hydrometeors. Radar measurements are used to estimate the rain rate based on several empirical ideas. The problem with ultrasonic distance measurement is that it is very object dependent in terms of detection ranges. This is so that just a well-defined object detection zone is provided by the idea. This platform basis on the internet of things in whole process to the infrastructure products and this can be mainly considering to store the data in the application. These technology has developed rapidly and has several applications in the area of smart phone with an expansion of the IOT many aspects of our lives.A sensor testbed is set up with an acoustic rain rate point sensor, additional rain gauges, and a hybrid broadband wireless network. The rain can cause a number of communities to flood. Thus, a device and system are required to track precipitation. This device and system was created using an Arduino Uno Microcontroller, which has integrated temperature, humidity, and rain sensors for weather monitoring. With the help of this program's rainfall data and warnings, the risk of flooding may be reduced right now. Ultrasonic phased arrays can provide safe navigation in inclement weather, such as rain, fog, or dust. The construction of

Image Specular Highlight Removal using Generative Adversarial Network and Enhanced Grey Wolf Optimization Technique

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***Abstract*—Image highlight plays a major role in different interactive media and computer vision technology such as image fragmentation, recognition and matching. The original data will be unclear if the image contains highlights. Moreover, it may reduce the robustness in non-transparent as well as glassy objects and also it reduces accuracy. Hence, the removal of highlights is an extremely crucial thing in the dome of digital image enhancement. This is to develop the enhancement of the texture in imageries, and video analytics. Several state-of-art methods are used for removing highlights; but they face some difficulties like insufficient efficacy, accuracy and producing less datasets. To overcome this issue, this paper proposes an optimized GAN technology. The Enhanced Grey Wolf Optimization (EGWO) technique is employed for feature selection process. Generative Adversarial Network is a machine learning (ML) algorithm. Here, two neural networks that will compete among themselves to produce better calculations. The algorithm generates realistic data, especially images, with great practical results. The investigational outcome reveals that the future algorithm has the ability to verify and eliminate the illumination spotlight in the image so that real details can be obtained from the image. The effectiveness of the proposed work can be proved by comparing the proposed optimized GAN with other existing models in highlight removal task. The comparison outcome gives better accuracy with 99.91% compared to previous existing methods.**

Keywords*—Highlight detection; optimization; specular highlight detection; GAN

I. INTRODUCTION

Image spotlight is a mutual factor in this physical biosphere, frequently an illumination is produced when the light contacts the material surface [1]. The highlights can easily damage the quality of the target image owing to the combined effect of the sunlight and the target's surface's physical characteristics. The flow and strength of the illumination will be determined by objective's category and dye, and also the reservation among the external area and the source of light [2]. Due to these highlights, the brightness of the image will be reduced in a sliding window and it frequently causes some unwanted discontinuities in the diffused part of the object [3]. Moreover, it will not provide true details of the image. To overcome this difficulty, a highlight removal method is introduced. The elimination of image spotlight is a major difficulty in supercomputer illustrations, computer visualization, and so on. Meanwhile, it delivers valuable info for some solicitations [4]. Because of two motivations. Firstly, it is necessary to find out the direction from where the light will be reflected. Secondly, eliminating the consequence from high spot will have the ability to improve the execution of various visualization tasks, like object recognition, essential image disintegration, and tracing.

Nevertheless, various methods have been recommended to find and repair specular reflection affected areas that rely on the evaluation of fixed images [5] . Due to this, the specular highlight may use high-level contextual cues to reduce uncertainty in areas with transformer module, thereafter the detection and correction of specular highlights from transmissive materials are more challenging and not forthright, especially when the geometry of the object is unknown. Therefore, the highlighted extracted method includes multi-scale data to identify regions with various level of highlight intensity. The estimated intensity ratio of the previous highlight removal method is used to relate the modifications among the diffused and specular replication modules then it enables the elimination of spotlights from a sole image. Hence, the standardized weighting mechanism is used to reinstate the fringe pattern in the illuminated zone whereas the highlight removal cannot be consistent between images from different viewpoints [6].

