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WIRELESS COMMUNICATIONS AND MOBILE COMPUTING FOR AMBIENT ASSISTED LIVING USING IOT

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ABSTRACT

A multiband planar antenna with a third-order toroidal coupling structure is presented in this study with possible use in mobile communications. Using a coplanar waveguide arrangement, the antenna is fed. On the basis of a first-order toroid, the radiating body model of the antenna is created by scaling and nesting twice in equal parts. The aforementioned patch was printed on a flexible polyimide substrate measuring 42 by 55 by 0.1 millimetres. This paper investigates the effects of coupling with the human body and different directions of bending on the performance of the antenna S11. A high-frequency structure simulator was used to mimic the antenna, and measurements were made in a microwave electromagnetic darkroom. The antenna's highest gain for its band coverage is 4.39 dBi, and the simulated findings and actual results agree well. The TD-LTE (B-TrunC) (1.447-1.467 GHz), LTE42/43 (3.4-3.8 GHz), WiMAX (3.3-3.8 GHz), 5G band n78 (3.4-3.8 GHz), WLAN (5.15-5.35 GHz), 5G (5.725-5.825 GHz), and other commercial bands are among the frequency ranges that the antenna can cover.

Keywords: Wireless, Communications, Mobile, Computing, Ambient, Assisted, Living, IoT.

I. INTRODUCTION

The usage of flexible media has allowed antennas to achieve a certain level of conformal capability in recent years thanks to the ongoing investigation of antenna technology. Additionally, given the conformal antenna's multiband, excellent mobility, and affordable qualities, the resilience of its performance is kept to a certain level. Engineers typically employ the slot loading approach [1], linked feed technique [2], distributed inductive loading technique [3], and matched network loading strategy when constructing antennas to produce the multiband effect.

Numerous articles [3–4] have advocated these techniques. Additionally, the design of antennas can incorporate the fractal principle. The aforementioned techniques enable an antenna to respond to many bands while increasing the electrical length of the antenna in a constrained area. For instance, Yu et al. [5] created a fourth-order fractal nested antenna using the fundamental concept of ancient Chinese coins in order to achieve the optimal operating frequency point and a multiband effect by lengthening the antenna's electrical length. Coplanar waveguides can increase the frequency bandwidth but with larger losses, according to research that looked at the impact of various feeding techniques on an antenna [6–8]. Although a microstrip feed has a perfect transmission loss, the bandwidth is limited.

II. SIMULATION RESULTS

The software programme ANSYS high-frequency structure simulator (HFSS) (Version 20) was used to simulate the antenna. The antenna may be thought of as a capacitive-loaded monopole antenna. Through HFSS simulation, the first-order model produces three centre frequency points. The frequency bandwidth expands, the electrical length of the current lengthens, and an electromagnetic coupling effect is seen between the rings as the number of continuous nesting repetitions rises.

The antenna's ground surface is examined once the number of radiator iterations has been determined. Additionally, as illustrated in Figure 5, a simulated comparison is done between the coplanar waveguide antenna's rectangular ground surface and the circular ground surface S11. The circular ground surface has a wider frequency bandwidth than the rectangular one, as seen in the image. S11 performs better and has a wider coverage of commercial frequency bands. Therefore, the antenna ground is determined as a semioval ground with a major radius of 15 mm and a ratio of 1.125.

