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Development Of Flexible Organic Wireless Rf Devices Utilizing Doppler Radar Fabric Antenna

[1]A.Durga Bhavani, [2]S.Parameswari, [3]Dr. P. Sampath, [4]Nisha A K, [5]Ch.Manohar Kumar,[6] Tulluri Sateesh

[1]Assistant Professor, Department of Computer Science and Engineering, BMS Institute of Technology and Management,
Doddaballapur Main Road, Avalahalli, Yelahanka,Bengaluru-560064.
[2]Assistant Professor, Department of Electronics and Communication Engineering, Kalasalingam Institute of Technology, Krishankoil, Virudhunagar -626126, Tamil Nadu.
[3]Professor & Head, Department of Computer Science and Engineering, Nehru College of Engineering and Research Centre, Pampady, Kerala- 680588.
[4]Assistant Professor, Department of Computer Science and Engineering, Nehru College of Engineering and Research Centre, Pampady, Kerala- 680588.
[5]Assistant Professor, Department of Electronics and Communication Engineering, Gayatri Vidya Parishad College For Degree and PG Courses (A), Rushikonda, Visakhapatnam, Andhrapradesh-530045.
[6]Assistant Professor, Department of Electronics and Communications Engineering, CMR Technical Campus , Kandlakoya, Medchal, Hyderabad, Telangana, 50140.

Abstract
The wearable system subsequent phase demands the creation of the personal area network and IoT by flexible, attractive, and skin pleasant wireless transmitters. In this study, the first completely functioning, poly(3,4-ethylenedioxythiophene) polystyrene sulfonate (PEDOT: PSS) material antenna array for the latest wearable devices is shown. It is an unmatched milestone because previous conductive polymers have all proved inadequate Radio Frequency (RF) because to loss of skin effects, because here, with the assistance of PEDOT: PSS conductive phase segregation, an all biological textile RF transmitter forming a linear coaxial with a conductive casing. The constructed antenna display minimal return losses of –55 dB and an acceptable irradiance efficiency of 27% with the resonance frequency of 2.345 GHz. In addition, an outstanding, extremely accurate speed and distance detection system from the Doppler radar. This approach produces all flexible wireless organic RF devices with significant ramifications for the wearable integrated electronic network system.

Keywords: Fabric antenna; RF devices; Radar; Copper particles

1. INTRODUCTION

In conjunction with the developing IoT and Body Area Network, wearable electronics increase quickly for a vast variety of applications. With huge developments, the need has changed from integration with user-friendliness into a comprehensive wearable platform [1].

As these demanding criteria are no longer fulfilled by standard antennas, composed of metal strips and a stiff microwave substratum, the development of antennas on base materials is essential [2]. Investigators long strived to attain standard materials by blending with fiber to fulfill this requirement [3]. Fabrics with finely-covered metal threads or textile with metallic coating threads, often form of electronic materials, were utilized as a showcase for different applications of the radiation frequency with a similar outcome as a copper substratum, e.g. silver nano-ink [4].

In this paper, we are presenting the first-ever manufactured, all-organic flexible patch antenna, which is based on a chosen substratum for the polyethylene terephthalate (PET) PEDOT: PSS. Ultra-low effective RF absorption coefficient was attained on the PEDOT: PSS imprinted textile surface by the use of nano particle assisted structural control and conductivity enhancement, and phase separation, to form and connect high conductivity various stages into consistent pathways on the surface of fabric fibers. In several relaxed and flexible configurations, the antenna exhibited great performance. In a radar system Doppler the RF transmission/receiving capability of the material, the antenna was also displayed. To our knowledge, this antenna patch marks the first CP-based worksheet antenna without metal usage.

2. OBSERVATIONS

The conductive fibers use the twisted architecture of the cloth to produce a unique three-dimensional structure comparable to the higher frequencies architecture [5]. The supporting information referring to state-of-the-art contains a picture of the printed fiber. Forms of the conduction layer on the surface of the fiber were further supported by the network of smoked silicone nanoparticles employed as detergents for the surface of PET fabric fibers [6]. Silica elements form a fabric that causes the development of a PEDOT electrically charged Sulfonate Ester link for separating PSS acid. The solvent reached exceptionally low pH levels during the drying of the printed tissue, which resulted in a condensation polymerization between some of the silica interface -OH group and PSS38 excess sulfone acid classes [7]. The process results in a covalent connection of the particles with the polymers that conduct them [8,9]. The generated sulfo-Syl-ester connection leads to the correct positioning, agglomeration, and printing of the PEDOT material interface.