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High-speed optimisation of an all-optical half adder using a T-shaped photonic crystal waveguide with an improved contrast ratio

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Abstract. In digital the detection techniques, the half adder is a component of electronic systems that performs calculations faster than the other logic gates. This article focusses on an all-optical half adder logic gate using a two-dimensional T-shaped photonic crystal waveguide and silicon in an air medium. The half adder design is predicated on the concept of constructive (in-phase) and destructive (out-of-phase) interferences. The high-intensity output is achieved by carefully selecting the lattice constant, rod radius and refractive index of the half adder structure. The effectiveness of the half adder is investigated using finite-difference time-domain and plane-wave expansion techniques at 1.55 μm wavelength. The suggested structure features a minimal size of 8.4 μm $\times$ 8.4 μm. For this structure, the CARRY has a greater contrast ratio of 18.96 dB and SUM of 8.7 dB, as expressed by the results. SUM and CARRY have bit rates of 28.5 Tbps and 23.8 Tbps, respectively. The proposed circuit's primary objective is to be compact and to have a high contrast ratio.

Keywords. Photonic crystals; half adder; T-shaped waveguide; finite-difference time domain; contrast ratio.

PACS Nos 71.20; 42.70.Q; 42.82.Gw; 02.70.Bf

1. Introduction

All-optical devices will eventually supplant electronic devices in the physical world due to their superior performance, low power consumption, noise reduction and small die size [1]. The disadvantages of the electronic components are signal jitter and high-power consumption. A relatively fast optical signal is investigated as a transmission signal to address these shortcomings. Optical communication transmits data via light rather than electrons. The term 'photonics' implies the usage of photons (light) for conveying and processing data. All-optical components and circuits are required to operate optical networks and communication technologies. Today's telecommunication networks strive for high bandwidth and speed, which is extremely difficult to accomplish with electronic-based technologies. Consequently, optical and photonics engineers are working to create all-optical components. As a result, photonics has emerged as a critical paradigm for enabling optics-based microprocessors on integrated circuit chips. Photonic crystals (PhC) have recently received significant attention due to their ability to propagate light in photonic integrated circuits and photonic crystal fibres [2]. PhC is gaining traction as a critical tool for manipulating photon flow at ultrasmall scales [3]. There are numerous advantages of employing PhC to generate optical components, including low transmission losses, high computing speed, large bandwidth and the ability to interact with multiple channels

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MANUSCRIPT

Implementation of all-optical 3-dB and 10-dB directional coupler for switching applications

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Abstract
The design of an all-optical 3-dB and 10-dB directional coupler that functions as an optical switch if applied a control signal by fusing two photonic crystal waveguides with a coupling wavelength of 14*a* is accomplished by fusing two waveguides at the center. This fusion is responsible for optical power transfer between the waveguides. The proposed structure was optimized using finite difference time domain and operates at a wavelength of 1550 nm, excluding some wavelengths that were calculated using photonic band gap. It can be used in a variety of telecommunication devices, including multi/demultiplexers for wavelength-division-multiplexing systems, splitters, and optical switches.

Keywords Photonic crystals · All-optical · Directional coupler · Photonic band gap · FDTD method · Optical switch

1 Introduction

Electronic devices have become nearly ubiquitous in the information processing industry over the past few decades, being used for virtually all applications. Moore's law dictates that the number of transistors and data density on a chip doubles every 18 months on average. This trend may continue for a decade or two, but it cannot continue indefinitely. Fundamental physical constraints on electronics have increased, including transistor size restrictions, the requirement for higher frequency operation, and power consumption, that are all becoming increasingly serious issues. At network nodes, where higher operational frequencies are required, the difficulties are exacerbated. As a result of their inherent limitations, electronic equipment cannot operate at high frequencies or with large bandwidths. On the other hand, the optical domain is unaffected by extremely high frequencies. The current trend in telecommunications networks is to reduce reliance on electronics and increase reliance on optics. Nonetheless, because optics are capable of handling high frequencies, small sizes, and wide bandwidths, it is critical that electronics be phased out wherever possible in favor of optics. Nowadays, electronic transistors consume a negligible amount of energy (a few femto-joules) per logic operation. In addition to power consumption, signal processing is complicated by fundamental physical constraints imposed by optics. Due to their extraordinary ability to regulate light, photonic crystals (PCs) have piqued the interest of numerous researchers [1–13]. The photonic band gap (PBG), and that is the frequency range in which light cannot propagate in personal computers, is one of their primary characteristics. When a defect is added to periodic arrays, a defect mode is observed in the PBG. If we repeatedly introduce errors into the computer, light will propagate across a line defect. This is referred to as PhC waveguides, and they have been examined by a large number of researchers. Directional couplers (DC) are made up of two optical waveguides that are brought close enough together to interact optically in

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Design and performance enhancement of an all-optical demultiplexer for optical computing applications employing photonic crystals