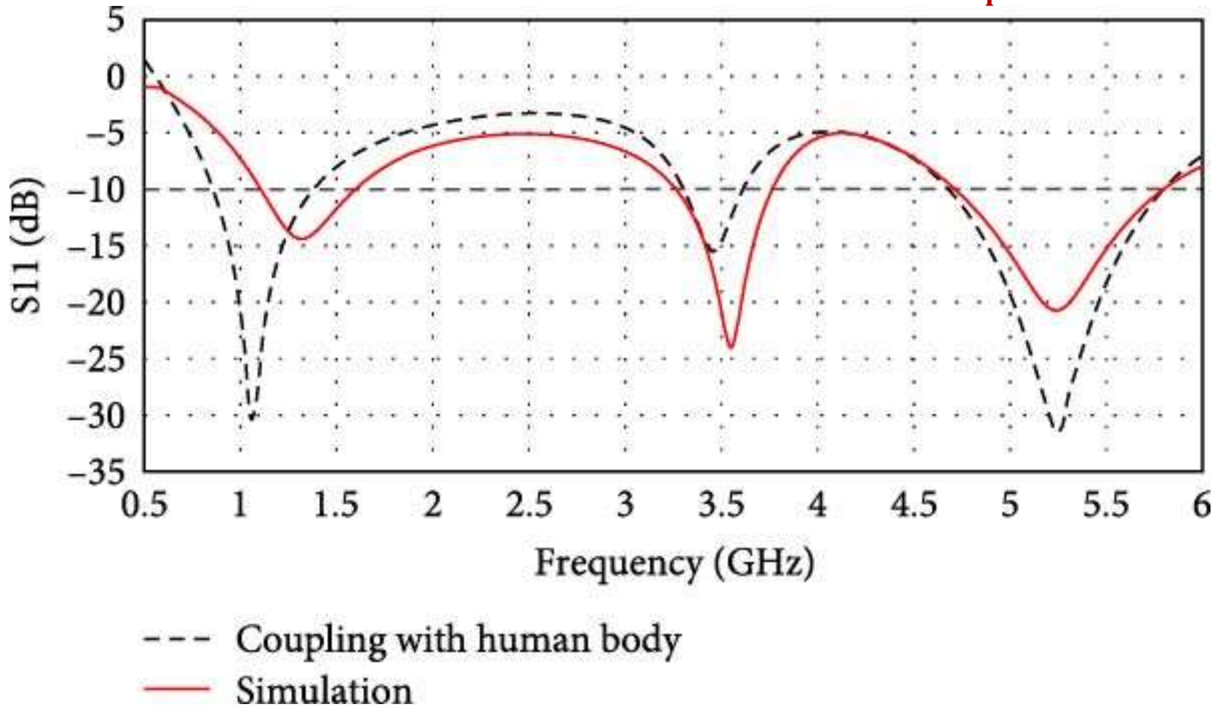

Fig.1: Wireless Communications and Mobile Computing for Ambient Assisted Living using IoT Graph

Fabrication and Measured Results

He exact size of the antenna prototype, which was created utilising a 0.1-mm thick polyimide material as the dielectric plate, As shown in Figure 13(b), the feeder is connected to the 50 sub-miniature-A (SMA) interface, tested in the electromagnetic screen darkroom, and the simulated performance of the antenna is confirmed. To ascertain the impact of coupling between the antenna and the human body, the antenna is examined.

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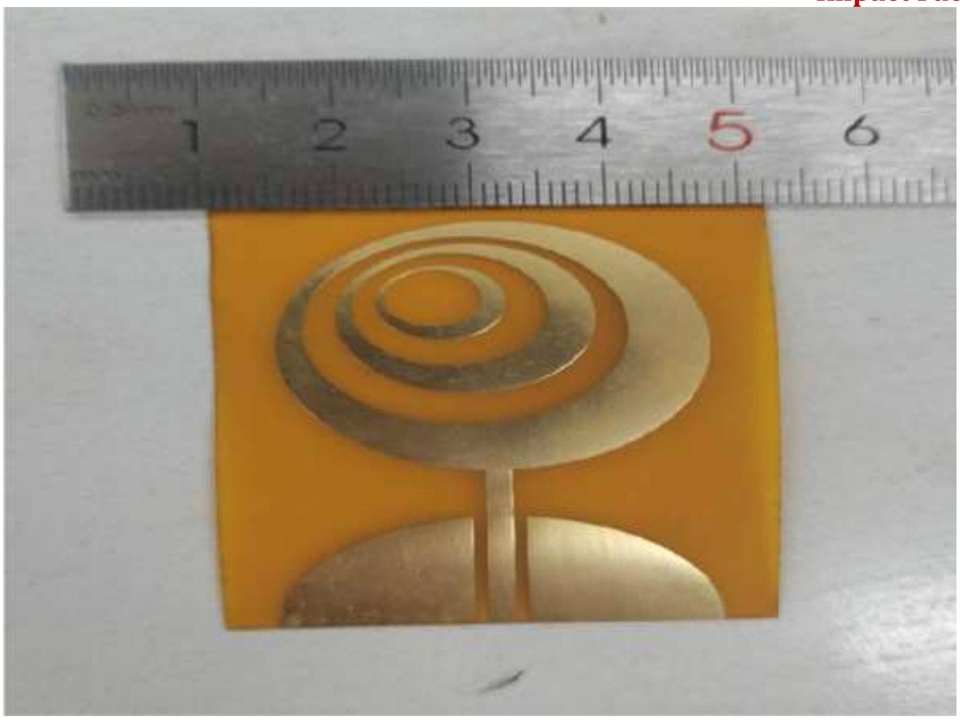

