Smart Irrigation System: Final Challenge- Smart Watering System	**Goals:**
In this activity, you will use a Digital Temperature and Humidity (DHT), moisture sensor, light sensor, MOSFET for power control, and a water pump to create your own smart watering system.	1. Use the read command to read temperature. 2. Use the read command to read humidity. 3. Use the read command to read light levels. 4. Use the set command to turn on the pump. 5. Use a While loop to repeat code. 6. Use an If-Then statements to make decisions

Background:

Recall the scenario introduced in the first challenge:

> *Humans invented agriculture over 6000 years ago as a way to produce more food than could be hunted and gathered from the environment. This increase in food availability produced a rapid increase in population that was totally dependent on agriculture for survival. Today, the world's large population requires sophisticated large-scale agriculture to keep everyone fed. Climate changes can have severe consequences on the food production required to keep the large human populations fed. Natural and man-made ecological disasters, such as the Dust Bowl of the 1930's, can have severe consequences on the dependent populations. A more recent example, told in April 2016 The Guardian article*, describes the devastating effects on the local population of a severe drought in Zimbabwe. Science and technology can help to optimize food production and mitigate the effects of climate change and poor farming practices.*

In this final challenge, you will be assimilating the skills you have learned, and will write a program to control your own smart watering system. Not only will you use sensors to monitor light, moisture, humidity and temperature; you'll use these values to control a water pump to water only when necessary. Your smart watering system will help ensure your crops grow and conserve water use.

Planning

Recall the previous challenges in this unit.

1.) What were some ideal light level readings? Why did you choose these levels?

2.) What soil moisture levels indicated the soil needed more water?

3.) What humidity levels were ideal for watering?

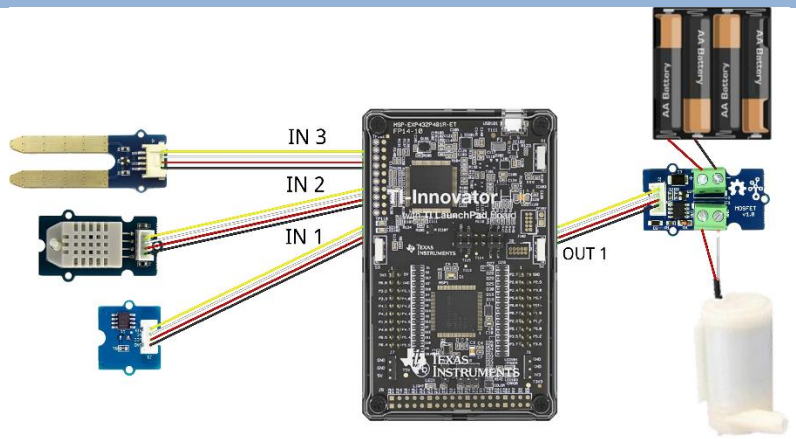
Command	Example	Behavior
CONNECT <type> <number> TO <port>	Send “CONNECT LIGHTLEVEL 1 TO IN1”	Associates the first LIGHTLEVEL object with a light sensor plugged into port IN1 on the Hub.
SET <type> <number> TO <value>	Send “SET ANALOG.OUT 1 TO 128”	Turns on an analog.out1 object, such as a pump, to a power setting of 128
RANGE <type> <number> <min value> <max value>	Send “RANGE LIGHTLEVEL 1 0 100”	Scales the measured values read from LIGHTLEVEL 1 to return in the range 0 to 100.
READ <type> <number>	Send “READ MOISTURE 1”	Reads one measurement from the first moisture sensor.
Get <variable>	Get m	Stores the moisture measurement into the variable named m. *Note a get command must immediately follow a read command. The value stored will contain the measurement from the immediately preceding READ command.”
DispAt <line #> , <”text”> , <variable name>	DispAt 3, “Moisture level = ”, m	When variable m has a value of 26, “Moisture level = 26” is displayed on line 3 of the calculator.
For index variable , start, stop <statements> EndFor	For n , 1, 3 Send “READ DHT 1 TEMPERATURE” Get t Wait 2 EndFor	Read and store the temperature as t 3 times. Wait 2 seconds between each reading

If <Boolean expression 1> Then
<statements 1>
ElseIf <Boolean expression 2> Then
<statements 2>
Else
<statements 3>
EndIf
	If t >=40 Then
	DispAt 3,”It is Hot”
	ElseIf t >=25 and t < 40 Then
	DispAt 3,”It is Warm”
	Else
	DispAt 3,”It is Cool”
	EndIf
		The example decision tree has two mutually exclusive Boolean expressions and two corresponding execution statements. It also has an Else condition that executes corresponding statements when neither of the first two conditions are true. This final Else condition ensures that a set of statements will always be executed. When this decision tree executes, focus proceeds from top-down. If the first Boolean expression is true, the corresponding statements are executed and the decision tree is immediately exited. In the example, if t=30 then the first expression is false and the <statements 1> are skipped, the second expression is true and <statements 2> are executed and the tree is exited. Additional ElseIf statements may be inserted if needed.

The DHT sensor requires a few seconds to "warm up" and begin communicating with the Hub. During this period, the temperature is reported to be absolute zero (-273 **°C)**.	Send "CONNECT DHT 1 TO IN 2 "
	temperature:=−273
	DispAt 3,"DHT is Warming up!"
	While temperature<−270
	Send "READ DHT 1 TEMPERATURE"
	  Get temperature
	  Wait 2
	EndWhile
	DispAt 3,"DHT is now ready"
		The program uses a While loop to continuously read the DHT every two seconds until it reports a value greater than absolute zero. You will need to include this code in your project.

Challenge:

Write a program that continuously monitors light level, soil moisture, temperature, and humidity and display the current value on the display. Use your knowledge of ecology, biology, and Earth science to determine what the best conditions are to water your garden. When the condition is correct, set the pump to deliver water at a rate that is best for your garden.



Test your system with different conditions. Record the values of each sensor as well as the result.

Light Level	Soil Moisture	Temperature	Humidity	Did the pump run? Should it have run? Explain.