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In this paper, a photonic crystal (PhC) based 1 × 2 demultiplexer is designed to work efficiently at 1550 nm, which is the operating wavelength of optical communication. In designing a 1 × 2 demultiplexer, the PhC structure employs Y-shaped square-lattice silicon rods with air as its basis in accordance with the principle of beam interference. This study presents a 15 × 15 rod-based PhC optimized structure with air as its background. Several distinct phase studies are carried out making use of a wide variety of lattice constant and refractive index values of PhCs. The design achieves enhanced performance in accordance with parameters such as having higher contrast ratio of 15.64 dB, high transmission efficiency of 77.92%, fast response time of 15.03 fs, and low insertion loss of 1.08 dB with optimal values for refractive index (RI), silicon rod radius, and lattice constant. The results of the simulation that used the finite-difference-time-domain technique illustrate the good performance of this structure, which exhibits a higher contrast ratio and bit rate, average transmitted power, and fewer power losses.

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1. INTRODUCTION

A kind of communication known as optical fiber communication (OFC) involves the transmission of a signal in the form of light rather than any other medium. This serves as a channel via which those light signals are sent from one location to another [1]. The term "light-wave communication" may also be used to refer to this kind of communication. At one end of an optical fiber, electrical signals are changed into light signals so that they can be sent, and at the other end of the fiber, the light signals are converted back into the electrical signals so that they can be received. After that, the signals are sent throughout the length of optical fiber to transmit the data [2,3]. The data that is to be transferred, whether it is audio, video, or telemetry, might take the form of data that is to be transmitted across enormous distances or through local area networks. Since OFC has been shown to be successful in the conveyance of data across long distances at a high rate of speed, it has been used as an application in a larger range of communication situations. Light, and especially laser light, is used for optical frequency conversion because it has constant wavelength [4]. When used for communication, other light signals, such as sunlight or the light from an incandescent bulb, would result in a beam that is quite a bit weaker than the single beam produced by the laser. Light is a good for communication due to the fact that it has low dispersion, can convey a large number of messages in a relatively short length of time, and consumes very little energy [5]. Thus, optical communication came into use with many different approaches. As such, PhC method is used to construct a demultiplexer. A demultiplexer is a sort of circuit that may distribute or give multiple outputs from a single input, as shown in Fig. 1(a). It does this by using a technique called "demultiplexing." This particular kind of circuit may also be referred to as a data distributor or demux. In each one of its various configurations, a demultiplexer may operate as a single input switch that controls multiple output switches. The number of lines that are produced by the demultiplexer is denoted by 'n', the number of lines from which a user may make a selection is denoted by 'm', and the value 'n' equals two to the power of m. The control signal or the pick input code will decide which output line is necessary to move the input in order to complete the process. Another function the demux is capable of performing is that as a binary to decimal decoder [6]. On the data input line, the logic '1' level should be present, and the select input lines should receive the binary input. On the line that corresponds to it, the output will be

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A miniature design of binary subtractor using 2-D photonic crystal structure for high-speed applications

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ABSTRACT

The expansion of the digital market is accelerating, and for faster communication, optical technologies have been developed. The binary subtractor is a combinational circuit that can compute the subtraction operations in arithmetic logic unit (ALU). The desired design is depicted as a 2-D structure with two T-shaped waveguides, and it is operates at a wavelength of 1550 nm. The design is verified and analyzed using finite-difference-time-domain (FDTD) method. It is also verified using MATLAB software. The identical design has been computed and simulated numerous times in this work, but with different lattice constants, refractive indices, and silicon rod radii. In this study, photonic crystals are used to construct a binary subtractor that is both compact and capable of producing a high contrast ratio (5.185 dB for difference and 17.78 dB for borrow). Moreover, the transmission efficiency is achieved 89.3%, insertion loss is 0.49 dB, and the response time and bit rate are achieved by 0.0204 Ps and 49.01 Tbps respectively.

