SOLAR TRACKING ALGORITHM USING COMPUTER VISION

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Abstract

Renewable energy is one of the many things we can use in order to preserve the worlds nature and make the living of the future generations better. One of the ways to generate renewable energy is from the sun. It radiates enormous amount of solar energy which can be used by the people to create electricity.Having this in mind we are going to present a new alternative way of controlling solar cells by using computer vision algorithm. The main goal of this algorithm is to optimize the control process of a solar system and provide better supply of solar energy.

Introduction

The renewable energy is generated from renewable nature sources such as wind, solar energy, geothermal energy, etc. During the last 8 years using the solar energy as a renewable source has increased around 40 times [1]. This is due to the fact that solar energy is a good long term investment, reduces the environmental pollution and also is easy and cheap to supply.

Problems

The process of solar energy generation is not awless. The massively used solar systems of average or lower class do not generate the full amount of electric energy from the solar energy which they use. This happens because most of them are not provided by systems to help them trace the sun trajectory. The goal that we set was to create an eective and relatively cheap way to optimize the solar energy supply. This should happen by improving the control of the solar panel. An algorithm for solar tracking by using computer vision was created as a potential solution of the problem.

Algorithm

The main functionality of the algorithm is to calculate the sun position based on speci

c input data and to move the solar cell to the best position that is possible. The structure of the algorithm is shown on Figure[1].

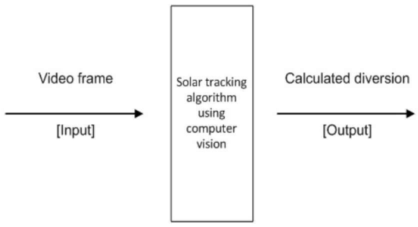

Figure 1 – Algorithm structure

The input data for the algorithm is the video stream from the web camera. Each frame is processed and the calculated diversion is uses as output information. Based on this result the solar cell is being moved to the best position according to the sun.

The first step of the solar position calculation is getting a frame from the video stream and presenting it as a single image. We should search the image for an object with the shape of an ellipse which is the sun itself. In order to and it we analyze the image with the Hough transform technique. As a final result of this step we have an image with all ellipse shaped objects and their coordinates.

We assume the possibility of having other ellipse shaped objects that got on the frame coincidentally. In order to remove them we use color filter and remove a predefined color range. When using an ordinary camera without physical filter we should leave the white-yellow color range. As a result we will have all the ellipse shaped objects with the desired color left on the image. There is a minimal risk that we have more than one ellipse left on the frame. To decide which one of them is the sun we use histogram comparison. For this we use predefined histogram of sun photos and use it as a pattern. We compare all the ellipse shaped objects that are left on the frame with this pattern and the one which histogram has the best match with the pattern is defined as the searched object.

When we have the sun on the frame and its coordinates it is easy to calculate the diversion needed to correct the position of the solar cell.

Application and Testing

The developed algorithm is tested in live conditions. In order to do this we created a solar tracking system prototype[2]. After testing in equivalent conditions the cell generates 8algorithm.

References:

1. Renewable Energy Policy Network for the 21st Century, REN21 // Renewables 2011 Global Status Report. Paris. 2011.
2. Mironov K., Kotsev V. Solar Tracking System Using Computer Vision. // Proceeding of International Students Conference of Informatics ICDD. 2012. ISSN:2069-964X. P.103.