

User Study on Wireless Sensor Network Programming Languages

Welcome

This user study aims to evaluate programming languages for wireless sensor network applications. It will help us design high-level programming languages for people with little programming experience. The study will take two hours and we will pay you \$20 for your time. You can quit the study any time you want, but you will only be paid if you complete it. During the study, you will be asked to learn one programming language and implement two applications using the language. We will also ask you to provide your background information and give us suggestions on the language. Your work will be monitored to let us identify problems with the language. These data will be shared with those outside our research team only in anonymous form. Please sign below if you are willing to participate.

Signature:

Date:

Background information

1. Your name:
2. Your age:
3. Your sex:
4. Your occupation:
 - Undergraduate student
 - Graduate student
 - Faculty
 - Staff
 - Other (Please specify):
5. Your field of work or study:
6. Do you have any programming experience? Yes No
7. (If answered "Yes" to Question 6) Approximately how many lines of code were in the largest program you have written?
8. (If answered "Yes" to Question 6) What programming languages have you used and in what context did you use them? For example, did you use it for a class you or at a job?

9. How much do you know about wireless sensor networks?

- Never heard of them.
- Read about them but never used them.
- Used them for some applications but I did not program them.
- I have experience with programming and deploying wireless sensor networks.

Wireless Sensor Network

A **wireless sensor network** is a wireless network consisting of spatially distributed autonomous devices. An individual device, also called a **sensor node**, a **node**, or a **mote**, consists of sensing, processing, and communicating components. Sensor nodes are low-cost, low-power, small in size, and are usually powered by batteries. Nodes can communicate with each other, and implement cooperative tasks. Each node has a unique identifier: **nodeid**, which is determined when it is programmed. **Nodeid** used in a network usually starts from zero. For example, in this study, you will simulate a network composed of four nodes with nodeids 0, 1, 2, and 3. A wireless sensor network is usually rooted at a **base station**. The **base station** is a special component of the wireless sensor network with much more computational, energy, and communication resources than most nodes. It acts as a gateway between sensor nodes and the end user. The sensor network is connected to the base station via the **root node**. The root node is the sensor node with nodeid 0. It communicates with the base station via its universal asynchronous receiver/transmitter (UART), a hardware device for communication. The **root node** and other nodes communicate with each other over radio.

User Study Procedure

The following instructions will lead you through the user study step by step.

- Step 1. Please read the manual of the programming language and get familiar with the programming environment. If there is anything that is not clear to you, you can ask for clarification. You will be given 30 minutes.
- Step 2. After 30 minutes, the instructor will provide a description of the first task. You can use what you learned in Step 1 to implement it. If you have any questions about the tasks, you can ask the instructor to make sure you understand the requirements before you start. Note that the instructor won't answer questions related to the task implementation. You have 40 minutes to work on this application. Please notify the instructor if you are confident you get a correct solution. After that, you can continue verifying the correctness of your program. If you detect an error, you can notify the instructor at any time and resubmit your solution. After 40 minutes, you have to stop working on this task.
- Step 3. The instructor will provide the second task. Please follow the instructions in Step 2.
- Step 4. Please fill in a form to give feedbacks on the user study.

Questionnaire

- On a scale from 1 to 7, with 1 meaning strongly disagree, 7 meaning strongly agree, and 4 meaning neutral, please indicate how well the following statement describe your experience.

1. The language manual is easy to understand.

1 2 3 4 5 6 7

2. I understand this programming language.

1 2 3 4 5 6 7

3. The descriptions of the tasks are clear.

1 2 3 4 5 6 7

4. The programming language is easy to learn and use.

1 2 3 4 5 6 7

5. The programming environment is friendly.

1 2 3 4 5 6 7

- On a scale from 1 to 7, with 1 meaning extremely easy, 7 meaning extremely difficult, and 4 meaning neutral, please rank the given tasks.

1. Task 1.

1 2 3 4 5 6 7

2. Task 2.

1 2 3 4 5 6 7

- On a scale from 1 to 7, with 1 meaning lowest, 7 meaning highest, and 4 meaning neutral, please indicate your confidence level for the correctness of your solution to each task.

1. Task 1.

1 2 3 4 5 6 7

2. Task 2.

1 2 3 4 5 6 7

- If you have specific comments on how to improve the manual or the language, please let us know. You can either write them down or talk with the instructor. Please use the back of the page if you need more space.