

# IMPLEMENTATION OF SUNSHINE DURATION SENSOR

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## Abstract

Sensors are widely used in many fields of science. The combination of different types of sensors in one system gives us the ability to measure various parameters. Consequently, brightness and temperature sensors enable more complete measurement of the sunshine duration. Due to calibration and voltage measurement, we are able to determine the intervals specifying the degree of brightness during the night and cloudy and sunny days.

## I. INTRODUCTION

The development of technology allows its use in more and more areas of science. An important aspect is the creation of sensors, sensitive to various parameters. The sensor is a device which provides information about the appearance of a particular stimulus, beyond a certain threshold value, or the value of a physical quantity recorded. Two of the most commonly used sensors are temperature sensors and sensors for measuring the brightness. They are also an integral part of the system for measuring sunshine duration. The temperature sensor cooperates with the light sensor to transmit detected sunshine brightness information of summer high-temperature and how long the day is. These sensors can provide useful information regarding cloud cover, enabling to draw a number of conclusions about the weather.

### Sensors:

Photoelectric sensor reacts to the change in the intensity reaching beam. It can be used visible light as well as infrared or laser. Depending on which component is based on the construction of the sensor, other electrical information is changed. If any object is in the optical path between the transmitter and the receiver, a change in light intensity will be detected [4]. This allows us to get information about the cloudy state.

To construct a system for measuring the sunshine duration used NORPS-12, CdS Photocell.

Thermocouples are instruments that respond to change of temperature in the thermodynamic forces embedded in them. The thermocouples are composed of different materials, thermoelectric power arises when the ends of cold weld

and are maintained at different temperatures. The sensitivity depends on the strength of thermocouple thermoelectric materials forming a thermocouple [5]. This project used a thermocouple 103AT-11.

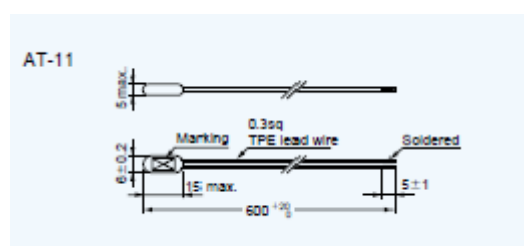


Figure 2. Size and dimensions in mm of thermocouple 103AT-11 [3]

## II. METHOD

Firstly, using Ohm's law set the current value of the system and made the conversion of resistance to voltage drop. Characteristics of the sensor was created from the table of temperature versus resistance. This curve can be fitted by the equation  $f = a \cdot x^b + c$ , where  $a$ ,  $b$  and  $c$  are constants equal to:  $a = 701.51$ ,  $b = -0.140733$ ,  $c = -166.85$ , respectively.  $f$  and  $x$  are resistivity and temperature. As a result, the input signal that describes the voltage drop across the resistor is converted to a temperature value in Celsius degrees with an accuracy of  $0.3^\circ$ .

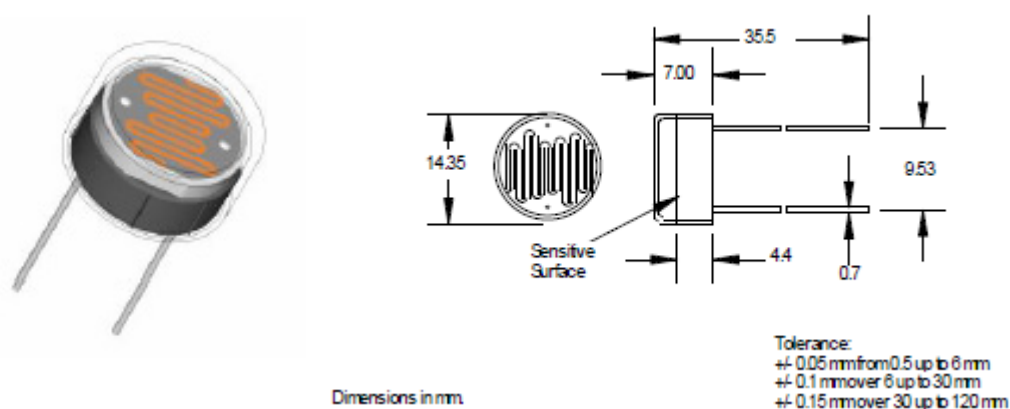


Figure 1. NORPS-12, CdS Photocell [1]

