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Autonomous Mapping Using RSSI-based Fingerprinting

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Abstract: In this paper we present an autonomous method of mapping an indoor location by building an RSSI (Received Signal Strength Indication)-based fingerprint database. We use a robot, a Kinect sensor, a laptop and a WLAN receiver in this project. The Kinect gives the coordinates of the robot; the coordinates are stored in a database. Simultaneously, the WLAN receiver sends the RSSI data to the database. Once this is achieved the robot moves forward and the process is repeated till the entire area is mapped.

Keywords: RSSI, fingerprinting, Localisation, mapping.

I. INTRODUCTION

The two techniques popularly used for indoor navigation are triangulation and fingerprinting. Fingerprinting is a more accurate way for indoor mapping [1]. Fingerprinting uses RSSI data from the access points to create a database along with the coordinates of the place where the RSSI data is recorded. When a person is at a location, the RSSI valueof that location is received by the WLAN receiver and these values are matched to the values recoded in the database. The coordinates corresponding to this RSSI value gives the location of the person. In this paper we suggest an efficient method of collecting the data for the RSSI- based fingerprint database.

II. MAPPING

We use a robot with a Kobuki base, a Kinect sensor and a laptop which helps us connect to the database and serves as the robot operating system. The Kinect sensor provides a 3-dimensional data of the surrounding. The input from the 3-D sensor is converted to a 2-Dimensional data. It gives the (x,y) coordinates of the robot. These coordinates are stored in a database [2].

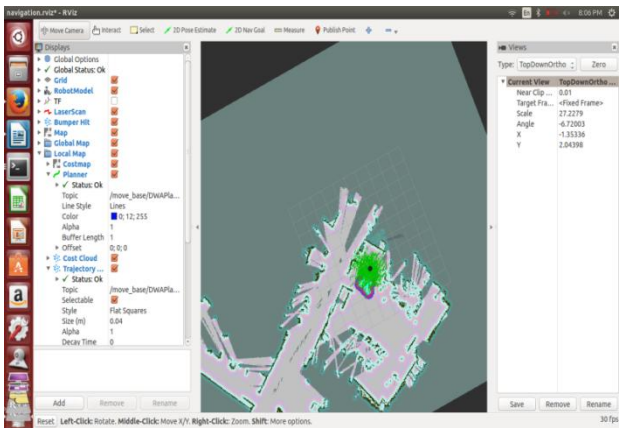

Fig.1. Completed map

At the same time the RSSI data from the WLAN receiver is entered into the database.

Once the two data are recorded into the database the robot operating system Master instructs the odometer of the base of the robot to move to the next coordinate. As the robot moves, the environment changes and the data from the Kinect changes as well. The RSSI value and the coordinates recorded. The whole process is again repeated till the entire indoor space coordinates and their corresponding RSSI values are mapped in the database. Fig 1 shows the completed map of the office area used for proof of concept.

III.ADVANTAGES OF THE PROPOSED METHOD

- The method of using a robot to create the RSSI-based fingerprint database has an advantage over the earlier proposed models. It has been observed that the RSSI-based fingerprint database becomes inaccurate over course of time [3]. Therefore, we can schedule the robot to take fresh RSSI and coordinate values into the database every few months. Previously the data recorded was manual and the process was tedious.
- The use of Kinect and the robot helps in providing comprehensive results, that is, the coordinates recorded are of very close intervals thereby giving a more accurate result during indoor navigation. It is precise to centimetres. During manual recording of the coordinates, very few coordinates are recorded and the result during navigation is not accurate [4].
- The time required for recording the data is faster with a robot. It moves to the next coordinate as soon as the RSSI readings and the coordinates are recorded. Manual recording is much slower [5].

IV.CONCLUSION

The method suggested of using a robot and a Kinect sensor to store values into the RSSI-based fingerprint database is efficient and more accurate than the earlier methods. This method can be scaled to large indoor spaces it also provides a more accurate final result during indoor

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navigation. However, the method is expensive. In future, a cheaper sensor that replaces the Kinect should be used and a cheaper robot.

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