CubeSat Communication Simulation
User Manual

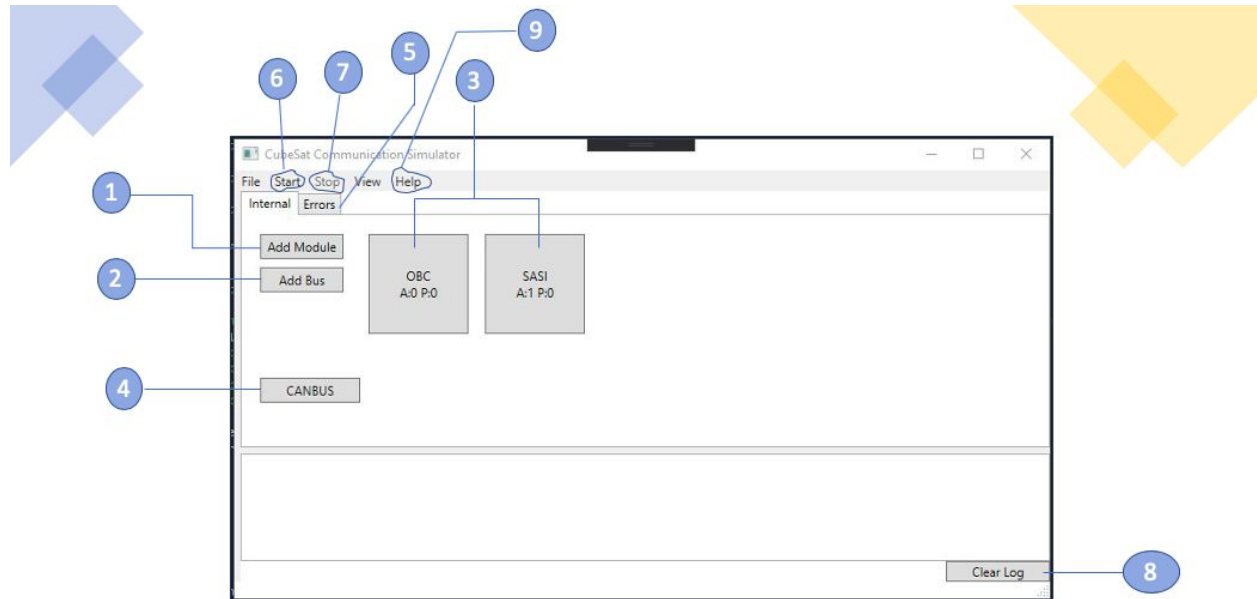A guide on how to use the CubeSat Communication Simulation Application.

By:
Harsvardhinee Chady
Maurice Lavoie
Thomas McGregor
Alexander Rostant
David Thomson

Contents

i. How to use the the CubeSat Communication Simulator

Steps:

1. Add Module
   To add a module, click on the "Add Module". The Add Module window, similar to
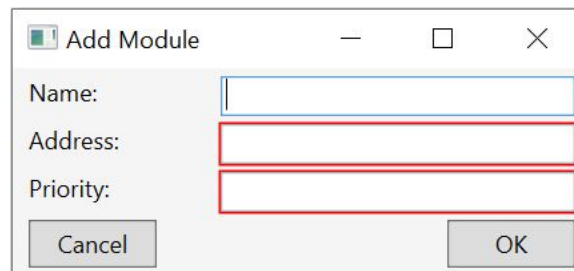   Figure
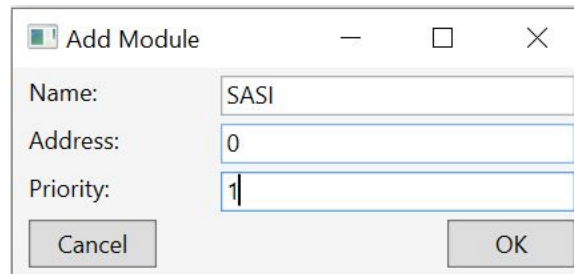   1.0, will pop up.

