SUMMARY.

The main objective of this Master's thesis was to fully develop a multi-rotor helicopter platform to use it together with MP2128HELI autopilot thereby developing multi-rotor helicopters with an autopilot. The aircraft had to be functional and at the same time with a structure as simple as possible. Commonly available components and materials had to be used to build the multi-rotor frame as well as the electrical components and other parts had to be commonly used. The autopilot main module with its other components and the electronics controlling user interface and the motors had to be removable from the rest of the aircrafts chassis to use it on other multi-rotor helicopter chassis. The aircraft had to fly about 10 minutes including the take-off and landing. The aim of this platform with MP2128HELI autopilot is to subsequently develop a fully functioning multi-rotor helicopter with an autopilot, that could be used during different surveilance missions and in research.

At first different types of multi-rotor helicopters are analyzed and after the analysis conclusion the best suitable type of aircraft is chosen. Of course other types of testing platforms can be used with the autopilot, all the electrical modules can be easily removed from one platform and put to another. After choosing the most suitable type of multi-rotor helicopter, all the mechanical components are developed step by step and all critical parts of the aircraft chassis are tested for strength and equivalent stress in a virtual environment. All the parts can be easily manufactured with laser cutting, water jet cutting, milling or just by making most of the parts by hand-operated workbenches. A mechanical module where all the electronics are connected was separately engineered.

Within this Master's thesis MP2128HELI autopilot's construction and functionality have been closely analysed in order to make a reliable link between the autopilot and the aircraft platform. Brushless motors with motor controllers have been carefully chosen for the quadrotor. According to the test results the maximum load that can be lifted with one rotor as well as the average power consumtion are determined. Also suitable batteries have been chosen according to the desireable flight time and the power consumers.

Connecting MP2128HELI straight to the motor controllers that control the aircraft's rotors is not possible mainly because the autopilot is designed for ordinary helicopters. The solution is to use a controller module that is specially designed for this platform, it is a link between the user, rotor controllers, autopilot and special sensors and actuators. The electonic module is capable of transferring information between the user and MP2128HELI, and 85

acting according to the commands that are given to it. The module also transforms signals coming from the autopilot and transfers these signals to rotor controllers. Also different input and output devices can be connected to the module that are controlled by the module according to the user's and the autopilot's commands. Additionally the central microcontroller C8051F580 on this linking module had to be programmed, this had to be dealt with as well.

The main goals of this thesis have been achieved, a quadrotor aircraft platform has been developed along with linking devices that are used for connecting the autopilot to the aircraft. A actual aircraft platform prototype has been built during the development. When the multi-rotor helicopter platform is developed further on, the next step would be getting the autopilot working splendidly and testing the aircraft in more difficult situations. The final step would be obtaining a fully functional multi-rotor helicopter with an autopilot that can be used in real life observation missions and in research.