Multi-Mode Smart Wearable Fabric Antennas for Augmented Touch Tracking and Motion Detection on Human Skin.

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Applications in the field of wearable electronics has seen significant growth in recent years. The wearable electronics industry itself is expected to grow up to $52 billion by 2022. Smart watches, such as Apple watch which can gather real-time health data i.e. heart rate and rhythm seamlessly, account for a significant portion of the market. However, demand for decreasing device sizes and increased features such as respiratory, heart rate and blood pressure monitoring systems has prompted development of fully integrated wearable electronics where sensors/devices and wearable fabrics are part of one another. Examples of such include 'Myontec Intelligent Clothing' which comprises of form-fitting athletic wear with integrated sensors capable of tracking muscle health and movement using principles of the electromyogram. Apart from health applications, smart wearables are also finding applications in human-body motion capture and augmented touch and tracking where users can control devices via smart wearables. These involve the use of on-body RFID tags tracked by an antenna where specific body movements result in user-defined actions. Examples of such devices include Google's project Jacquard: a fabric jacket that tracks hand motions, translating them to programmable actions.

Although such devices provide informed and interactive 3D user space, they lack human-body conformity. This lack of impracticality and comfortable wearability over long periods of time is attributed to the expensive and rigid nature of the integrated sensors. In this study, we present a novel antenna design topology screen-printed using conductive inks onto commercially available wearable fabric substrates for multi-mode augmented touch and human-body motion detection capability. These smart antennas are screen-printed onto fabric substrates and mounted in unique positions on the human body to track motions without external space antennas. Motions specifically, arm movements are captured in real-time and translated into programmable actions for external device control and human body movement data logging activities. A parametric analysis of the fabric antenna will also be presented.