Figure 1.0

Fill the name, address and priority of the new module, as shown in example Figure 1.1.

Figure 1.1

When you click on "OK", the new module will be added to the simulator, as shown in Figure 1.2.
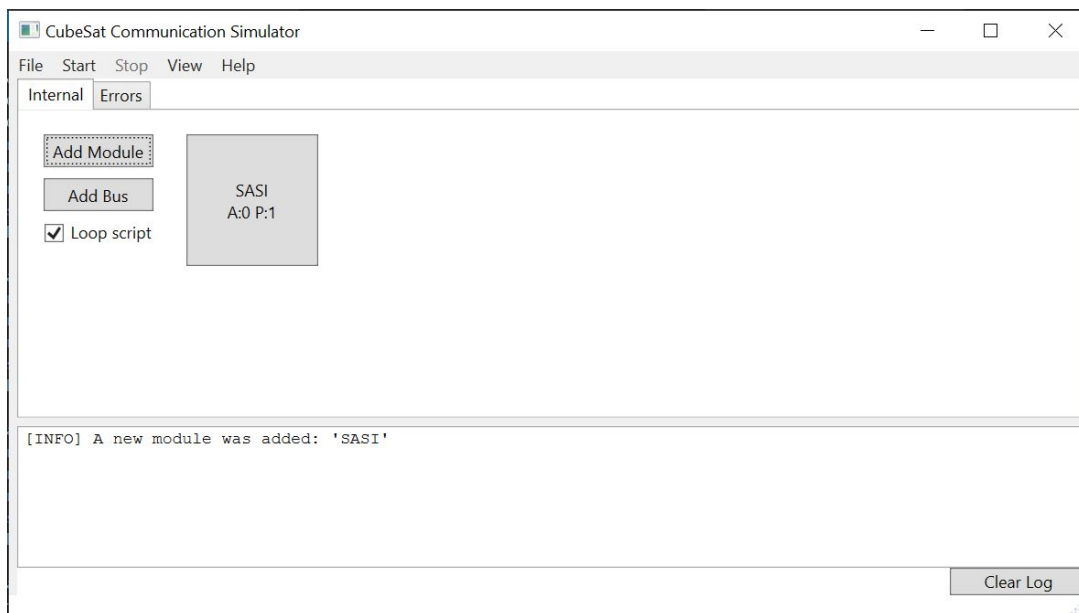

Figure 1.2

2. Add Bus

To add a module, click on the "Add Module". The Add Module window, similar to Figure 2.0, will pop up.

Figure 2.0

Fill the name and data rate of the new bus, as shown in example Figure 2.1.
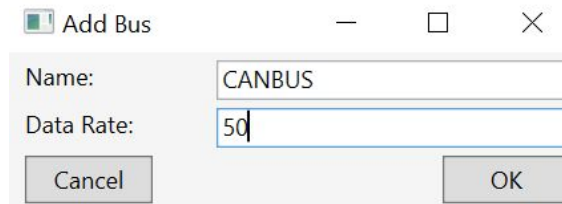

Figure 2.1

When you click on "OK", the new bus will be added to the simulator, as shown in Figure 2.2.