1. Introduction

In the beginning, the systems were constructed using vacuum diodes as the main employed component (Abdullin and Morozo, 2013). Later PN junction diodes (Schneider and Strutt, 1959) were invented as a response to the enormous size of vacuum diodes as well as the significant delay in transmission speed. These diodes are faster than vacuum diodes in transmitting data, and similar devices are being developed to fulfill the requirements of modern-day technology. Utilizing nanotechnology, all of the diodes, transistors, and digital circuitry (Zhang et al., 2007) are combined onto a single circuit called integrated circuit (IC). At this point of time, these devices are utilized in various kinds of systems such as in smart phones, medical domains, automated systems, and so on. However, using these devices results in higher power dissipation and slower speed as a result optical devices have been introduced to overcome the present modern situations that are to have less power consumption and high speed. This is due to the fact that optical devices transmit information through light, whereas electronic devices transfer data through electrical signals and the speed of electrical signals is 3.2 m/s, whereas the speed of light has a velocity of 3×10^8m/s; consequently, optical devices have quick response and are also compact (Andalib and Granpayeh, 2009; Calhoun et al., 2008). The devices are becoming quicker and more complex as time goes on, but they do not meet the expectations of people like fast switching devices (Jin and Wada, 2014); less delay time, compact size, etc., thus optical signaling is employed to make the devices faster and smaller in size. One way to think of an optical fiber (Zhang et al., 2022) is that it is a type of dielectric waveguide (Li and Ho, 2003) that is designed to transmit signals at optical frequencies. In general, the waveguide refers to a device or a tube which in order to radiate energy, must either be bent or terminated. These devices use light or sources of light to pass the information. There are countless applications for light sources such as LEDs (Weismann et al., 2009) and laser diodes (Chassagneux et al., 2009) etc. These devices are relatively cheap, extremely light weight and compact, and quite durable with a long usable life span. Besides, these solid-state sources generate less heat and require less power compared with more traditional light sources. Due to their significant energy and cost savings, LEDs are being used widely as a replacement source.

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Design and optimization of photonic crystal based all-optical logic gate with enhanced contrast ratio

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Abstract
An ultra-compact all-optical AND logic gate is realized using two-dimensional photonic crystal waveguides. These circuits are implemented on a photonic crystal substrate in an effort to develop energy-efficient, simple, and compact devices appropriate for photonic integrated circuits. The suggested device operates on the beam interference principle, which is feasible for operation at 1550 nm wavelength. Performance of the proposed device is analyzed by evaluating the several key parameters, including contrast ratio, transmission ratio, response time and bit rate using simulations employing the finite-difference-time-domain approach on Opti-FDTD software. The designs are purely silicon-based, which simplifies manufacturing and offers simple compatibility with both current opto-electronic systems and upcoming all-optical systems. Compared to traditional semiconductor optical amplifiers, quantum dots, and photonic crystal ring resonators, the suggested technology has a higher contrast ratio of 40.08 dB, less response time of 23.45 fs and higher bit rate of 42.64 Tbps at a wavelength of 1550 nm.

Keywords All-optical AND gate · Photonic crystals · Beam-interference principle · Contrast ratio · Transmission ratio · FDTD method

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Modeling and simulation of photonic crystal switching devices for high computational applications

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ABSTRACT

Optical gadgets will take the role of electronic devices in the following decade due to their fast speed, low power consumption, and low heat tolerance. As a consequence, photonic crystal (PhC) based all-optical Buffer, AND, and OR (BAO) logic gates (LoG) were constructed by exploiting square lattice silicon rods with an air background. The suggested LoGs function efficiently by altering the phase of light beams having a wavelength of 1550 nm and are working on the beam-interference principle. The structure is modeled and tested through the finite-difference time-domain (FDTD) approach. For each logic gate, the performance parameter of extinction ratio (ER) is determined by tweaking the silicon rod radius and refractive index over a set of parameters. The suggested all-optical BAO LoG has extinction ratios of 11.84 dB, 33.9 dB, and 11.65 dB, respectively. The response time and operating speeds for each input combination are also calculated and tabulated. The processing speeds of BAO were observed to be 38 THz, 27.7 THz, and 38.46 THz, respectively.

Keywords: photonic crystal; PhC waveguides; all-optical logic gates; FDTD; interference principle.

1. INTRODUCTION

Photonic crystals (PhC) have several uses in optical information transduction, computer networking and immense-scale unification [1, 2]. Previously, devices were implemented by utilizing semiconductor technology; however, these gadgets have shortcomings notably significant power consumption, considerable power supply consumption, and short switching period. Interferometer, Mach-Zehnder interferometer (MZI) [3, 4], semiconductor optical amplifiers (SOA) [5], and nonlinear [6] phenomena such as electro-optical phenomenon, thermal optical effect and two-photon absorbance were used to develop PhC-based all-optical logic gates (LoG) [7, 8]. All-optical Buffer, AND [9, 10], and OR [11] (BAO) LoG have been employed in optical combinational and sequential systems including optical detectors, resonators, and LoG [12-18]. Random noise, intricate structure, and gain saturation effects are some of the concerns of the ways to manufacture all-optical LoG. All-optical BAO LoGs are developed by utilizing PhCs to conquer the aforementioned challenge in optical transmission [19]. Compact footprint, minimal power usage, fast throughput, and effective confined illumination are all features of PhCs [20-25]. To reduce back reflection, this construction uses an optimized index of refraction (n) and silicon (Si) [26] rod radius, resulting in lower power losses [27]. The proposed design includes advantages such as low power consumption, compact size of 7.2 μm ×5.4 μm, 8.4 μm × 5.4 μm, and 9 μm × 9 μm respectively.

