An Accurate Indoor Navigation Method Using Radio Signals and Machine Learning Techniques

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Navigation is the process of identifying positions of the passengers and then display feasible paths to guide them to their destinations. Global Positioning System (GPS) is suitable for outdoor navigation. Due to the lack of GPS signal reception inside buildings, new technologies should be emerged for navigating inside the buildings and covered areas. The main objective of this study is to propose an accurate and reliable schema to navigate passengers inside unfamiliar indoor environments along the shortest path to their destinations. The proposed navigation process consists of tracking the passenger, identifying shortest path and continuously guide passengers to their destinations on the fly. Triangulation technique is employed on Wi-Fi signals coming from at least three WiFi routers to identify the position of the passenger. Wi-Fi routers are recognized using their MAC addresses and then triangulation algorithm is applied. Proximity algorithm is used together with triangulation algorithm to increase accuracy. The map of the indoor area is scaled via x and y axes and positions are identified as coordinates of it. The path to the destination is animated through these coordinates. Shortest path between current and destination location is calculated using Dijkstra's algorithm. Prototypical development is achieved by proofing the concept for feasibility of the proposed indoor navigation architecture. It can be concluded that, a significant accuracy can be achieved by using Wi-Fi technology, triangulation algorithm, proximity algorithm and Dijkstra's algorithm. Further improvements on accuracy of proposed indoor navigation architecture can be achieved by incorporating Radio Frequency Identification or Bluetooth beacons technologies together with Wi-Fi technology.

Keywords: GPS, Triangulation algorithm, Dijkstra's algorithm, Fingerprint algorithm, Indoor navigation, Bluetooth, RFID