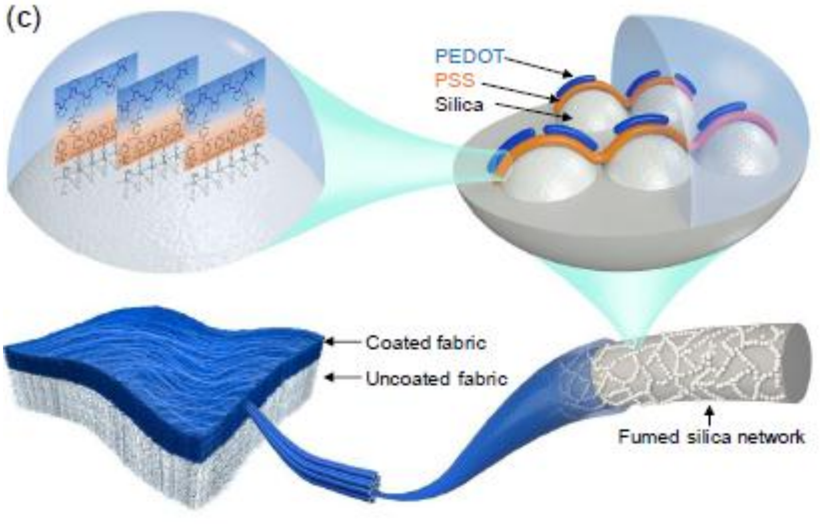

Figure 1. Demonstration of the PEDOT: PSS architecture and the improved silica nanoparticles network resistivity on fabric fiber surfs.

Figure 1 shows a schematic chart showing the increase in RF and partitioning. The PEDOT: PSS stage partitioning of the nanoparticle helped the compressed to mitigate the skin effect, by taking advantage of its unique fiber bundle structure and showing low RF sheet strength. The observed RF sheets of copper resist are 2.0 liters at 2.4 GHz, while the calculated PEDOT: PDOT printed RF sheet resistance is 6.9 liters. As seen in Figure 2(a) this is a good value because the quantity of metal will be the same.

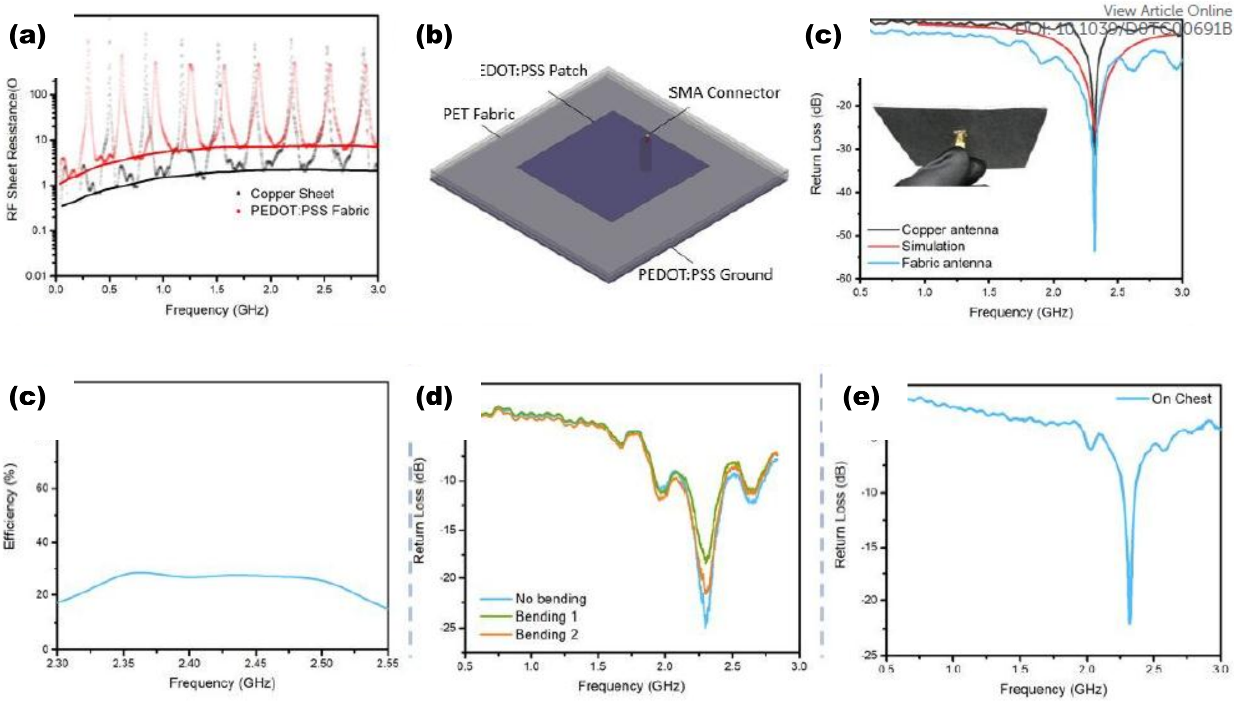

Figure 2. (a) Comparing of RF between copper and PEDOT: PSS (b) All organic antenna printed patch, and substrates. (c) Compare the prototype of a microwave (blue) copper sample, the antenna of a simulated organic fabric result (red), the antenna - all-organic fabric (blue) (d) Transmitting measuring coefficient configuration picture.

