

Community Management unit using RF sensors

This project's objective is to model an RF based community management system. The communication between different nodes is done through wireless Zigbee modules. The objective of the system is to control the humidity of an environment using the data from DHT sensors and using a motor to pump water to bring up the humidity. This system was implemented using 4 STM32F4 Discovery boards, 2 DHT sensors, 4 Xbee transceivers, a DC motor and motor driver, and a YF-S201 water flow sensor. One of the boards was approximated into a node by transmitting dummy data to the Base Station.

The algorithm for the communication between nodes and its respective cluster heads is as follows:

Each cluster head initialises data transfer by broadcasting the device ID of the particular node it requires information from. The node responds by sending the cluster head's device ID and a channel for transfer of data is established. The data transfer is then initiated with the data packet format being [Packet number, Timestamp, Temperature, Humidity]. The data from multiple nodes is then sent from the cluster head to the base station. The packet format is the concatenation of all packets from all nodes. To decrease power consumed by the system, the nodes and cluster heads are setup to wake from SLEEP mode, only during the time window of their data transfer. This is achieved using the Real Time Clock on the MCU. To avoid loss of data when the device goes to sleep, we write all data onto Flash memory.

The base stations objective is to control humidity, by controlling a motor and with a flow meter giving adequate feedback as to the amount of water that has already flowed, based on the data received from the nodes. The amount of water to be given as output is controlled using a flow meter as feedback and integrating the time of flow with the flow rate to obtain total volume of water.

This system can be scaled as per requirements by simply adding more nodes and cluster heads. The window of time for which data transfer will happen between nodes, Cluster heads and Base station will have to be appropriately scaled as well. Zigbee modules can also be exchanged with LORA WANs, WiFi, or GSM modules in order to increase the coverage of the system. The limitations of this system are:

1. Synchronisation of the different elements in this system is not automated. All the elements in the system have to be started at the same time.
2. There is no provision to obtain data from a particular node whenever we require it. The data is limited by the SLEEP cycles of the nodes in the network.