A Weather Station Example

- Display the current wind speed at 150 ms intervals.
- Display maximum wind speed at 150 ms intervals.
- Use a button to determine which to display.
- Indicate maximum wind speed display with light.
- Have a button to reset the maximum wind speed.
- Display the wind direction (8 dirs) every 110 ms.
- Flash a light every 30 ms to show system health.
- If wind speed is zero, show the zero wind speed light.
Diagram of Weather Station System

- Wind Vane
- PORT E
- 68HC11
- PORT D
- PORT C
- STAF
- 8 Seg
- 8 Seg
- One-shot
- Anemometer
- Switch
- Display Highest Wind Speed
- Highest Wind Speed
- Wind Vane
- PORT B
- N
- NW
- NE
- W
- E
- SW
- S
- SE
- No Wind Light
- Reset Highest Wind Speed
- Switch
- Flashing Light
- One-shot
- Display Highest Wind Speed
- Highest Wind Speed
- Wind Vane
# System Software Design

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Task Control Blocks

The basic unit of information for each task.

1. Task ID
2. Task State - running, ready, suspended
3. Time to Run - Clock time to run task again
4. Stack Pointer
5. Stack Space
6. Initial Context
System Initialization

1. Initialize output ports
2. Initialize task control blocks
3. Initialize condition code register
4. Initialize stack pointer to point to TCB
5. Initialize task "local" variables
System Service Routines

1. Create a service control block (SCB).
   - One byte function value
   - Parameters for the function
Put the address of the SCB in the X register.
Execute an SWI.
SWI Service Routine

1. Save the current task (RUNNING contains TCB Address)
2. Get function number from SCB pointed to by X.
3. Execute the desired function by doing a table jump.
IRQ Service Routine

The anenometer has rotated.

1. Clear interrupt flag (STAF).
2. Set Task0 to the ready state.
3. Save current task.
4. Run the dispatcher.
5. RTI causes dispatched task to run.
Dispatcher

Runs when an interrupt occurs or when called directly.

1. Loop through the task list
   (a) If not ready, skip.
   (b) If blocked, skip.
2. Set RUNNING to be the highest priority runnable task TCB.
Suspend Task Service

A task is suspending itself.

1. Set state to not runnable.
2. Call the dispatcher to schedule next task.
Task 0 - Wind Speed

1. Schedule Task 5 to run in 2560 ms.
2. Turn off the no wind light.
3. Calculate the rotation rate.
4. Reset the maximum wind speed if appropriate.
5. Suspends itself.
Task 5 - Zero Wind Speed

1. Start Task 3 without suspending self.
2. On return, turn on no-wind light.
3. Turn off interrupts.
4. Suspend self.
5. Turn on interrupts.
Task 1 - Wind Direction

1. If wind speed zero, blank wind dir light, go to resched.
2. Read voltage and calculate direction.
3. Run Task 3.
4. Reschedule for 110 milliseconds (delay with suspend).