A textile patch antenna has been created and manufactured, based on this unusual conductive fabric. High-Frequency Structure Simulator (ANSYS HFSS) analysis was run for an optimized antenna design and Figure 2(b) shows the side view scheme of the model antenna. A copper-based antenna was manufactured as a reference with the traditional microwave metal substratum. Figure 2 (c&f) shows details of the manufacturing of the copper antenna and the entire organic fabric antenna. The resonance pitch established by the insertion loss characteristics is the wavelength at which the antenna is most effective in transmitting and receiving signals and the loudness is an indicator of the power loss produced by antenna signal reflection and attenuation.

The material antenna was linked to the transmitter of port 1 of the Vector Network Analyzer (VNA) and the copper patch antenna reference was attached as an ideal receiver to port 2, respectively. The energy ratio of Port 2 to the energy from Port 1 was measured by the VNA.

To decrease the power loss into free space, two antennas were placed near together. The radiation efficiencies are calculated at 27% at the frequency response, and the results are closely matched with the predicted effectiveness of 26%. This finding shows that this printed fabric's effective RF sheet resistance is in the same magnitude as the copper sheet.

The selected curvature is representative of the thigh and torso's natural radius. The measurements in a flat state and two conditions of flexion are shown in Figure 2(d). The antenna worked well in these twisting abnormalities since the frequency response without excitation frequency was sustained. The output voltage marginally dropped from that of the flat condition, resulting in a smaller loss of return, as per the Smith Chart data. These modifications to the return loss did not decrease the antenna's performance. The antenna was fixed in a t-shirt, as illustrated in Figure 2(e). The result of the return loss in Figure 2(f) demonstrates that the antenna feature is properly preserved when used on the body.

