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Survey Paper on Human Following Robot

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Abstract - *The purpose of this project is to develop an autonomous mobile robot which can follow a human being. The robot will have a structure resembling a human. It will sit on a controllable platform that has wheels to move around. A tag that is placed on the person will continuously emit a signal. The Robot will detect this signal and follow the human. The robot can also be controlled remotely by an operator using a remote control.*

The method of triangulation will be used to find the location of the transmitting source. Multiple antennas, present on the robot will find the phase and the magnitude of the received signal and based on these values, the location of the tag will be determined.

Key Words: *autonomous, tag, triangulation, multiple antennas, phase, magnitude*

1. Surveyed Algorithms

The techniques used to calculate the relative positions of the emitter and the receiver use PIR and RF localization system as wireless pyro-electric infrared sensory fusion system to monitor the location information of robots and people. It reduces the error of RF localization information through tile proposed dynamic triangulation (DTN) method. An algorithm called as the WPIR interference algorithm is also used. This algorithm determines the fused position from both the PIR localization system and radio frequency signal localization system which utilize tile received signal strength (RSS) propagation model. They have developed and experimentally demonstrated a WPIR sensory fusion system which can be successfully applied in locating targets such as people and robot. With an accurate localization mechanism for tile indoor environment, tile provision of appropriate services to people can be realized.

A mathematical algorithm can also be used which uses the DOA measurements from emitters with known locations to estimate the vehicle's position as well as its heading. The parameters ΘA and λA, show the vehicle's position and HA shows the vehicle's heading. ΘEi and λEi show the emitter's position and Bi shows the emitter's heading. These values are calculated by using mathematical formulae. Error in the calculation of these values is considered in the mathematical equations and the output is adjusted accordingly. If a new error occurs in the system, it has to be accommodated into the equations.

A method to calculate the position of the receiver with respect to the emitter uses radio frequency identification (RFID) technology to navigate a location. A proposed cordic architecture with floating arithmetic operation is implemented and verified on FPGA chip. The cosine law is used to calculate the location of the reader with respect to fixed locations of high frequency RFID tags. The CORDIC algorithm is adapted to the cosine rule.

An RF-based system for locating and tracking users inside buildings is provided. The signal strength information gathered at multiple receiver locations to triangulate the user's coordinates is used by RADAR. Both empirically determined and theoretically computed signal strength information is done using Triangulation. Experimental results are quite encouraging. With high probability, RADAR is able to estimate a user's location to within a few meters of higher actual location. Larger classes of location-aware services can be built over an RF local-area wireless data network. Using the synchronized timestamps, we mixed all of the traces collected during the off-line phase into a single, unified table containing tuples of the form (x,y,d,ss,snr,), where i E {1,2,3}corresponding to the three base stations. For each (x,y,d) tuple, we computed the mean, the standard deviation, and the median of the corresponding signal strength values for each of the base stations. For much of our analysis, we use the processed data set rather than the original, raw data set. To determine exact as well as closest matches we wrote routines to search through the processed data set. There is a lot of database research literature that describes efficient data structures and algorithms. The focus of the research is on the analysis and not on developing an optimal closest match implementation.

A Bluetooth controlled robot contains an RF transceiver; baseband and protocol stack and provide services allowing the connection of various devices and the exchange of different data classes. Bluetooth devices can be divided into slave and master, which are able to actively initiate and negotiate with other B1uetooth modules. They have various effective ranges in different situations. This is because of the influence of the environment, material coverage, battery's power and antenna configuration. The range is lower than the theoretical distance due to the attenuation caused by signal reflections. For different classes of device and maximum power, their specified ranges are distinct. The distances for Class 3, 2, and 1 radios are up to 1, 10, and 100 meters. Mobile devices are based on class 2 radios while class 3 radios are mostly found in industrial environments.

Another way to control the robot is by sending directions to the microcontroller with the help of Bluetooth module, then Arduino handles the motor driver which further supports the dc motors and enables the high signal at specific motor pins. The motor driver has several pins and those pins are for power supply, ground, and each dc motor has its own respective pins which when gets a high signal activates the dc motor. The distance of the robot from the obstacle is calculated by the ultrasonic sensor which gives an output on the app screen showing the distance.

2. Advantages:

- The use of both antenna and PIR technology ensures accurate calculation of position for direct line of sight.
- Calculation of position using only triangulation of the emitter is a fast process.

3. Disadvantages:

- Combining PIR and antenna data requires lots of time.
- The use of only triangulation method may produce inaccurate results.
- The scope of operation of these techniques is

4. Proposed Method:

The method we will be using to calculate the location will use triangulation. The angle between the emitter and each antenna will be found. The distance between the emitter and each antenna will be calculated using the RSSI method. This method calculates the distance between the emitter and the receiver by measuring the attenuation caused in the received signal. Based on the angle and magnitude values, the position of the tag can be found. The use of three antennas will provide high accuracy. Measurements can be made in all directions because of the uniform placement of the three antennas. Besides the triangulation method, the robot can also be controlled remotely by an operator. The robot will transmit and receive signals via. a Bluetooth module. Thus the robot can be used as an autonomous vehicle or it can be controlled.

5. CONCLUSION

After reviewing several papers, it was found that the methods for calculating the relative positions of the emitter and the reader have to be fast to accommodate for the constant motion of the reader or the emitter. The accuracy in the calculation of the position has to be high. The algorithm used should account for small errors in the data.

Thus a new method is proposed in which the robot can be autonomous or can be controlled remotely.

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