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Implementation of an indoor localisation algorithm for Internet of Things

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Abstract

Internet of Things (IoT) is usually associated with the acquisition of sensor node information and controlling of things. However, the inadequateness of location information of these sensor nodes compromises the intelligence of the IoT network. With an emphasis on indoor environments, localisation in IoT has become a very important area for research due to the fact that well-established positioning services such as the Global Positioning System (GPS) are not viable indoors. In essence, the difficulty for satellite signals of such existing systems to reach indoor environments causes huge localisation inaccuracies. Therefore, indoor localisation in recent time has been based on Wireless Sensor Networks (WSN). In this work, distributive indoor localisation accuracy and computational performance as implemented in real life towards IoT are of concern. Therefore, this work presents a methodology comprised of a mix of existing techniques to integrate indoor localisation of sensor nodes and IoT in a realistic environment and at an acceptable degree of localisation accuracy. The major contribution presented in this work is the attainment of an acceptable level of localisation accuracy while maintaining high computational efficiency on a developed hardware sensor node prototype. In achieving this, the implementation issues regarding the complexity of localisation algorithm and hardware computational capabilities are tackled. In ensuring that this work is aligned with the IoT context, an Internet and Intranet enabled connectivity for real-time access to the location information of sensor nodes is developed and presented. This work is also achieved through the use of a distributive online based localisation algorithm based on Kalman filtering Received Signal Strength Indicator (RSSI) and Gauss–Newton Algorithm (GNA). A sensor node prototype capable of handling complex computations is developed and presented. A gateway device and an IoT framework are also proposed and implemented based on Linux, Apache, MySQL, PHP (LAMP) server to provide global and local access to real-time location information of the sensor nodes. The algorithm is first simulated for pre-validation and then ported to the sensor node prototypes. The computational power of the hardware is analysed based on the time it takes to perform the GNA based localisation process towards convergence. The Root Mean Square Error (RMSE) is computed for analysing the accuracy level of the proposed concept. This work further presents findings based on the effect of node orientation changes as the

localisation process is performed and logged, which is an issue of great concerned to be tackled in future works.