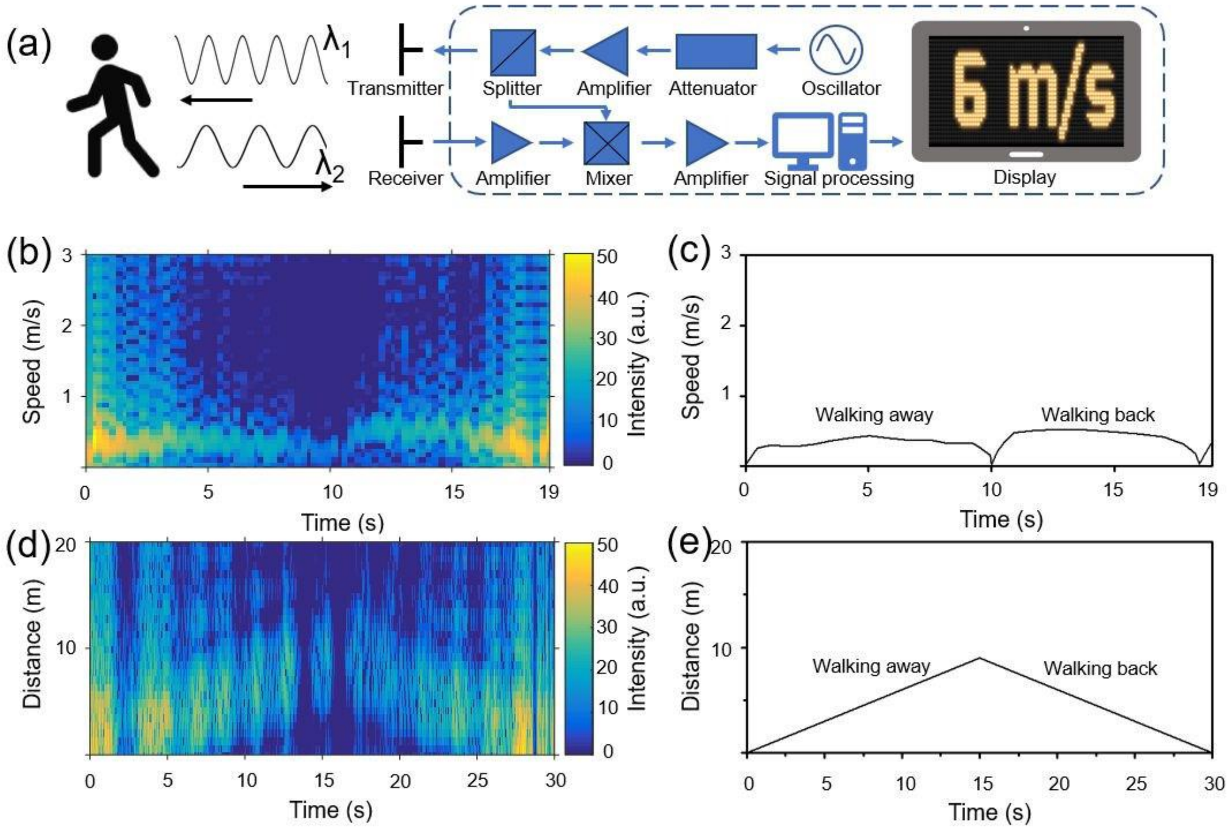

Figure 3. (a) Doppler radar system schematic design with fabric antennas patches. (b) a map of speed-time-intensity when a participant left the scanner and returned. (c) the speed measured by the greatest intensity of a voluntary worker. (d) The long-term intensity map results when a participant leaves the scanner and returns. (e) The distance is measured by the maximum intensity between both the scanner as well as the participant. Demonstration of RF communication systems in a radar system from Doppler.

Figure 3(a) shows that fabric antennas were employed for the transmission of high frequencies and the receipt of the reference signal. Doppler effects are used to handle signals via an RF circuit and to estimate moving objects and distances to radar utilizing MATLAB.

The initial measurement is taken by a volunteer walking from the radar and back to measure the volunteer's speed using a 2.4 GHz transmission.

The volunteer speed is shown in the speed time-intensity chart by the greatest signal points (Figure 3b). Figure 3(c) shows results were refloated using the greatest intensity data alone to assist the observed speed to visualize. At speed of 0.45 m/s, the Volunteer halted at the 11th second and returned by 0.55 m/s. In a second study, a 2.4-2.55 GHz signal was measured by radar to determine the distance from the antenna. The volunteer left the radar and returned, the volunteer is indicated in intensity distance (Figure 3d). In Figure 3(e), the results were deployed solely the maximum intensity data for improved viewing. The results demonstrated that after 14 seconds the volunteer had gone 99m away and a velocity of 0.66m/s may achieve component. In this short-range Doppler radar, the RF signals transmission capacity of the fabric antennas is well seen.

3. CONCLUSIONS

In summary, for the future generation wearing electronic system, we presented PEDOT: PSS organic material antenna. The antenna was manufactured using a highly RF driving material, allowing for a beach-assisted PEDOT: PSS phase separation and multi-strand wire structures. A Doppler radar system for short-range sensing was created, showing high accuracy speed and distance detection. This discovery opens up a new approach to produce flexible organic wireless RF devices that keep their practical use promising ineffectively handle telecommunications.

4. REFERENCES

[1]. P. S. Hall and Y. Hao, *Antennas and Propagation for Bodycentric Wireless Communications*, Artech House, Norwood, MA, USA, 2nd ed., 2012.
[2]. J. Lee, H. Kwon, J. Seo, S. Shin, J. H. Koo, C. Pang, S. Son, J. H. Kim, Y. H. Jang, D. E. Kim and T. Lee, *Adv. Mater.*, 2015, **27**, 2433-2439.
[3]. R. Salvado, C. Loss, R. Goncalves and P. Pinho, *Sensors*, 2012, **12**, 15841-15857.
[4]. Z. Wang, L. Zhang and J. L. Volakis, *Textiles and Light Industrial Science and Technology*, 2013, **2**, 105-112.
[5]. W. H. Hayt and J. A. Buck, *Engineering Electromagnetics*, McGraw-Hill New York, 2001.
[6]. Sekaran, K., Rajakumar, R., Dinesh, K., Rajkumar, Y., Latchoumi, T. P., Kadry, S., & Lim, S. (2020). An energy-efficient cluster head selection in wireless sensor network using grey wolf optimization algorithm. TELKOMNIKA, 18(6), 2822-2833.
[7]. Kalaiselvi, K., Murali, D., Reddy, R. V., Devi, G. R., & Ponnusamy, S. (2021). Analytical Framework to Build Predictive and Optimization Functions From Manufacturing Industry Sensor Data Using Cross Sectional Sharing.
[8]. Sridharan, K., & Sivakumar, P. (2018). A systematic review on techniques of feature selection and classification for text mining. International Journal of Business Information Systems, 28(4), 504-518.
[9]. X.-J. Wu, Y. Wang, W. Yang, B.-H. Xie, M.-B. Yang and W. Dan, *Soft Matter*, 2012, **8**, 10457-10463.