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A Review of Minkowski Fractal Geometry Antenna Design

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Abstract- This paper manages scaling down and tuning of wearable electro-textile antennas by the utilization of Minkowski fractal geometries and tuning holes. It is a challenging task today to explore body mounted antenna system for various monitoring applications. The increasing interest in wearable product such as medical devices, health monitoring, sport wear and military domains promises to replace wired-communication networks in the near future in which antennas play a paramount role. By varying the size of slot present in the Minkowski fractal geometries we can change the resonant frequency as per requirement. Previous work done using the same geometry increases the complexity as number of iterations increases only up to 2nd iteration.

KEYWORDS: Minokowski Geometry, Zelt Antenna, Flectron Antenna, Fabrication, CST, Micro-strip Antenna.

I INTRODUCTION

Improvement of wearable Micro-strip antennas has quickly enlarged within the recent past, as Micro-strip style is easy to any form. Antenna properties like reduced size, straightforward creation; mechanical ability and ease square measure crucial wants to set up antennas for wearable applications. The concept of making reduced antennas by applying cutting down procedure utilizing geometry was already tested technique. The pattern components turn out "fractal loading" and allow the formation of smaller sized antennas for a given frequency of operation. Commonly 50-75% shrinkage is possible by utilizing a pattern configuration whereas maintaining the performance [1-2].

Fractal associate degree antennas likewise offer varied alternative benefits like they'll be astonishingly very little for applications obliging an put in antenna, for clear substrate materials it's attainable to style nearly unwearable larger scale structure, it conjointly has lowers price and enhances desirability. The target of this paper is to check, analyze, style and describe wearable pattern antennas capable of operating with trendy wireless standards. varied structures of fractals are tested so as to realize a comparison between them and therefore the parameters like radiation patterns,

come back loss, BW, SWR curves, input resistance are wont to compare these antennas.
Other objective is to form associate degree antenna capable to work consistent with the IEEE 802.11 standards (802.11a = 5,235 to 5,350 GHz and 5,725 to 5,875 GHz, 802.11b = 2,412 to 2,472 GHz and 802.11g = 2,412 to 2,472 GHz). The remainder of the paper is organized as follows: second section describes the properties of Hermann Minkowski island pattern and its generation method [3]. The third section presents the antenna style parameters. Then the performance characteristics of all designed antennas are compared in fourth section. Finally the conclusion is drawn on the idea of those results are show in fifth Section.

Communication between humans was 1st by sound from setting out to finish voice. With the will for to some extent additional distance communication came like drums visual strategies signal flags and smoke signals were used. These communication optical devices utilized the sunshine portion of spectrum. It's been utilized for communication that solely terribly recent in human history that the spectrum outside the visible region through the utilization of radio.
Their search work bestowed here is primarily supposed to investigate geometrical options of fractals that influence the performance of antennas victimization them. Many antenna configurations supported pattern geometries are rumored in recent years [1] – [4]. These are low profile antennas with moderate gain and may be created operative at multiple frequency bands and thus are multi-functional. During this work the multi-band (multifunctional) side of antenna styles are explored any with special stress on distinguishing pattern properties that impact antenna multi-band characteristics.

Antennas with reduced size are obtained victimization David Hilbert curve geometry. Furthermore, style equations for these antennas are obtained in terms of

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its geometrical parameters like pattern dimension. Antenna properties have conjointly been connected to pattern dimension of the geometry. to get come back loss, BW, SWR curves, input resistance are wont to compare these antennas.
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In Today’s world, so as to face the technological development, men got to sustain with the evolution. This evolution ends up in the event of cellular devices. This mentioned several new areas of investigation; the one with main interest for this thesis is that the analysis of antennas with pattern geometries.
The main downside of common antennas is that they solely operate at one or 2 frequencies, limiting the quantity of bands that instrumentality is capable of supporting. Another issue is that the size of a typical antenna. Owing to the terribly strict area that a French telephone has, putting in place over one antenna is extremely tough. To assist these issues, the utilization of pattern formed antennas is being studied.

II RELATED WORK

This paper [5] introduces for the first time a novel flexible magnetic composite material for RF identification (RFID) and wearable RF antennas. First, one conformal RFID tag working at 480 MHz is designed and fabricated as a benchmarking prototype and the miniaturization concept is verified. Then, the impact of the material is thoroughly investigated using a hybrid method involving electromagnetic and statistical tools. Two separate statistical experiments are performed, one for the analysis of the impact of the relative permittivity and permeability of the proposed material and the other for the evaluation of the impact of the dielectric and magnetic loss on the antenna performance. Finally, the effect of the bending of the antenna is investigated, both on the -parameters and on the radiation pattern. The successful implementation of the flexible magnetic composite material enables the significant miniaturization of RF passives and antennas in UHF frequency bands, especially when conformal modules that can be easily fine-tuned are required in critical biomedical and pharmaceutical applications.

