

Homework 5

1. Design the means of communication for the fish tank control system (designed in HW3)

Describe each instance of communication. Include both communication out from the controller and into the controller. Explain the purpose of each.

- *Temperature communication:* The controller receives a desired temperature from the user and sends it to the heating/cooling system. While checking from the idle state read temperature from the sensor to determine if a signal should be sent. Output current temperature to the controller. This keeps the water at the desired temperature (within limits predetermined by manufacturer).
- *“Cleanliness” Communication:* Similar to temp. communication, constantly read water chemical balance and output it to the controller. If water needs cleaning, display it on the controller. This keeps the user informed when the tank needs cleaning or water needs changing. Send a signal to the automated cleaning system when needed. The system outputs to the controller when complete or displays an error.
- *Clock Communication:* Clock communicates to the controller to read and display times. Clock has a local time and scheduled times for feeding and lights read in as input. Signals are sent to the feeding and light systems for turning off and on. This allows the system to be automated for
- *Signals for feeding/lights:* read signals from the clock and output to the controller for successful feeds/lightswitches, or display an error.

Describe any “parameters” which will be passed:

- *Temperature System:* current temperature and desired temperature is needed bidirectionally between the Controller and the subsystem.
- *Cleaning System:* Current water level, chemical content (PPM of desired chemicals in water) need to be passed bidirectionally between cleaning system and controller.
- *Clock:* The current time needs to be sent to the feeding and lights systems as well as the controller.
- *Controller (to subsystem):* sends desired temp. And scheduled times to the feeding and lighting to each subsystem. Also sends current status (OK or error) to the main display.

2. Define each instance as the command of your control system's "language" using binary only. Minimize the length of each command. Be sure there is no ambiguity (commands must be unique). Include error messages/codes where necessary:

All systems can communicate using 19 bits total:

Time: 6 bits for hour, 7 bits for minute, 6 bits for signal type

Temperature (68-86F): 13 bits for temperature with padding, 6 bits signal type

Cleaning system: 2 bits for cleaning, idle, or error, 11 bits for chemical content, 6 bits signal type

Status Signal: 7 bits for error type, 6 bits ACK or NACK to subsystem, 6 bits signal type

Example:

Controller:

Temp Ctrl. Error	Cleaning Error	Change Water	Add more food	Display Error	Controller Malfunction	NACK from Feeder	NACK from thermostat	NACK from Lighting	OPTIONAL or PADDING	To Display	ACK/NACK (or request)	error	Cleaning system	Temperature	Time
18										5					0

From controller, zero denotes subsystem stays idle, 1 is a signal to system. For instance, 1 in field zero to the feeding system signals to feed. The feeding system sends an ACK back along with a time bit to denote cleaning completed. An ACK Request may be sent from the controller to request another ACK from the subsystem in case an error occurred. Periodic ACK requests are also useful to check if a subsystem works properly or to check things like cleanliness, temperature, or status of a current system like the lighting system. PADDING bits can be used for extra information, for instance a temperature increase signal could be a single 1 being sent, a 10 could be temperature down, and a 00 could be to set a system to idle. This gives us options to update the system later to give definitive errors on user feedback or after testing to change errors to common errors and allow for updates.

For the temperature System, two packets will be sent, the first being the desired temperature, the second being the current temp. The second packet is for feedback.

For the lighting and cleaning system, bits 17 and 18 denote the light's/cleaner's status:

00 - idle

01 - cleaning/lit

10 - change filter/off

11 - system broken

The above bits are put into the OPTIONAL section from the controller to display.

The system can also controller crashes by specifying 11111 in the optional field to the display.