Fig.2: Wireless Communications and Mobile Computing for Ambient Assisted Living using IoT Testing

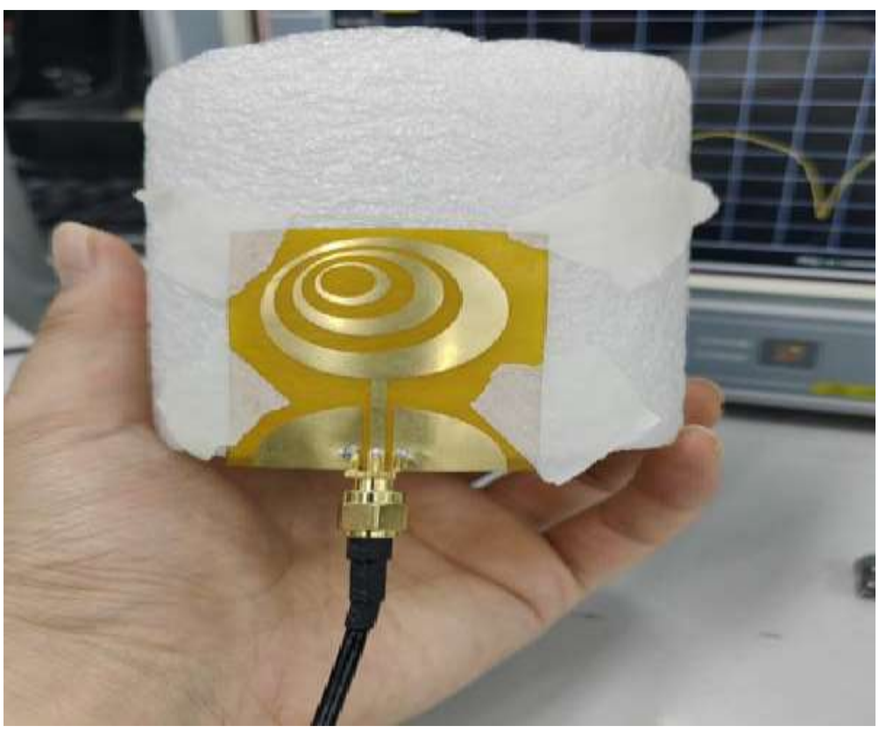

Fig.3: Wireless Communications and Mobile Computing for Ambient Assisted Living using IoT

III. RESULT

The efficiency and gain of the curved antenna and the flat antenna were compared in the darkroom. Here, the planar antenna's gain in the first band spans from 0.64 to 2.87 dBi, with a maximum radiation efficiency of 60.3%. The third band's gain varies from 0.76-3.55 dBi with a maximum radiation efficiency of 71%, whereas the second band's gain ranges from 1.59 to 4.39 dBi with a maximum radiation efficiency of 81.8%. When the gain and efficiency of a planar antenna are compared to those of a bent antenna, it can be seen that the gain and efficiency of the bent antenna reduced, but the change was acceptable.

The radiation efficiency of the antenna in the target band remains above 50% after bending, and the antenna meets the performance requirements of most frequency band applications to a certain extent.

IV. CONCLUSION

This work designs a multi-band miniaturised antenna with a third-order ring construction. The antenna supports commercial frequencies in the GPS, BDS, TD-LTE (B-TrunC), LTE42/43, WiMAX, WLAN, 5G, and other bands. 1.18-1.63 GHz (32.8%), 3.2-3.8 GHz (16.9%), and 5.1-5.92 GHz (15.1%) are the coverage frequencies and relative bandwidths, respectively. The antenna's miniaturisation, excellent stability, and multiband properties define its omnidirectional radiation performance. The antenna may be utilised in practical applications since it covers the necessary frequency ranges for 4G and 5G. such as smart cities, mobile communications, medical care, high-speed data transmission, and VR/AR. However, as the antenna is not circularly polarized, the usability of the satellite navigation system bands covered by this antenna in practical applications needs to be further explored.

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