The following is the structure of a paper. The first part incorporates an introduction. Section 2 depicts the concept and functioning of all-optical BAO LoG design, Section 3 explores the simulation outcomes, and Section 4 explores into the conclusion.

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A novel structure of all-optical optimised NAND, NOR and XNOR logic gates employing a Y-shaped plasmonic waveguide for better performance and high-speed computations

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Abstract
All-optical devices have demonstrated a broad range of applications in the communication field. These devices serve as the fundamental building blocks of sophisticated integrated circuits. By integrating these devices into fields such as signal processing, chip design, and network computations, it is possible to achieve a much more efficient device. This paper describes the design of all-optical logic gates such as NAND, NOR, and XNOR using a plasmonic-based Y-shaped power combiner. The combiner employs the concept of linear interference to generate the desired logic gates. The work is simulated and analysed using MATLAB and finite-difference time domain method. The current work is framed within a 60 μm^2 area which is less than the size of the existing structures. The parameters characterising insertion loss, transmission efficiency, and extinction ratio are calculated and compared to those of a variety of other designs.

Keywords All-optical devices · Y-combiner · Universal logic gates · FDTD · Linear interference · Plasmonic

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Design of All-Optical Directional Coupler Using Plasmonic MIM Waveguide for Switching Applications

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Abstract

In this paper, we have proposed, analyzed, and verified the performance of an optimized plasmonic 10-dB directional coupler and a 3-dB directional coupler in 2-D plasmonic waveguides using the finite-difference-time-domain (FDTD) method. A plasmonic 10-dB directional coupler and a 3-dB directional coupler are based on the metal–insulator-metal (MIM) slab waveguide and analyzed at the telecommunication wavelength (λ) of 1550 nm. Here, coupling and transmission characteristics are analyzed with the optimized separation distance between the two parallel waveguides. The developed approach ensures the minimization of the crosstalk and overall directional coupler length via simultaneous adjustment of the separation distance between the parallel waveguide and the length of the linear waveguide. Then, an optimized structure is acquired by trading off between coupling length and separation distance. The proposed 10-dB directional coupler and 3-dB directional coupler feature good energy confinement, ultra-compact, and low propagation loss, which has potential applications in photonic integrated devices, optical signal processors, and other all-optical switching devices.

Keywords Plasmonic directional coupler · Metal–insulator-metal (MIM) waveguide · Finite-difference-time-domain (FDTD) · Coupling length

Introduction

The increasing demand for high-speed systems urges us to design a system with low complexity and power consumption. In the current scenario, to achieve the technology demand of higher capacity at a lower cost, optical communication has been introduced. In optical communication, the transmission capacity is large along with the longer transmission distance [1, 2, 7]. But in earlier decades, devices were implemented using semiconductor technology, which have some limitations like high power dissipation, high input power, and low switching time [1, 3–5, 35]. To overcome the limitations of semiconductor technology, optical communication came into consideration. Optical communication is quite instrumental in the field of telecommunication due to its large bandwidth, high speed, and low interference [5–9]. Due to these reasons, researchers have shifted focus on the optical signal to transmit the information [1, 4, 5, 7, 10–13]. Different types of optical techniques are employed such as metal–insulator-metal (MIM) [3, 6, 14–18], insulator–metal-insulator (IMI) [14, 16], dielectric-loaded surface plasmon polaritons (DLSPP) [10, 11, 15, 16, 19–22], metal slot waveguide [3, 6]. The directional coupler already has been implemented by using a semiconductor optical amplifier (SOA) [17, 23–27] photonic crystal [13, 15, 17, 27–35] and lithium niobate ($LiNbO_3$) [5,8,15,]. SOA has some limitations like gain saturation and high driving current input, and in $LiNbO_3$, the electrical signal is used to switch the optical

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Improved design of all-optical half-adder and half-subtractor circuits using MIM plasmonic waveguides for optical networks