Figure 2.2

3. Edit Module
    Click on the module to be edited. The Edit Module window, similar to example Figure 3.0, will pop up. Do the necessary changes, for example, edit name, edit priority, edit the address. Edit module also allows us to connect the module to busses. To do so, assert the checkbox besides the chosen busses. To disconnect, de-assert the checkbox.
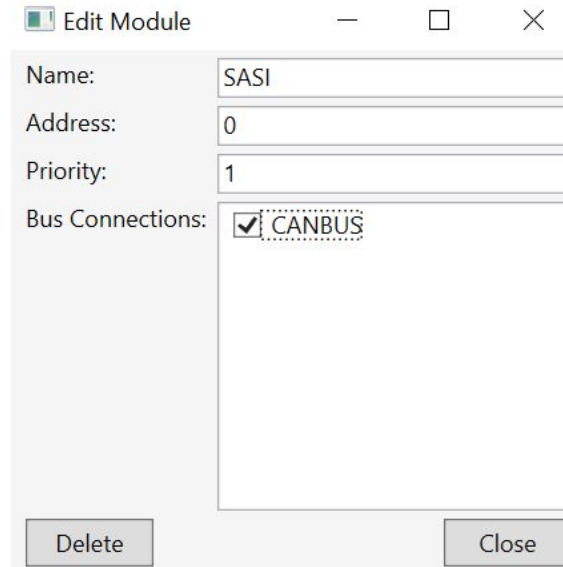
Figure 3.0

Click on "Close" and the editions will be applied to the simulator as shown in example Figure 3.1.
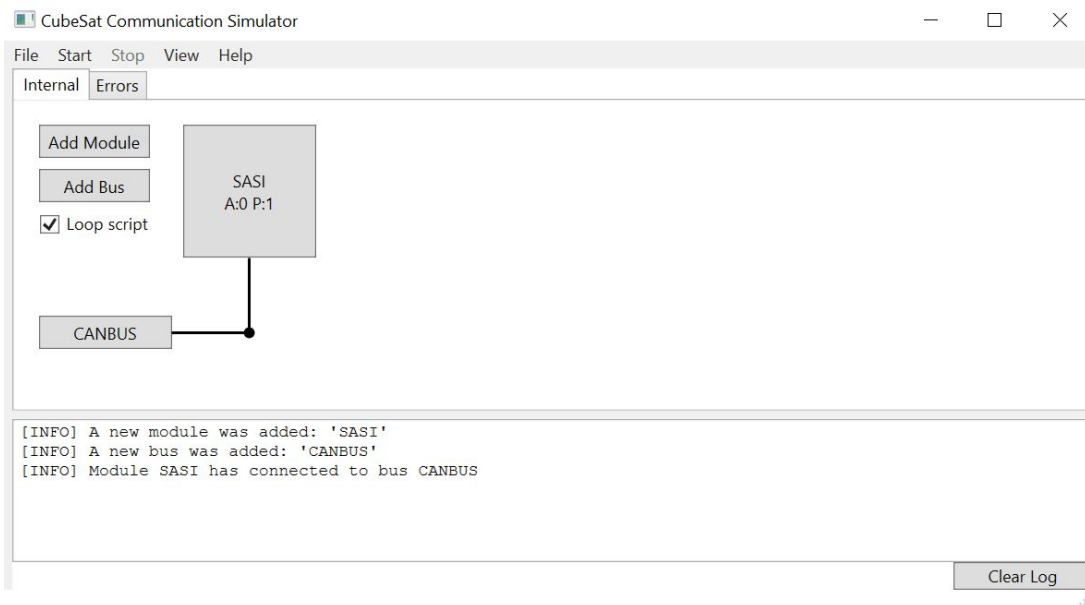
Figure 3.1

4. Edit Bus

   In order to edit a bus, click on the bus you would like to edit. The Edit Bus window, as shown in example Figure 4.0, will pop up. Do the necessary changes, for example, edit name, edit Data Rate. Click on "Close" and the changes will be applied to the simulator.
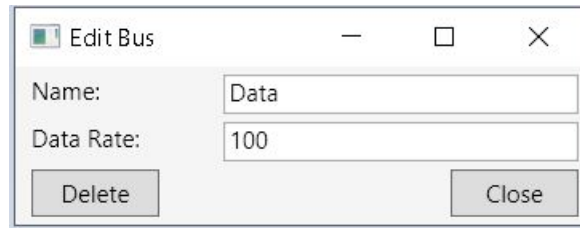
Figure 4.0

