Summary

The belt conveyor is a very important component of logistic systems which carries heavy weights of bulk material at, for example, mines. One of the most critical parts of the support system of the conveyor is the bearing of the roll. To avoid a total shutdown of the conveyor system, the total conveyor has to be monitored. Monitoring large conveyors is very labor intensive and therefore expensive. To avoid a total shutdown, of the conveyor system, the bearings will be replaced before they fail. Therefore a condition monitoring system, based on radio frequency, might be a feasible solution for monitoring the bearings of the rolls to reduce downtime of the conveyor system. The radio frequency based monitoring system consists of a temperature sensor which determines the health of the bearing. Another component of the system is the active radio-frequency identification tag, which transmits the identification of the tag and the collected data from the sensors. These tags use direct roll to roll communication. This means that the collected data will be transmitted from tag to tag until the data reaches the base station. This system is expected to optimize maintenance and reduce the risk of failure due to lack of information about the conditions of the bearings.

Nowadays the radio frequency tags are powered by batteries. Since all these sensors and batteries are being installed at the same time, they also be depleted at the same time. The energy source of the sensors determines the life time of the roll, since the deployments of the sensors in the belt conveyor systems will not allow recharging or changing the batteries. Therefore new ways of energy harvesting should be investigated.

The tag can be powered by different types of energy sources. A requirement of the energy source is that the energy source is capable to deliver enough power. Since the tags are now powered by batteries, the new energy source has to deliver the same amount of power. There are two different categories of energy sources, namely energy storage and energy harvesting devices. In this report the assumption is made that every sensor has the same energy consumption.

Energy storage devices have a certain amount of energy stored in the devices, which have to be refilled or recharged when the devices are depleted. Examples of energy storage devices are: batteries, radioactive devices, fuel cells, capacitors, micro heat engines and kinetic energy storage devices. The other category of energy sources is energy harvesting devices where no energy is stored in the device but all the electrical energy is converted from thermal, photonic or mechanical energy. This thermal, photonic or mechanical energy is derived from an ‘inexhaustible’ source. Since the energy source is inexhaustible, the life time of the roll will not be determined by the amount of stored energy inside the device but by the life time of the energy harvesting device and sensor. The most suitable energy source is an electromagnetic device, which will be integrated inside the roll of the belt conveyor. Integration inside the roll is a constraint, since the environmental conditions are very harsh.

To prove if the dynamo delivers the required voltage, a prototype will be build. The dimensions of this prototype are based on calculations which provide the required dimensions of the energy harvester. Not only the dimensions of the energy harvester will be determined also the type and configuration, materials and costs of the energy harvester.

The measurements show that it is possible to power the sensors with an electromagnetic harvester and show a big difference between the calculated generated voltage and the generated voltage of the prototype.