



***Intelligent Computing Circuits and Systems***  
**NATURE Sunday Academy 2017-2018**

**Project Description:**

*In this lesson, we will design an intelligent weather station which can show real-time temperature and humidity, as well as display. Over the course of this lesson, students will be introduced the embedded system platform and its working principle, work on the embedded programming, and learn important techniques to gather, process, and display sensor data.*

**Project Objectives:**

*By creating a simple Weather Station with Raspberry Pi, students will learn:*

- 1. Embedded system platform and principal*
- 2. Basic embedded programming*
- 3. Sensor data collection*
- 4. Design loops to continuously detect inputs from multiple sensors*
- 5. Process data received from sensors into a meaningful form*
- 6. Display the results in real time*

**Session Organization:**

<i>11:00-11:30</i>	<i>Cultural connection/brief introduction</i>
<i>11:30-12:00</i>	<i>Activity I</i>
<i>12:00-12:45</i>	<i>Lunch</i>
<i>1:00-1:30</i>	<i>Activity II</i>
<i>1:30-2:00</i>	<i>Activity III</i>
<i>2:00-2:30</i>	<i>Activity IV</i>
<i>2:30-3:00</i>	<i>Wrap up</i>

**ND State Science Standards:**

*9-10.6.1. Use appropriate technologies and techniques to solve a problem (e.g., computer-assisted tools, Internet, research skills)*

*9-10.6.2. Explain how scientific principles have been used to create common technologies (e.g., household appliances, automotive parts, agricultural equipment, textiles, fabrics, computers, Internet resources, CD-ROMs)*

*11-12.6.1 Select and use appropriate technologies, tools, and techniques to solve a problem (e.g., computer-assisted tools, Internet, research skills, CBL, graphing calculators)*

*11-12.6.2 Identify examples of how new technologies advance science*

### **Materials and Equipment:**

- *Hardware boards required for each group (<=3 students in each group):*
  - *Raspberry Pi 3*
  - *Raspberry Pi Sense HAT*
- *Programming*
  - *One computer for each group to program*
- *Testing*
  - *Commercial temperature and humidity sensor*
  - *Fan*
  - *Ice water*

### **Introduction:**

*The Sense HAT temperature sensors can measure temperatures from as low as -40 degrees Celsius up to +120 degrees Celsius*

#### *Temperature sensor:*

- *Discuss the principle of temperature sensor*
- *Provided code to get in the input from temperature sensor*
- *Explain how it works*
- *Run the provided code and check the results*

### **Hands-On Activity I:**

- *The temperature in the provided code is in Celsius. The students need to program and convert it into Fahrenheit*
- *Check the results and test*

### **Hands-On Activity II:**

- *Based on Activity 1, try to use a while loop to monitor the temperature in real time.*
- *Introduce loop programming techniques: while, do-while, for*

### **Activity III:**

- *Based on Activity 2, the students will use LED array to display the temperature.*
- *Principle of LED*
- *Test the results*

### **Activity IV:**

- *Based on Activities 2 and 3, the students will design the program to monitor the temperature.*
- *Will introduce the principle of humidity sensor first*
- *Then the students will work on the programming and run the code*

- *Test the results*

**Wrap-Up & Discussion:**

1. *How were the concepts of STEM used in today's activity?*
2. *The students are interested in this topic or not?*
3. *What was the most successful idea you used in the activity?*
4. *What did you try in the activity that did not work?*
5. *Why do think it did not work?*
6. *Experiences and lessons learned today?*