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Abstract
All-optical half-adder and half-subtractor circuits are implemented through using metal–insulator-metal (MIM) waveguide utilizing a footprint of 66 μm^2. The linear interference principle is used in this design at 66 μm operating wavelength, the suggested device focuses on transverse electric (TE) polarization of optical communication. Both the half-adder and half-subtractor has the identical structure which is flexible in nature. The structure consists of two Y-shaped power combiners giving optimized operation and comparison of different performance parameters such as extinction ratio, transmission efficiency and insertion loss. The device is designed mainly for ultrafast surface-plasmon polariton switching applications. The finite-difference time-domain (FDTD) technique is used to examine this design. MATLAB simulation and mathematical computation results are used to further verify the computation.

Keywords Half-adder · Half-subtractor · Linear interference · Waveguides · Optical networks

1 Introduction

Nowadays, optical communication is essential in all aspects of human life (Anguluri et al. 2021). It contributes to the facilitation of information and knowledge exchange (Pal et al. 2021). As technology advances, the demand for faster communication increases proportionately (Udupi and Madhava 2021). The cost of individual circuits must also be taken into account while designing a device, in addition to the speed of communication

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An All Optical 2 × 1 Multiplexer Using a Metal-Insulator-Metal based Plasmonic Waveguide for Processing at a Rapid Pace

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Abstract: This study proposes, designs, and simulates a unique plasmonic Y-shaped MIM waveguide based 2 × 1 multiplexer (MUX) structure utilising opti-FDTD software. Two plasmonic Y-shaped waveguides are positioned facing one another inside a minimum wafer size of 6 µm × 3.5 µm in the 2 × 1 MUX configurations that is being described. The design parameters are adjusted until the plasmonic multiplexer performs as required under optimal conditions. Extinction ratio and insertion loss are two performance metrics that are calculated for performance analysis of the design, which indicate the potential to be applied in plasmonic integrated circuits.

Keywords: multiplexer; MIM waveguide; Y-shaped Waveguide; finite-difference time-domain (FDTD); plasmonic waveguide

1. Introduction

The operating speed issue with its counterpart, the electrical circuits, has been widely addressed by all-optical systems [1,2]. As the bandwidth and bit rate of electronic-based processing and computing systems approach their limits, future optical communications and networks will require all-optical data processing. Researchers used a variety of techniques to create all-optical devices, including Kerr materials, Mach-Zehnder interferometers, the self-collimation approach, optical rings resonators, photonic crystals, and plasmonic waveguide [3–9]. This raised the need for photonics since it severely controls light and only requires a very minimal input power to switch on [10–16]. In addition to being faster and compact, these optical circuits are equivalent electrical circuits in size. The diffraction limit of photonic circuits has enabled a new field, plasmonics [17], which integrates photonics with electronics at the nanoscale and has attracted a lot of attention due to its reduced diffraction limit and higher frequencies, which allow for faster data transmission. The generation, detection, and manipulation of optical signals at the material interface are the main goals of plasmonics [18]. The primary drawbacks of plasmonic circuits include their limited propagation length, high heat emission, and difficulty in changing a signal's direction within the circuit [19]. In order to reduce these losses, plasmonic waveguides are used in these circuits to optimise both the length of surface plasmon propagation and confinement. Additionally, the fact that they can work in the visible to far-infrared range while using less power and a faster processing speed is drawing a lot of interest [20–22].

Numerous plasmonic waveguide types have been studied by researchers, including Metal-Insulator-Metal (MIM) [23–25], Insulator Metal Insulator (IMI) [26–29], and hybrid waveguides [30–32]. Plasmonic MIM waveguides, which have a dielectric core and

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A novel structure of all-optical optimised NAND, NOR and XNOR logic gates employing a Y-shaped plasmonic waveguide for better performance and high-speed computations

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Abstract
All-optical devices have demonstrated a broad range of applications in the communication field. These devices serve as the fundamental building blocks of sophisticated integrated circuits. By integrating these devices into fields such as signal processing, chip design, and network computations, it is possible to achieve a much more efficient device. This paper describes the design of all-optical logic gates such as NAND, NOR, and XNOR using a plasmonic-based Y-shaped power combiner. The combiner employs the concept of linear interference to generate the desired logic gates. The work is simulated and analysed using MATLAB and finite-difference time domain method. The current work is framed within a 60 μm^2 area which is less than the size of the existing structures. The parameters characterising insertion loss, transmission efficiency, and extinction ratio are calculated and compared to those of a variety of other designs.

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