

Abstract

There is a directive in the European Union, when a new dump is being built, a protective layer is needed to construct in the reservoir for the waste. The protective layer prevents the leechate from entering into the soil. This layer is made from High Density Poli-Ethilen (HDPE) foil. The main profile of Geoelectro Ltd. is the installation of sensor networks, which can detect and determine the exact location of the damages of the HDPE foil layer. An automatic measurement instrument is under development, which can start a measurement at a preprogrammed time. There is an important requirement toward the units of the embedded system. The requirement is that the units must work properly without line power. It is also important, to extend the time period of maintenance from a month to couple months, or half a year. We are planning to build the instrument with a charging circuit which monitors the instrument's battery, and refills it with the power needed by the instrument.

There are different ways for recharging the battery. The measurement system has a lot of sensors which are inserted into the ground. I would like to perform experimental measurements with this sensor network, investigating the possibilities of harvesting telluric currents for battery charging. The other way to get the energy for battery charging is the application of solar cells. In this case it is important for the charger to be able to provide enough amount of charging power for the battery considering the change in the light conditions and the battery voltage. The Maximum Power Point Tracking (MPPT) is a method developed for solve these problems. It gains 10-45% more charging power from a solar cell.

In my thesis, I will review the system design of the automated measurement system, considering the roles and specialties of each subunits. After the examination of the measuring unit I will give an estimation of power consumption. Based on this information I will lay down the requirements for the charger and make the exact specification for the charging system.

I will perform experimental measurements for determining the possibility of using telluric currents for battery charging. The measurements will contain the investigation of stainless steel electrodes applicability, and the amount of power which can be harvested with the measurement system's sensor network.

In the possession of the results, I will select the proper energy harvesting method for the charger device. I create the system and modular design of the charger, based on the V designing model. Based on the specifications I select the components for building the device. I create the hardware and software design of the charger. According to the plans, I build the device, and make its firmware. After building and programming, I test the device, both its hardware and software, and I analyse the operation of the whole automated measurement system.