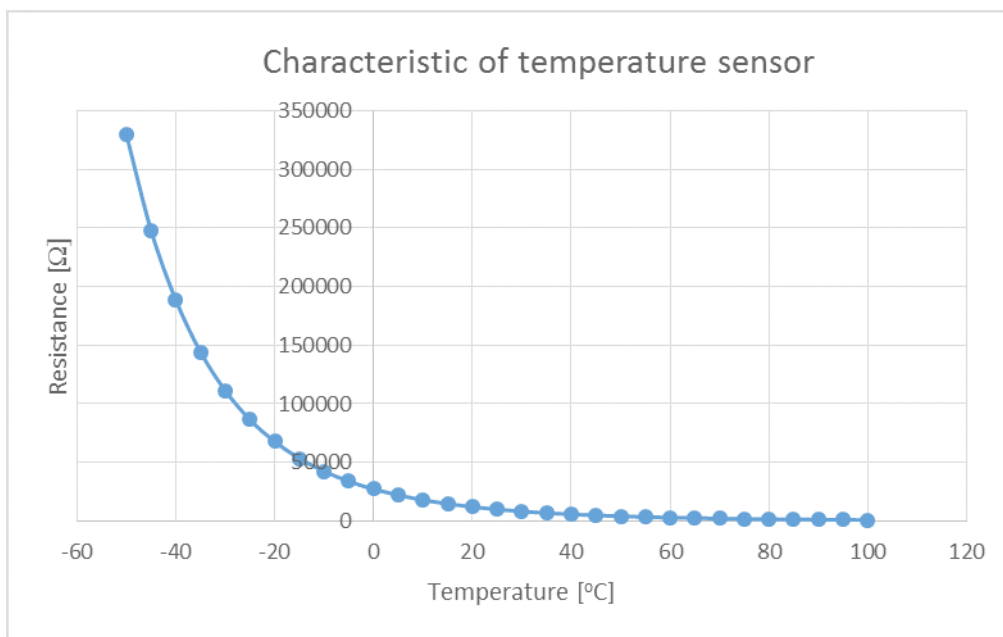


Figure 3. Characteristic of temperature sensor

Temperature sensor is measured by the voltage drop across the resistor at the sensor. The sensor is calibrated by voltage drop contained in the datasheet.

TEMPERATURE	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
RESISTANCE	329500	247700	188500	144100	111300	86430	67770	53410	42470	33900	27280	22050	17960	14690	12090	10000
TEMPERATURE	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	
RESISTANCE	8313	6940	5827	4911	4160	3536	3020	2588	2228	1924	1668	1451	1266	1108	973,1	

Table 1. Sensor resistance dependence on temperature

The sensor used for measuring brightness and temperature are connected in parallel to each other. For processing the received signals used real-time driver my RIO-1900. Measured light sensors is operated by determining the voltage drop across the sensor. When it is dark, the voltage is below 2V. In the case of a cloudy day, voltage varies between 2-3,5V. During a sunny day the voltage is between 3,5-4.5 V.

<2V	night
2V-3,5V	cloudy day
3,5V>4	sunny day

Table 2. Voltage ranges that define the degree of brightness

The information about degree of brightness is displayed in the figure.

### III. CONCLUSIONS

The sunshine duration sensor will make it easier to automatically measure the presence and duration of sunshine. Such a built-in system will allow us to determine the length of day and night in different seasons of the year in easier and fairly accurate way . Futhermore a statistical report of cloudy and sunny days would be possible to prepare. Due to temperature sensor we are able to determine the height of its during the measurements.

### REFERENCES

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