AAU3 Documentation v1.1
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Code Usage - Environment Setup

The code is provided as .tar.gz archive.
It is written in `C++` and is intended to run on a BeagleBone Black (using ARM processor) with all peripherals (motor and actuators) included in the one-faced Cubli from Aalborg University (AAU3). To be able to compile it, the user should have a working instance of the Eclipse software with `C/C++` tools installed as well as the GNU Compiler Collection (g++) for cross-compilation to ARM processors.

> ⓘ **Info**: The compilation process has been tested on a Ubuntu 12.04 virtual machine, running through VMWare (Workstation for Windows, Fusion for Mac OSX) or virt-manager (for GNU/Linux, with qemu-kvm).

To install the corresponding needed packages under Ubuntu 12.04, the following command should be typed in a terminal:

```
sudo apt-get eclipse eclipse-cdt libstdc++6 libstdc++6-armhf-cross \
              g++-arm-linux-gnueabihf make
```

Once everything is installed, the archive file should be extracted to Eclipse's workspace path (by default it should be */home/workspace/*).

> ⓘ **Info**: Some additional configuration might be needed to ensure that the code can be compiled and sent to the BeagleBone Black. (See here for a setup example.)

> **Note**: A replacement to this heavy virtual machine system is under development here. It uses docker as a simple, light-weight and portable cross-compiler environment. A basic version for advanced users is already available. Otherwise, please check regularly if you want something more user-friendly.

Contributors

A very large part of the C++ code base is due to Benjamin Krebs.
However, some code has been added or modified by Simon V. Johansen in the *controller_test.cpp* which includes the principal function that is called at regular intervals and runs the core of the program. He has also added some external MATLAB generated files (in *controller/controller_code*) containing the first Linear State Feedback (LSF) controller as well as a Sliding Mode (SM) controller and observers.
Eventually, a significant amount of code has been changed and added by the project group 16gr630. This includes some refactoring of the core part of the program as well as the addition of controllers (a second state-space controller - LSF2 - and other classical controllers which aren't stabilizing the system). It also includes the addition of a complementary filter applied on the IMUs and the possibility to choose some option when running the controller and toggle features (see next section).

Program Usage

When connecting to the BeagleBone Black through SSH as root (be it through Eclipse terminal or an external terminal), the default destination folder is root's home. To be able to run the program, it is necessary to change directory and go into the *aau3/* subfolder. Then, a few I/O need to be activated in Linux, which is done by running a bash script. Finally, it is possible to run the AAU3 program.

```
cd aau3/
./pwm_script.sh
./main
```

When AAU3 is launched, a shell interface is available for you to run specific controllers and other desired options. If you type `c run --help`, the following output should appear.

```
SYNOPSIS
c run [-nc/-c] [-t [controller type]] [-d] [-l2f [filename]]

ARGUMENTS
-c        Enables the complementary filter. Has priority over -nc. Default behavior.
-nc       Disables the complementary filter and uses the potentiometer instead.
          Is cancelled by -c.
--no-comp Equivalent to -nc.
-t        Allows to choose the desired type of controller. [controller type]
          should be either one of {lsf, lsf2, prop, sisot}. Default is lsf2.
-d        Enables the debug option. Prints sensor readings and current applied to
          the motor.
-l2f      Enables logging into a file which should be specified right after
          All log files are situated in the logs/ subfolder.
          and contain comma-separated values. Default is log.csv.

EXAMPLE
c run -c -t sm -d -l2f test.csv
This will run the Sliding Mode controller with the complementary filter. It will log
data from the sensors and the desired current both on the screen and in a csv file
named test.csv located in the logs/ folder.
```

It is also possible to toggle directly the complementary filter by `c compfilter`.
You can also stop the controller to run another one with different options. This can be done with `c stop` while the controller is running (the physical setup should be resting still, not in equilibrium!). This will return you to AAU3 shell.
If you want to stop the program completely you should type `q` or `quit` and then *Enter*. To run it again, simply type the command: ./main.