5. Errors

   To check how the module(s) is/are affected by errors. Click on the Errors tab. Assert the checkbox besides selected module(s).
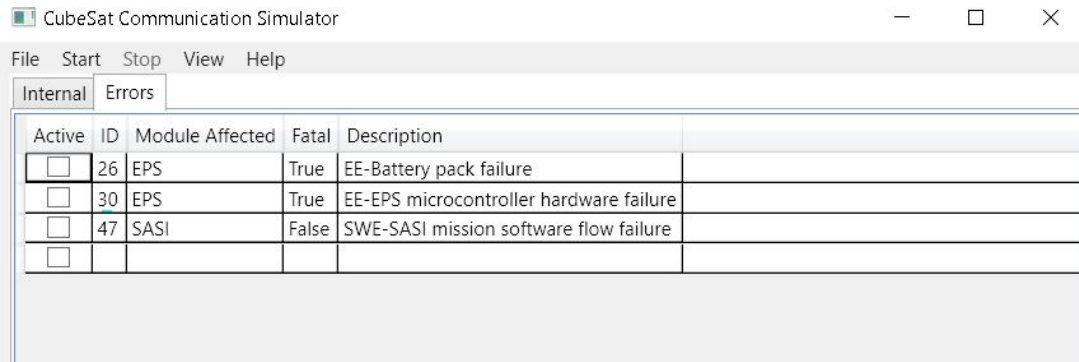
Figure 5.0

6. Start

   To start the simulation, click on "Start". Select the .csv testscript file required in the pop-up window. Figure 6.1 is an example of the opened .csv file.
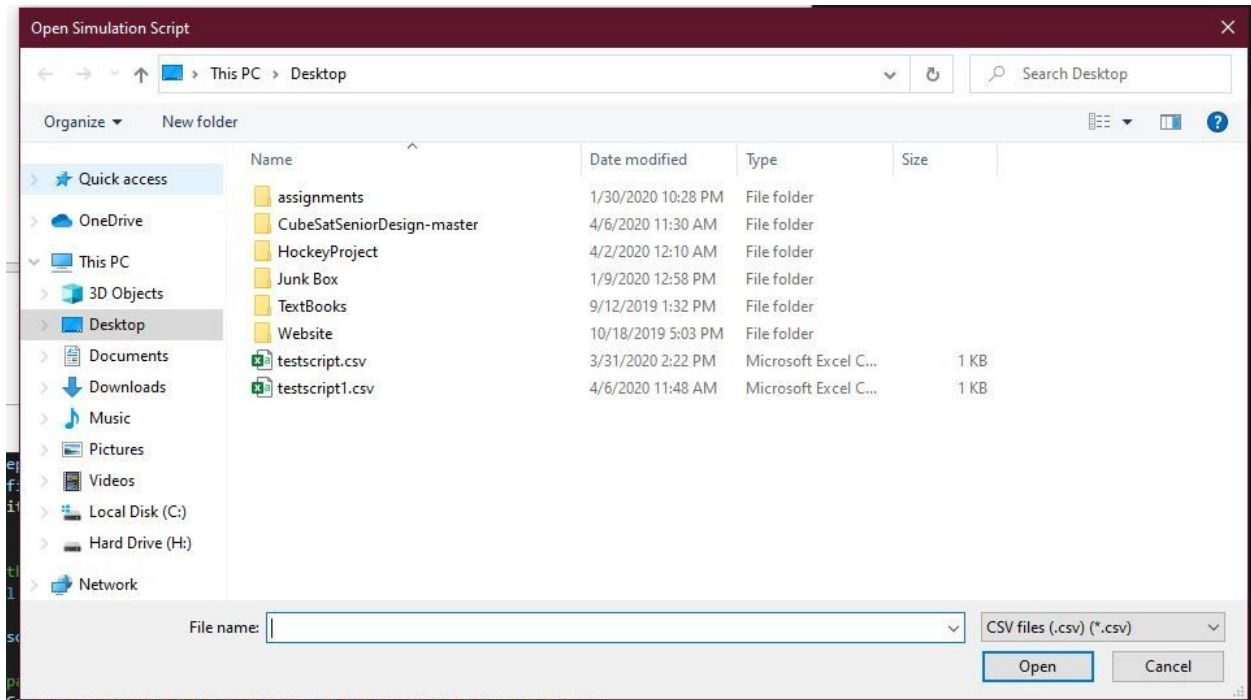
Figure 6.0

