Figure 1: System Diagram

CEL Team VI - Demonstration Plan Overview

System Overview

This system performs wireless position sensing using an 802.15.4 *MiWi* network. The *MiWi* transceivers have limited range with a maximum power output of about 1 mW. Several fixed transceivers are positioned in the sensing area to receive beacon packets from a mobile transmitter. The mobile transmitter beacons eight times per second with GPS data from its on-board receiver.

Each fixed transceiver calculates the received signal strength (RSSI) of the incoming packets and forwards the RSSI information to all other fixed nodes. Connected to one fixed node is an ARM processor board. This board uses the known location of the fixed nodes, and their RSSI information to estimate the position of the mobile transmitter.

1

The Universal Transverse Mercator (UTM) system is used for this system. It allows for a localize projection of the earth's ellipsoid onto a 2D coordinate system. After following a gradient descent algorithm to estimate the transmitter position, two range and bearing calculations are performed. First, the range and bearing from the ARM board is calculated, then range and bearing (error) from the recorded GPS position is calculated. Additionally both GPS and calculated positions are displayed on the LCD, recorded to a storage device, and displayed on a dynamic webpage.

Demonstration Plan

1. Demonstrate communication and parsing of GPS data by entering receiver node calibration mode.

    (a) The User interfaces with the ARM LCD screen and follows on-screen calibration instructions.

    (b) GPS data is received over UART on the mobile node. *Verification: DVS3100 Logic Analyzer*

    (c) GPS data is then parsed and transmitted using MiWi to the receivers. *Verification: MIWI_STATUS and MIWI_TX LEDs*

    (d) ARM board queries node0 for GPS position information. *Verification: DVS3100 Logic Analyzer*

    (e) ARM board accumulates several samples of GPS position information and determines the designated node's position. *Verification: Current DMS GPS Position is displayed during calibration.*

2. Demonstrate position estimation algorithm by placing the system into run mode.

    (a) As the user moves about, GPS data is transmitted from the mobile node.

    (b) Each receiver node calculates received signal strength from the mobile node.

    (c) node1 and node2 forward their received signal strength to node0.

    (d) ARM board queries node0 for all RSSI and GPS data. *Verification: DVS3100 Logic Analyzer*

    (e) Positioning algorithm updates position estimation based on RSSI data. *Verification: Position information on LCD Display*

3. Demonstrate web interface functionality

    (a) After section 2 is complete, continue to operate system in run mode.

    (b) Establish a connection to the ARM webserver.

    (c) Recent position information will be displayed on the web page.

    (d) The web page refresh rate is once every 10 seconds.

4. Demonstrate filesystem functionality

    (a) After sections 2 and 3 are complete, shut down the ARM board.

    (b) Remove the SD card and insert into a computer.

    (c) Display the logged information on a computer.

5. Demonstration Complete.