Louis Coyle

ECE300

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HW06 – Chat Program

1. The XBee has analog and digital IO pins that can be configured by setting the appropriate registers through software commands. This is detailed in Chapter 8 – XBee Analog and Digital IO Lines of the XBee manual. In order to get a voltage on XBee ‘A’ to show up on an output pin on XBee ‘B’, one could set up a pin on ‘A’ as a single-ended analog input. This is done by issuing the ATD2 command for AD2/DIO2 pin with a parameter of 2 an ‘A’, to enable the analog input. On ‘B’, DIO4 can be set as output, by issuing the ATD4 command with a parameter value of 5. After sending these commands on both ‘A’ and ‘B’, the changes must be applied by issuing an AC (apply changes) command, on each ‘A’ and ‘B’.

After configuring the necessary IO pins, one must make sure that the two XBee’s are set up so that the sending device samples all enabled IO pins and returns an IO sample to the receiving device. This is done by sending an IS AT command from the **receiving** device to the sampling device. Doing so will cause the current states of the enabled IO pins on the sampling device to be sent to the receiving device, which sent the IS command. However, this will only sample the pins once. In order to set up periodic sampling, the **sending** device must send an IR command with the sample rate in milliseconds as a parameter. The DH and DL commands are used to determine the destination address that will receive the samples.

1. Getting this to work is an extension of the above. One will need to set up four analog IO lines for reading the analog values from the IR sensors, a PWM digital IO line for sending the steering information, and a digital IO line for sending the motor control information (I will assume we are using a car, not a truck and will not need to PWM the motor control as well). Before discussing how the XBee’s should be set up to sample and send the states of their pins, they first need to be set up to allow this to happen.

To begin, the XBee’s must be paired to each other, by setting the DH and DL commands with the address of the microcontroller XBee on the car XBee and vice versa. Next, the pins that will be used as outputs and inputs on each XBee must be configured. On the car XBee, four analog IO pins must be configured as inputs. This is done as described above, by sending the ATD command corresponding to the desired analog pins (0,1,2,3) with a parameter of 2 (for analog input). The microcontroller XBee will therefore require four digital pins to read these analog values that will be sent in a UART data frame, this is done by sending the ATD command as described, with parameter 4.

On the microcontroller XBee, two digital IO lines must be configured as monitored digital inputs, done by using the ATD command for the pins with parameter 3, for the steering and motor control. Correspondingly, the car XBee must have two digital IO lines set as digital outputs, default low, done by using the ATD command with parameter 4.

It makes sense that the analog values from the IR sensors would be sent periodically, by issuing an IR command from the XBee on the car to the XBee connected to the microcontroller. Note, however, that both the XBee’s must be running API firmware in order to send and receive IO data samples via UART. The microcontroller will interrupt on a UART receive, so the rate at which the lines are sampled should be slow enough so that the microcontroller is able to run the rest of the AI code efficiently.

The PWM digital IO line for steering and the normal digital IO line for motor control should both be sent from the XBee connected to the microcontroller to the XBee on the car. These should be set up in the detection sampling mode, by sending the IC command to the XBee on the microcontroller. The IC command takes as parameter a mask for the IO lines to have their state changes transmitted. This will allow a PWM signal to get to the steering control on the car, as the state of the pins on the car will be sent as soon as they change. It will also allow the motor control signal to be sent immediately with no overhead.