Figure 6.1

Click on "Open". The simulation will start as shown in example Figure 6.2.
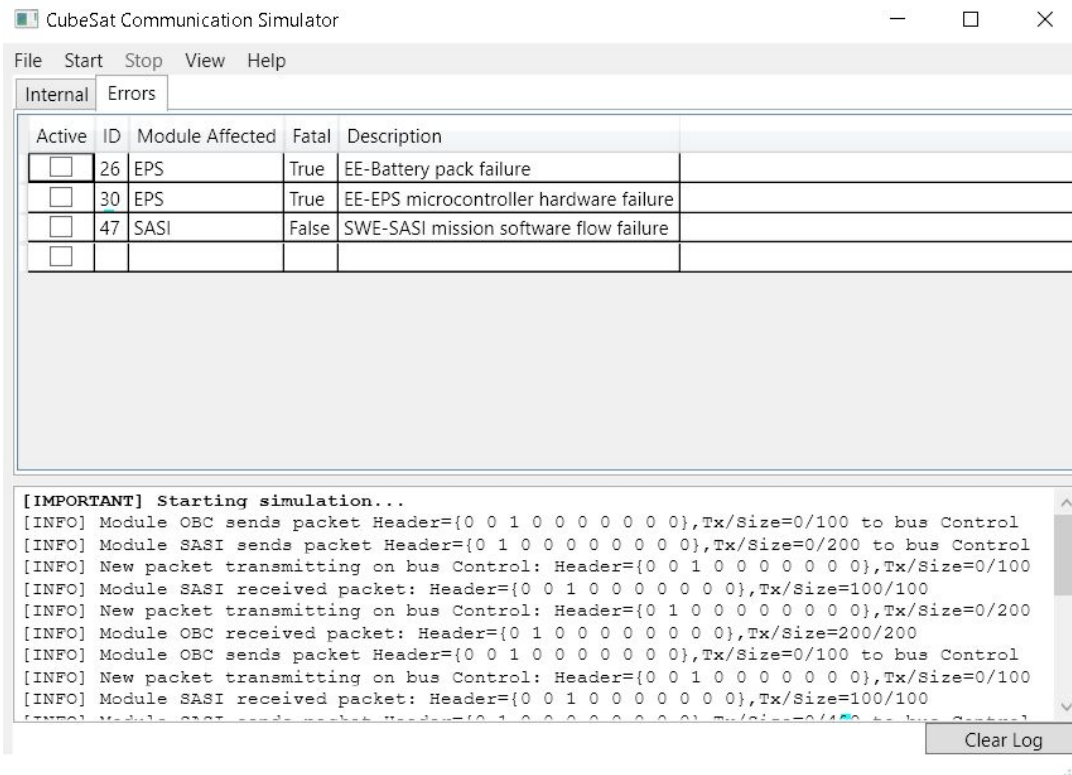
Figure 6.2

7. Click on "Stop" in the menu bar to stop the simulation.
8. Click on "Clear Log" to clear the log.
9. Click on "Help" in the menu bar to view the user manual.

ii. Scripting Reference

CSV Script: A comma separated values document that contains the planned transactions of data between the modules using the buses of the application configuration. Column A shows the simulation step that the transaction occurs, column B shows the module activating the transaction, column C shows what kind of transaction it is (currently just send), column D is the address of the other end of the transaction, column E is the bus used, and column F is the transaction data size.

To create a script, ensure that each module and bus is a module or bus in your application configuration so that there are no errors when you run a simulation.

