Leveraging unintentional Electromagnetic Emissions for Radio Tomographic Imaging

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Radio Tomographic Imaging (RTI) is a promising technique for imaging non-line-of-sight areas. RTI uses radio frequency signals to create a map of the area of interest (AoI) by analyzing changes in signal strength caused by the presence or movement of objects within a network of wireless transmitters and receivers. However, current implementations require complex setups with multiple transceivers and costly, dedicated radio circuits. These systems are difficult to use in embedded and IoT applications and are highly sensitive to terrain and surface structure variations, which can significantly impact signal propagation. We investigate an alternative approach that exploits the unintentional electromagnetic (EM) emissions from computing devices to detect the effect of a human presence on the link between the device and the antenna. We conduct experiments in three different environments with a stationary person in the link using EM emissions of a single desktop PC with an Intel i5-7400 CPU. Our results demonstrate that an object in line of sight between the signal source and the receiver causes variations in the received signal from 0.65 to 3.52 dB, dependent on the AoI and the surroundings. Our results also show that changes can be detected up to 2.4 m from the signal source in a cluttered indoor environment and up to 3 m in an outdoor environment. Our findings further indicate that unintentional EM emissions from electronic devices can enable passive human detection without the need for purpose-built transmitters. Therefore, our approach can be extended to RTI.

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