Exercise 5: Speed Of Light

The LiFi-project

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OVERVIEW

In the fifth exercise of the LiFi project you'll take a big step towards building the LiFi prototype. We'll send and receive our first byte.

Here are the relevant lessons of the online script. Make sure you study them carefully in order to solve this exercise:

- Measuring Information
- The OLED Display
- Very Light Messages

Good Luck!

YOUR TASK

To pass this exercise, you must complete the following task and submit your results via ILIAS. You find the details on the form of submission below.

Speedy Bytes

In this exercise, you will write a program that sends a byte over LiFi using the LED and receives it with the color sensor. This is part of the larger goal of enabling robots to exchange information using LiFi. Your program should be able to send one byte, consisting of eight bits, using the three-color protocol we introduced in the lesson Very Light Messages.

Here are the steps your program should perform:

1. Ask the user for a decimal number between 0 and 255.
2. Convert the decimal number into its binary representation.

3. Send the resulting byte using the LED and the three-color protocol.
4. Use the color sensor to receive and decode the signal and store the received sequence of eight bits as a string.
5. Convert the received byte into a decimal number.
6. Check whether the received decimal number matches the user's input. If it does not, fix any issues.
7. Measure the time it takes your program to send and receive the byte. Try to optimize your program for speed while ensuring that the same number is received as was sent.
8. Print each received bit to the OLED display once it is received and recognized.

SUBMISSION

For this exercise, please submit:

- `speedy_bytes.py`

Submit the file via the corresponding exercise in ILIAS.

MORE QUESTIONS TO PRACTICE

Try to answer the following questions to practice your understanding of the topics around the LiFi-project. The questions are optional and not part of the submission.

- Please provide the amount of information in bits that needs to be transmitted for the following messages. Explain how you arrived at your answer for each:
  - A German license plate
  - A hand of "Doppelkopf" (a German card game)
  - The lottery numbers (6 out of 49)
  - A 10-digit phone number, such as: 555-123-4567
  - An 8-character password that includes only uppercase letters, lowercase letters, and numbers
  - An IP address like 192.168.0.1