	A	B	C	D	E	F	G
1	2	OBC	SEND	1	CANBUS	100	
2	2	SASI	SEND	0	CANBUS	200	
3	6	OBC	SEND	1	CANBUS	100	
4	7	SASI	SEND	0	CANBUS	400	
5	11	OBC	SEND	1	CANBUS	100	
6	11	SASI	SEND	0	CANBUS	100	
7	14	OBC	SEND	2	CANBUS	200	
8							

iii. Error Reference

Errors: included in an xml document called ErrorInfo.xml found in the data folder of the application. To add more, copy and paste the format bellow and fill it out.

```xml
- <Error>
    <id>51</id>
    <description>Radiation or interference flips random bits in the destination address</description>
    <moduleAffected>OBC</moduleAffected>
    <behaviour>7</behaviour>
  </Error>
- <Error>
    <id>52</id>
    <description>Radiation or interference flips random bits in the source adddress</description>
    <moduleAffected>OBC</moduleAffected>
    <behaviour>8</behaviour>
  </Error>
- <Error>
    <id>53</id>
    <description>Radiation or interference flips random bits in the destination port</description>
```

```xml
<Error>
    <id>XXX</id>
    <description>XXXXX</description>
    <moduleAffected>XXX</moduleAffected>
    <behaviour>XXX</behaviour>
</Error>
```

Ensure that id is an integer, description is a string, module affected a true or false Boolean value, and behaviour an string of the possible behaviours. Just copy and paste it under any error before the </ErrorInfo> end tag.

Possible Behaviours:

RETRY_TASK	-retries the task if this error is encountered
RANDOM_PRIORITY	-part of the bit flip errors
RANDOM_DESTINATION_ADDRESS	-part of the bit flip errors
RANDOM_SOURCE_ADDRESS	-part of the bit flip errors
RANDOM_DESTINATION_PORT	-part of the bit flip errors
RANDOM_SOURCE_PORT	-part of the bit flip errors
FATAL	-crashes the specified module when this error is encountered
GARBAGE_DATA	-data is unusable
unknown	-behavior is unknown

iv. Manual Set Up of the CubeSat Communication Simulator

This section will guide you through the steps for setting up the CubeSat Communication Simulator manually from the source code so that you can build and run the program yourself or edit the source code to modify it.

Pre-requisites:

·   A Windows 10 PC with Microsoft Visual Studio 2017 or later installed.

·   .NET Framework 4.6.1 which can be installed through Visual Studio.

Steps for setting up the CubeSat Communication Simulator manually from the source code:

1.   Clone or download the CubeSatCommSim repository from github at https://github.com/dthomso1/CubeSatSeniorDesign (Note that the repository is currently private and you must request access from the owner to see the linked page. You may also need to copy the link and open it manually).

2.   Once downloaded, find the repository folder on your PC and navigate to CubeSatSeniorDesign-master\Source then open CubeSatCommSim.sln with Visual Studio.

3.   In Visual Studio, look for the Solution Explorer window, typically located on the right side of the main window. Right click on the CubeSatCommSim project file located directly below the "Solution 'CubeSatCommSim'" root node. In the context menu that appears, click "Set as StartUp Project".

4.   In the toolbar at the top of the main Visual Studio window, click the Start button to begin the build process. Once the build is completed, the program should open automatically.

If you encounter errors during this process, consult Microsoft's documentation for your version of Visual Studio and make sure you have .NET Framework version 4.6.1 installed.

If you want to be able to make changes to or build and use the installer project (CubeSatCommSim_Setup) follow these next steps, otherwise you are finished.

5.   In visual studio, open the Tools menu at the top and select "Extensions and Updates…". A window should appear showing you your currently installed extensions.

6.   Click the Online section on the left of the extensions window. Now you can use the search bar in the top right to search for "Microsoft Visual Studio Installer Projects" and install this extension.

Once installed, you may need to restart Visual Studio, then you should be able to access the installer project.