Politechnika Wrocławska

Laboratory work station for multirotor control algorithms development

Author: Bartłomiej Kurosz

Class: Intermediate Project

Instructor: Ph.D. Witold Paluszyński

Abstract

Main goal of the project was to design and prototype a test rig for laboratory work station for multirotors. The rig should be small enough to put it on the table within student's workspace, simultaneously being able to handle small quadcopter with BLDC motors. Main result of the project is mechanical design prepared for manufacturing. Some parts of the prototype were produced.

Faculty of Electronics
Wrocław University of Technology
WWW.PWR.EDU.PL

February 21, 2017

1 Introduction

First days of testing stabilization algorithms for multirotors can be very tedious, and even dangerous. It is hard to debug the system without real knowledge about its state. It is also dangerous to test it without any kind of protection for the drone.

The project assumed designing a testing rig for a multirotor platform. It should be able to measure real orientation of the drone basing on encoders in order to compare it with measured signal from sensors onboard. Main assumptions for the projects were:

- easy to reproduce,
- small enought to put on the table,
- lightweight,
- low–cost
- durable.

One of the main constraints for this project was the manufacturing technique. To achieve low cost construction which can be reproduced many times 3D printing was chosen for main frame elements.

2 Results

As the result, the mechanical part was designed in *Autodesk Inventor*. Full design in shown on picture 1.

Some parts of the rig were prototyped and manufactured on a low-quality 3D printer. Printed parts are shown on figures 2, 3 and 4.

Unfortunatelly, all the slots in printed parts turned out to be too small. Moreover, the quality of used steel rods is very low, their diameters differ and they are not perfectly straight. After many mechanical adjustments, main parts of the frame were put together, which is show on figure 5. Precision, quality and durability of the frame is too low, so the frame has to be redesigned.

Apart from mechanical parts, magnetic encoder PCB was designed and manufactured in an external company. Dimensions of the boards are $10mm$ x $7mm$. Final product is shown on figure 6.

