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Mobile IP Camera Solution

This article describes the master thesis work performed at LTH and concerns the process of designing and building a prototype that makes an Axis Communications stationary camera completely wireless. This will be achieved by incorporating a Wi-Fi and a suitable battery into a chassis design.

The data transfer rates of wireless communication has only recently reached high enough levels to support high quality video streams. There are a lot of cameras that do not yet have the functionality integrated. At Axis Communications several such cameras exists which has led to this project focusing on the development of a separate complementary device that will enable a camera to have complete freedom from wires. The device will need to supply the camera with power via a battery as well as a way of relaying data communication via a wireless link. While the project only reaches a proof of concept stage it is still beneficial to protect the battery and power electronics inside a shell that also serves as an esthetic front to market the product.

Goals of the project

- Create a fully functional prototype
- Select a battery that runs the prototype for more than 5 hours.
- Create an esthetic design that covers the battery and electronics.

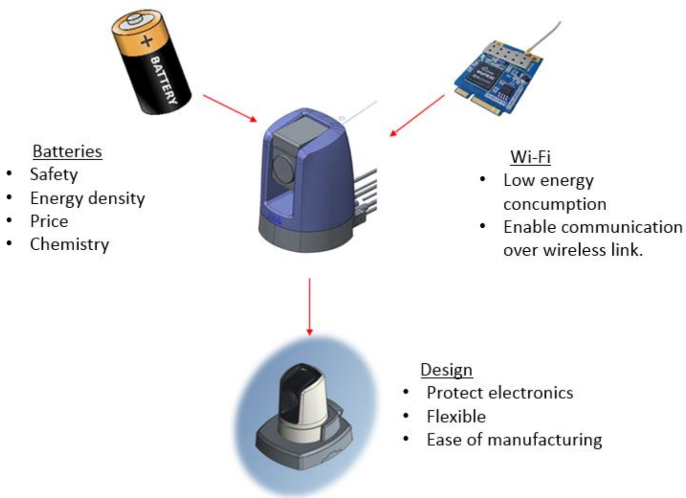

Figure 1 - Layout of docking station project.

The methods used in order to achieve the desired goals, are divided into mechanical and electrical parts. The electronic components were chosen as the result of market research, while the mechanical design followed the methodology described in Ulrich and Eppinger’s *Product design and development*. The workflow shown in figure 2 was followed in order to establish the battery needed and how the printed circuit board should be designed.

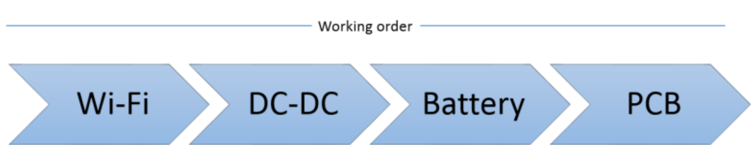

Figure 2-The workflow of the electrical approach.

First a suitable Wi-Fi unit is selected based on supported bandwidth, level of programing needed to implement, and power consumption. After studying several different Wi-Fi solutions the WizFi630 was selected. A DC-DC stepdown unit was chosen to provide the Wi-Fi module with the right voltage level. Several different voltage regulators from Linear Technology were simulated using LTspice IV, and selection criteria included output voltage ripple and efficiency. The device that best met the requirements was the switch modulated power supply circuit *LTC3646-1* which showed a high level of efficiency and a low output ripple.

Figure 3-WizFi630

A portable supply of energy was chosen to satisfy both the camera’s and the electronics’ need for power. The average power consumption, product dimensions and the desired period during which the application should run served as the basis for selecting a battery with the correct capacity and dimensions.

Figure 4-RRC2024 Lithium ion

The camera consumes between 12 and 18 watts depending on motor usage and data transfer rate. While the Wi-Fi unit consumes approximately 2 watts with its peripheral components. A custom designed battery was developed together with supplier 2 but not produced. Instead the battery RRC2024 from supplier 1 was used to test the functionality of the prototype.

The method for deriving the chassis design was divided into three phases which are: concept generation, concept screening and concept scoring. During the first phase a lot of ideas where generated but most were discarded in the concept screening. The ideas that showed the most potential were developed further before selecting a final concept via concept scoring. The best concept solution is shown in figure 5.

Figure 5- Concept to continue with.

The final chassis design concept was improved with the manufacturing process in mind to make it easier and cheaper to produce.

The final docking station with the electronics in the chassis was capable of running the system for up to eight hours while continuously streaming data to a client. The eight hour test was performed with all internal systems of the camera running. The video stream was compressed to H.264 format and an office environment with moving scenery was filmed. The internal workings of the docking station can be seen in figure 6. During the process of assembling the docking station it was noticed that some vital components were missing and these were included into the final docking station. The components are:

- A transformer.
- A LDO regulator stepping 3.3 volts to 1.8 volts.
- Termination to the Ethernet lines.

These were required in order to get a good signal from the camera to the Wi-Fi.

Figure 6 - Internal architecture of the docking station

Figure 7-Final docking station with camera docked to it.

Summary
The project resulted in a fully functioning prototype with the design shown in figure 7. The battery selected for the docking station is capable of running the communication and the camera for up to 8 hours which clearly surpasses the 5 hour goal.

The recommendation regarding the future of the docking station project is that it should be implemented to work with a wider range of Axis cameras. If the implementation is successful there is a lot to gain from the economies of scale that comes with larger volumes. With only a few modifications to the internal power regulation, the docking station can offer wireless compatibility to virtually any camera with a reasonable power consumption.

For more information contact the authors of the Master thesis *Mobile IP Camera Solution* in association with Lund University, faculty of engineering.

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