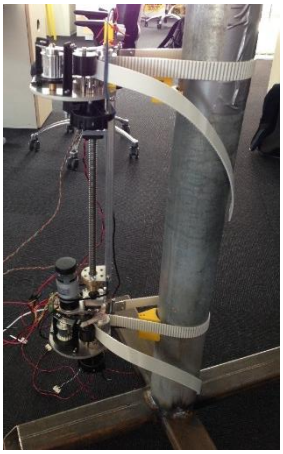
Development of a Pole Climbing Unit

Temporary surveillance with an easily deployable camera can give a tactical advantage for police in riots or similar situations when big crowds suddenly gather, or for the fire department when a fire breaks out. This is a brief description of the development for a prototype pole climbing unit where a camera in a later product can be attached.



Before concept development begins it is important to research future customer needs and requirements for the climbing system. With a pole study it is determined that the prototype should handle poles with changing diameters. Customer needs are found by conducting interviews with people experienced in camera issues and crowd control. This research is used during concept development to determine requirements for a final concept.

Brainstorming is a good way to kick off concept development. Pictures of challenging obstacles and similar products can help with finding the perfect concept. Selection for the final concept is made by concepts competing against each other. This is done with concept screening and concept scoring where performance is compared from requirements researched in the initial study.

The winning concept is reworked many times both on paper and in computer models to determine what the final prototype should look like. Calculations are made for required motor strength, battery needs and transmission on cogs. Component selection and 3D-modelling is an iterative procedure where modeled parts and selected components are fitted and refitted many times before the final prototype is ready.

Electrical components like DC motors and sensors needs to be connected to a micro controller that controls everything. This connection is made by designing a printed circuit board (PCB). On the PCB H-bridges are used for motor control and a low-dropout regulator (LDO) is used to reduce voltage from battery to micro controller and sensors.

The microcontroller is ordered mounted on a separate PCB with a special integrated development environment (IDE). This IDE has built in libraries that enables a mix of C and C++ for easy programming. The whole package is called an Arduino and is used to control the robot.

The mechanical parts used in the prototype are either ordered or built in a workshop. For a lighter structure 3D-printing is used as much as possible but many parts needs to be either steel, brass or aluminum. Some parts had to be modified to fit together because 3D-model differed from real life tolerances.

The finished prototype uses cog belts to tighten itself to a pole. As the upper belt is loosened it can be moved up the pole and tightened again. Now the upper belt holds the climber while the lower belt is raised to a higher position and tightened. By extending a counter arm slower than the belt is reeled in the climber can always stay parallel to the pole despite of diameter changes on the pole. This is beneficial both for safer climbing and gives a straight camera installation.