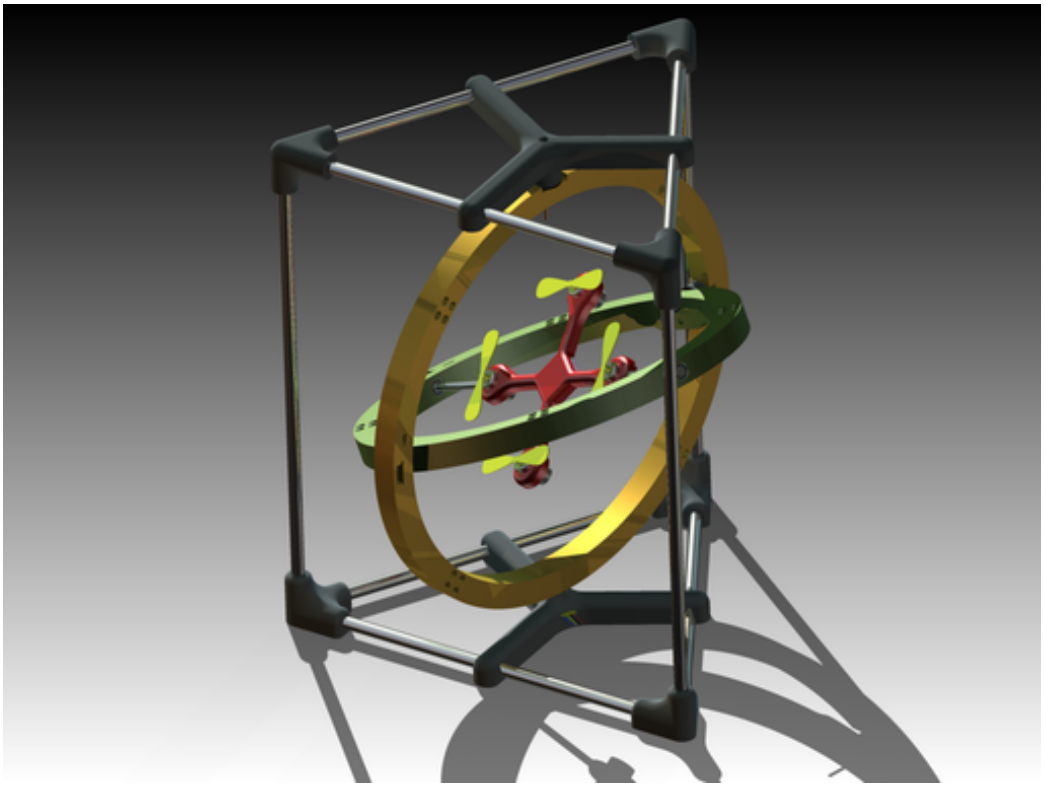

Figure 1: Full rig designed in *Autodesk Inventor*

3 Conclusions

Although 3D printing allows for fast and low-cost prototyping, designer has to be aware of its drawbacks and limitations, as low precision, limited printing workspace and feasible shapes.

Connecting all the frame parts was possible, but the consequences of impresicion of the whole construction would be so large, that this concept is to be rejected and redesigned.

Figure 2: Outer Rim

Figure 3: Middle holder

Figure 4: Corner

Figure 5: Frame

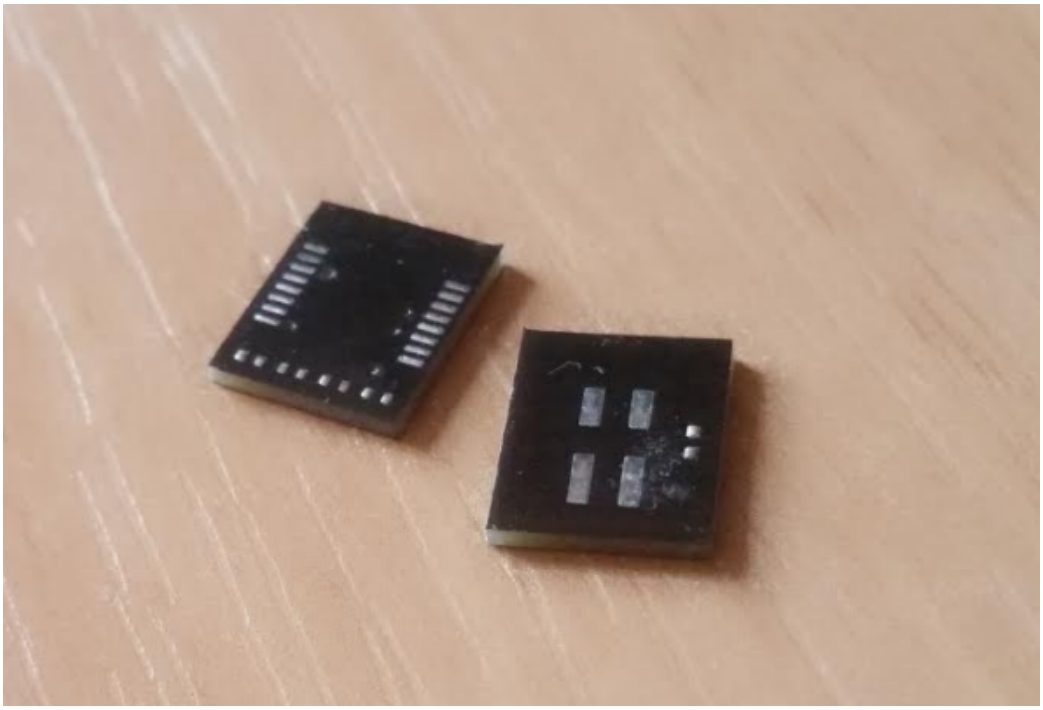

Figure 6: Encoder PCB