

Breeze Board v2.0

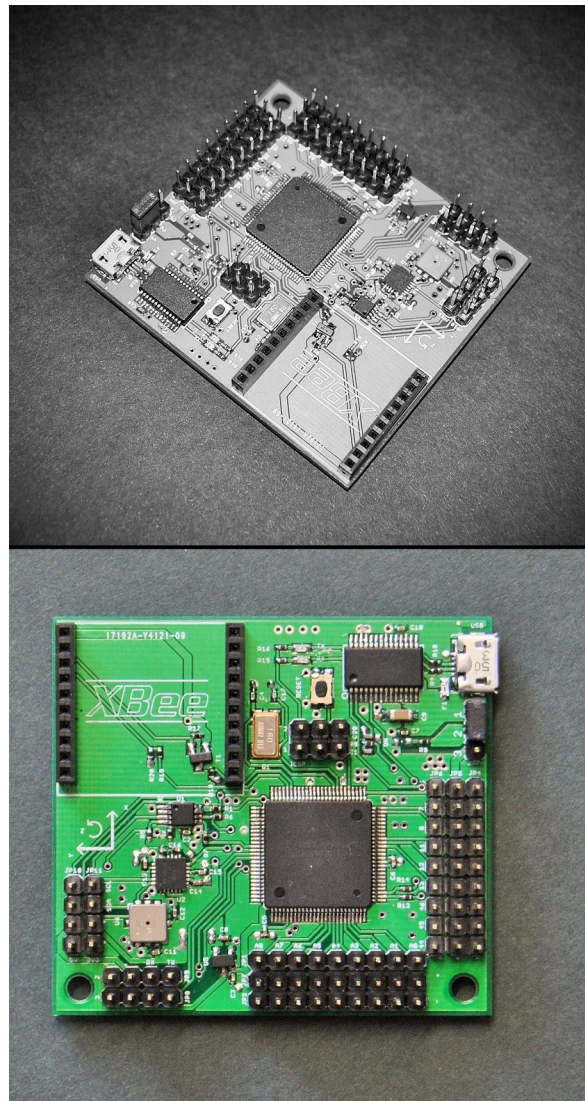
Specifications

1) Introduction

Breeze is an autopilot system for UAV. Our goal is to provide innovative features to small aerial vehicle in order to improve takeoff, flying and landing capabilities. An UAV system relies on both the on-board electronic device and the ground station.

In this document we focused on the board. A previous version called Breeze Board v1.0 has been developed based on Atmega 2560 processor which runned at 16Mhz. This solution allows us to test our basic function such as flight stabilization. However since our needs in CPU are getting bigger with new features, we need more power to ensures such capabilities.

Our goal is to provide a much better version while keeping its size and weight around 20 grams. Below a screenshot of our first board :



2) Changes from v1.0

The cornerstone of the v2.0 concerns its processor : ARM Cortex M4. In fact such processor keeps power consumption low while providing more than 150Mhz. We also want to improve our prototyping method by finding reliable companies which produce PCB board and assemble them in a good manner.

3) Risks

Type	Description	Solution
Production & Factory	Ability to find a reliable and cheap company to produce and assemble board	
ARM Cortex code	Difficulty to adapt the Atmega2560 code into ARM Cortex (see library libopencm3 on github)	See library http://www.libopencm3.org/wiki/Main_Page
Voltage	Providing the right voltage +3.3v and +5v where its needed (ARM runned at 3.3v, while PWM needs 5v)	
Magnetic & RF interference	Magnetic or RF perturbation between magnometer and Xbee	

4) Performance requirements

Type	Description	Ensured
Clockspeed	Over 150 Mhz	
Weight	Keep weight under 30 grams	
Size	Keep it under 5x5cm Any benefit with 4 layers instead of 2? Make two design : one in stick, one square to compare the benefits	

4) Specifications

4.1- Components

Type	Name	Notes
MCU	ARM Cortex M4	Is it ST STM32F4 ? Choose the best one compatible with libopencm3
IMU	MPU6050 6 axis (magnetometer are not enough good)	Interest to have 2 IMU instead of one to combine data (see chapter 6)
Barometer	BMP085	
SBUS on board signal inverter		Resistance and transistors
Port	Mini/micro usb port (the same as current board)	To power and upload program on the board

4.2- Pins

Type	Number	Notes
Analog	2	
SDA/SCL	4 pins with +3.3v 4 pins with +5v (for LIDAR Lite laser)	
PWM 3 pins-header (signal +5v ground) related to ARM Cortex timers	at least 9	
SBUS on board signal inverter	tx ; rx ; +5v ; ground	
GPS (Ublox LEA-6) Serial 3 pins	tx; rx ; +5v ; ground	
+/- pin for LED in series	1 positive negative pin header	In order to light 1,2,3... and more LEDs using this port.
Xbee mount	Power, rx/tx and RSSI strength	Same as v1.0

4.3- Electrical and others services

- On board inverter logic for Futaba SBUS port (Only three pins (signal, +5v, ground) on the Rx)
- On board indication with pin number / IMU orientation (x, y and z to the top) / "Breeze board v2.0" on the bottom

5) Work packages

Design

Name	Description	Earnings (€)
Review specs	Answering questions in chapter 6 "To be defined"	20
Design the board, produce eagle and gerber file	- Produce multiple quick design to be able to estimate size for various model (stick, square, xbee over components, ..)	80
Price estimation	Prediction of the board components and productions pricing (for one or multiples boards)	20

Production

Name	Description	Earnings
Find company reliable for printing PCB and assembling the board	Making quote and companies reviews	20
Listing components and ordering them		Price of the components
Producing and assemble the PCB board		Price of the production and shipment
Assemble and test the board		80

Total earnings : 220€

Total cost : 220 + 180 (printing, assemble, components, shipping)

This amount must be reviewed as soon as we choose the company for printing and assembly.

6) To be defined

- How many timers are available on ARM cortex, TBD each timer used on Breeze for motors ?
- How many PWM ports are available, TBD PWM for servos (related to timers)
- Xbee signal strength, which pin is needed on the ARM to have RSSI data ?
- Is it interesting to embed two IMU such as MPU6050 and combine the data, and in this case how to read/write on two components having same BUS addresses ?
- Which ARM Cortex to choose ? (Look library libopencm3 to see ARM available for this lib)
- Without taking care of the specifications size, Is it possible to embed the ublox-lea-6-h GPS ?
- Is there any solution for ESC/usb power without jumper ?
- Is it possible to make a board where components are under the xbee to minimize size ?