3. Requirements

3.1 Analysis of Customers Needs

The system has to carry a payload of minimum 1 kg. Therefore normally 6 to 8 rotors are needed and it has to be evaluated which number of rotors fits our requirement best by measuring the lifting capacity of selected motors and rotors.
Another requirement of the customer is that the model should fit through a standard door. Because of this the model has to be constructed with a maximum width of 85cm to have enough clearance.
The system also has to reach a flight time of 10 to 20 minutes. For multi-copters normally Lithium Polymer accumulators with 1 to 10 cells and 500 to 20000 mAh are used and it has to be measured how much power is consumed by the system, especially the motors. To reach these requirements the weight of the model should be as lightweight as possible. All components have to be checked regarding to their weight and the use of different materials such as carbon fiber should be evaluated.
The Customer also wants to have a modular design of the whole system.
Therefore a physical model has to be designed in order to have enough space for additional modules such as new sensors. It also has to be possible to change the weight distribution to keep the model balanced and also the electronics need to have enough standard interfaces to add new hardware components.
Another requirement of the customer is that the different software components don't interfere with each other. To fulfill this, the system should consist of multiple processors that have separated memory and interact with each other over bridges.
The customer also wants to have the possibility to extend the existing multiprocessor system with more powerful hardware over a widely spread communication protocol.
To meet this requirement an Ethernet interface should be realized and the system should support to give the new hardware access to the required sensors.
To meet security requirements manual interaction has to be possible at all times.
Therefore the system has to have a receiver for a remote control and has to meet hard real-time requirements.
The system also should be able to fly stable and to give the other processors the possibility to control the flight of the system. Therefore a flight control unit has to be designed that has an interface with which other processors can interact.

3.2 Functional and Non-funtcional Requirements

Functional Requirements

- **The flight control of the model consists of a multiple processor system**
  Description: The client wants a multi processor system in order to have separate address spaces for different processes.
  Rationale: The flight control system consists of different processors.
  Priority: High

- **Option to replace the main processor**
  Description: It would be nice, if it will be possible to replace the actual main processor with a more powerful one.
  Rationale: It is possible to use an external processor system for more computing power.
  Priority: Mid

- **The model is motor-vibration resistant as good as possible.**
  Description: The clients mapping algorithm needs a preferably stable flight for calculating a map. High vibrations through the motors or propellers should be avoid.
  Rationale: Pulse dampers are integrated in the model.
  Priority: Mid

- **The model has an attachment for mounting Kinect cameras.**
  Description: The clients application for the model needs cameras, actually connect cameras, for creating 3D maps from the environment (in buildings). Therefore it should be possible to mount these cameras in a proper way on the model.
  Rationale: The model has an attachment for cameras.
  Priority: Mid

- **The model should be able to communicate later on with a basis station.**
  Description: The ability for using different communication standards for data transmission should be considered
  Rationale Interfaces for using communication techniques are implemented.
  Priority: Mid

Non-functional Requirements

- **The model should be usable for indoor flight.**
  Description: The client wants to use the model for indoor navigation and mapping. Therefore the design needs to be as slim as possible. The model should be able to pass doors and smaller parts of a room.
  Rationale: The width of the design is lower than 80cm. The model is able to do a precise flight.
  Priority: Indispensable

- **The model should have an adequate flight time.**
  Description: The client needs an adequate flight time for his mapping-application. To be useful the model should be able to map bigger areas before it has to fly back for loading the power supply.
  Rationale: The flighttime is higher than 15 minutes.
  Priority: High

- **The model consists of a modular design.**
  Description: Actually the clients mapping algorithm works with two Kinect cameras. So the system has to carry these and a small computer for the mapping algorithm.

Later on it would be nice to have the possibility to replace single components and add additional sensors.
Rationale: The finished model can easily be modified and reshaped. Additional sensor mount points are available.
Priority: Mid

- **The model should be able to carry at least 1 kg of payload.**
Description: The client wants to carry some additional parts like the cameras and a small computer for map calculating. Therefore the model should be able to carry this additional payload easily.
Rationale: The finished model carry at least 1 kg payload
Priority: Indispensable

- **It is possible intervene the autonomous flight every time**
Description: It is necessary that the client is able to intervene the manual flight every time he wants. Therefore the difference between manual and algorithmic input has to be detected. Manual input must be accepted at all times with an higher priority.
Rationale: A reliable way to manually interact with the model has been implemented.
Priority: Indispensable

- **The model should be able to fly autonomously**
Description: The mapping of a building does mostly not take place in the clients view. So the model should be able to fly autonomous, controlled by the mapping algorithm.
Rationale: An interface for an autonomous flight is implemented.
Priority: High

- **The project has a good documentation for further project groups and an easy use for the client.**
Description: The project is not finalized in this projectteam, so it is necessary that the progress is good documented for further work on the project.
Rationale: HowTos and a detailed report are provided by the project team.
Priority: High

- **The clients are satisfied by the work of the project team in WS 14/15**
Description: The clients want to have a usable platform later on. Therefore it is necessary to create a proper design for the platform. Furthermore the project should be well documented.
Rationale: Clients are happy about the result.
Priority: Indispensable