The Wind Turbine Model

Overview

The Wind Turbine model (WTm) allows you to explore the operate of a small wind turbine. Features of the WTm are:

- 3" propeller
- 180 degrees of directional rotation
- 2 magnets for position on the rotor (1 for sensing, 1 for balance)
- 1 magnet for home position
- 2 hall sensors for reading the blade speed and position magnets
- 4-phase stepper motor and driver
- Adruino ATMega 328 based processor with USB serial-power connector
- Pre-installed Arduino sketch with API commands for monitoring and control

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Connecting the Wind Turbine model

The Wind Turbine model can be connected directly to your computer's USB connector through a standard USB C connector. Simply plug in a USB cable to your computer and then the USB C connector into the WTm model.

Upon connecting the WTm to your computer, the wind turbine will be ready to command.

Monitoring and Controlling the Wind Turbine model

The WTm has a set of pre-programmed commands for you to interface with it. When these commands are issued to the WTm, it will carry out the requested action. If you issue a command to the WTm that it does not recognize, that command will be ignored.

There are several ways to send commands and receive responses to the WTm. One way is to address it through a serial terminal like those found in the Arduino IDE or in apps. Other ways to control the model is through programming languages like LabVIEW, Matlab, Python, C, or anything that can send and receive serial strings through a USB serial port.

The first two commands that the WTm recognizes are:

*ID? and *getCommands*

The **ID?** function. Sending the *ID? string to the WTm will prompt it to respond with its identification string. The WTm responds with the string "windturbine".

The **getCommands** function. Sending the **getCommands** string to the WTm will prompt it to respond with a list of the commands that it understands. Below is the list of functions and their meanings that the WTm will return when it receives **getCommands**

Overview of Wind Turbine model Commands

Command	Description	Number of parameters sent or returned
Init	This moves the wind turbine to home and then to the front facing position	
setLoad	Sets the KW load assigned to the wind turbine	1 sent
runScan	Initiates a 320 degree scan and determines the maximum light level and positions the panel at that angle	
trackOn	Initiates a tracking routine to seek and follow the brightest light source	
trackOff	Exits the tracking function	
getIAll	This returns seven numbers from the wind turbine. These are: wind turbine kilowatt capacity, the current KW level being generated, the load allocated to the wind turbine, the difference between what's being generated and the load assigned to it, the type of energy (1=renewable, 0=non-renewable, and -1 meaning neither like a house load, and line voltage	7 returned
goHome	Returns the panel to the home position	
goMax	Rotates the panel to the last know maximum light position	
goL	Rotates the panel to the left position	
goF	Rotates the panel to the front position	
goR	Rotates the panel to the right position	
moveCW	This will rotate the panel clockwise a given number of steps. The "1" signifies that it requires one number after the moveCW command is issued. To run this command, type moveCW then a CR/LF and then a single number afterwards with another CR/LF	1 sent
moveCCW	This will rotate the panel counter-clockwise a given number of steps. The "1" signifies that it requires one number after the moveCCW command is issued. To run this command, type moveCCW then a CR/LF and then a single number afterwards with another CR/LF	1 sent
lookCW	This will rotate the panel clockwise and if the light level is greater, the panel will remain there, else the panel will return to its original position	
lookCCW	This will rotate the panel ccounter-lockwise and if the light level is greater, the panel will remain there, else the panel will return to its original position	
getVal	This returns the current voltage value being generated by the wind turbine	1 returned

getKW	This returns the current kilowatt value being returned by the wind turbine.	1 returned
getCarbon	This returns 0, the level of carbon emissions from the wind turbine	1 returned
setRange	Sets the distance the turbine stand rotates when looking for max wind speed	1 sent
getMax	This returns the position of the maximum light level.	1 returned
setDwel	Sets time turbine waits or dwells for the determining wind speed when looking for max	1 sent
getPos	Returns the current position of the wind turbine	1 returned
setSteps	Sets the number of steps the lookCW and look CCW use to determine how far ahead to look	1 sent
on	Enables the wind turbine to send its current power values	
off	Sets current power value to 0	
eoc	Indicates end of command list	