In this paper [6], we analyze the performance of novel wearable multiple-input–multiple-output (MIMO) systems, which consist of multiple electro- textile wearable antennas distributed at different locations on human clothing. For wearable applications, a semi directional radiation pattern of the wearable patch antenna is preferred over an omni directional radiation of conventional dipole antennas to avoid unnecessary radiation exposure to the human body and radiation losses. Additionally, the spatial distribution of the antennas is not constrained as a typical handheld unit. Through theoretical modeling and simulation, the wearable MIMO system is shown to demonstrate a significantly higher channel capacity than a conventional system on a handheld platform (e.g., a compact dipole array or a single dipole), due to enhanced spatial diversity and antenna pattern diversity. The unique effects of antenna directivity and location on the MIMO system capacity are investigated in terms of antenna correlation and effective gain under different wireless channel models. The advantage of a wearable system over a conventional system was further confirmed by detailed physical modeling through the combination of full-wave electromagnetic and ray-tracing simulations. Finally, complex channel response matrices were measured to characterize the performance of a body-worn MIMO system in comparison with a reference full- size dipole antenna. The 319% improvement in 10% outage capacity for the body-worn system over the reference system made of a full-size dipole antenna is consistent with the 288% improvement projected by theoretical modeling and the average 300% improvement found in the physical simulation of two typical indoor scenarios.

The design of the first wearable active receiving textile antenna in the 2.45 GHz ISM band is addressed for use in personal area networks [7]. The integrated low- noise amplifier is realized on a hybrid textile substrate and positioned directly underneath a wearable patch antenna. The antenna and low-noise amplifier are designed by means of circuit/full wave Co- optimization techniques within

communication systems operating in the frequency range of 2.3 GHz to 2.4 GHz with 2.34 GHz as center frequency [9]. Three highly efficient and flexible antennas, built using three different conductive fabrics and an insulating polyester fabric are evaluated and results reported in this paper. To the best of authors' knowledge, this is the rest attempt.

This work [10] investigates the design of a flexible Minkowski fractal antenna. Two potential materials are included for examination - conductive copper tape and ShieldIt conductive textile. Both are designed and simulated to achieve a satisfactory resonance at the Very High Frequency (VHF) band for Land Mobile Radio (LMR) application through proper structure segmentation and iteration. Optimization concludes that the antenna is suitably fed using an L-shaped folded ground plane, with a Minkowski radiator of the third iteration (n3). The better performing material, i.e. conductive copper tape, is used to fabricate an antenna. It is observed through measurements that the wearable antenna reaches a gain of larger than 0 dB and an efficiency of 48 %, with a size of less than 0.5 m.

III PROBLEM IDENTIFICATION

In order to transmit to receive data in communication system, it is necessary to have compact system, a novel multi-platform simulation setup to account for all the losses induced by using textile materials. A good agreement between simulations and measurements is obtained. An available gain of about 12 dB, on top of the passive antenna gain of about 5 dBi, and a noise figure of about
1.3 dB are realized. The effect of the human body on the active antenna performance is investigated by means of on-body measurements.

This paper [8] discusses the design of a broadband Dielectric Resonator Antenna (DRA) tailored and modified appropriately for implementation as a textile wearable antenna in Body Area Networks (BAN). DRA addresses the issues of small size, wide bandwidth and low conductive loss in particular. Due to its vital credentials, DRA serves well to be a choice as a wearable antenna for on-body communication system. The proposed design is simulated in CST Microwave Studio (CST MWS). The prototype is a textile-based construction offering a wide impedance bandwidth. Detailed tests and measurements carried out using a full-body phantom are reported in this paper.

A fully fabric triangular shaped Micro strip patch antenna is proposed for Wireless Broadband (WiBro)

Transmission and reception system requires transmitting or receiving antenna to transmit/receive information. There are different factors which govern antenna selection. These are size, weight, complexity, bandwidth, gain and applications. One of best antenna that can optimize all parameter is micro-strip antenna. This antenna is having small size and less weight but suffer from disadvantage like low bandwidth, high return loss and loss gain and efficiency. In order to use micro strip antenna for different WSN application, different techniques have to be applied which are slot antenna, fractal antenna, use of met material, electron band gap structures, use of DGS. Advantage of using slot configuration is that characteristics of antenna improved in term of gain and return loss. By applying DGS, only bandwidth of antenna increased, hence in order to increase bandwidth of antenna and multiband characteristics, fractal antenna would be required. There are different fractal geometries that are used. Minkowski fractal geometry had been used to make ring shape patch antenna for dual band application.

VI CONCLUSION

Wearable electro-textile patch antenna is meant by mistreatment mathematician shape geometries with standardization hole for 0th, first and planned iterations. 3 electro-textile wearable antennas mistreatment Flectron and Zelt materials are designed. The planned antenna shows a big size reduction compared to the standard Micro-strip patch antenna. These antenna structures are compatible for wearable applications too as they're made mistreatment solely light-weight weight and versatile textiles.

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