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Subject Area	Product Development
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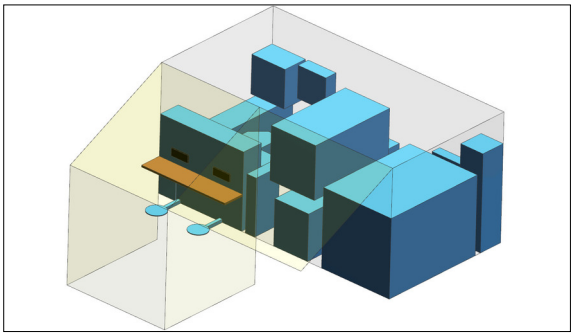
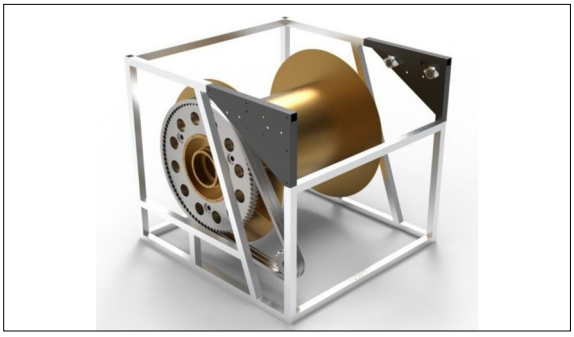
Sewer Inspection Robot

Concepts for system organisation and weight reduction

Inspection Robot in front of the sewer access
Wei Chuan Law, Robotic Research Centre, NTU, Singapore



This picture shows one specific arrangement of all equipment needed in the storage room of one truck.
Own presentment



All components of the winch system optimized for weight are shown in this visualization.
Own presentment

Definition of Task: For Singapore's long term needs of drinking water, a sewer system that covers the whole country, is being built. To inspect the sewer system, NTU is contracted by Public Utilities Board (PUB) to develop a robot. The approach is to capture the conditions of the sewer walls by panoramic images. For the fourth and last prototype, the whole system should be optimized in organisation and weight.

Therefore, the two goals are:
1.) Creating concepts for the workplace and storage organisation on the trucks
2.) Reducing the weight of the current winch system.

This bachelor thesis was carried out according to the methodological approach of "clarify, concept, design and elaborate". But most of the content is in field of clarifying and conceptualizing. Project members will do elaboration and integration of the concepts into the robot system from NTU. To find solutions, creative thinking methods are applied, like Brainstorming or Morphological box. Mechanical components are proven by calculations with tools as MSC-MarcMentat and MDesign.

Result: It was possible to prove that all component needed to run the system can be carried in one medium-sized truck by systematically rearranging all components needed. With a few customisations on the truck, it is possible to create one single system, which then can be used as an operation centre. However, these concepts are most interesting for PUB on how the project should be realized, while in the prototype phase, too many variables still are unknown. However, these results can be an inspiration to exactly define as many parts as possible, to reduce the needed effort from PUB to complete the project.

Result: By calculating the required cable force, it is proven that the current winch is over-designed by approximately factor of three. With this knowledge, the chain-size and the thickness of the aluminium drum can be reduced. In addition, the stainless-steel frame can be substituted by aluminium. With these changes, 910 kg of the current winch can be reduced to 722 kg, a total weight reduction of 20%. Furthermore, there is still more potential as not all components have been redesigned yet.