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CHARACTERISTIC STUDY OF COMMERCIALLY AVAILABLE OPTOELECTRONIC IR SENSORS FOR EFFICIENCY IMPROVEMENT

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ABSTRACT

This study was carried out with the intention of identifying the dependency of optoelectronic Infrared (IR) receiver based sensors on the environmental status. The identification of this study can be lead to decide whether those IR sensor based applications are efficient for Sri Lanka as it consumes little power as well widely and popularly used. To identify the dependency under Sri Lankan weather condition the study was carried out with Optoelectronic IR (OIR) receivers with an IR LED as the source. Two specific circuits were designed and constructed in order to power up the IR LED and the IR receivers respectively. The experiment was carried out with three imported OIR receivers using one at a time basis. Measurements were taken for the supply voltage and supply current with the intention of comparing the results with the standard data available in their data sheets. Whenever the Current vs. Voltage characteristic curves are not available in the data sheets the experiment was conducted with a constant voltage and plotted the current by varying the temperature. With graphical analysis of the results for the tolerance range 5% for the OIR receivers, it can be shown that there is a dependency on environmental temperature thus affecting their performance in tropical countries like Sri Lanka. It emphasized the fact that the efficiency of OIR receivers in Sri Lanka will depend on the temperature as there are deviations from the standard values mentioned in foreign environmental conditions. This finding is important and need to do further research with sophisticated devices as there is deviation from the standard values measured in foreign environmental conditions as currently selecting an OIR receiver for an application. The OIR sensor based applications and such implied imported devices are widely used in fields such as medicine, fiber based telecommunication systems, etc. under Sri Lankan atmosphere.

Keywords: Optoelectronics, Optoelectronic IR Receivers, Optoelectronic Sensors, Infrared

1. INTRODUCTION

Optoelectronic IR sensors are under the type of electromagnetic (EM) radiation such as radio waves, ultraviolet radiation, x-rays and microwaves [1]. Optoelectronic devices such as IR sensors are widely used in consumer electronic device applications in Sri Lanka as well as in world wide. OIR light is the part of the EM spectrum that people widely encounter in everyday life, although much of it goes unnoticed [2]. Most of the times it is invisible to human eyes, but people can feel it as heat as well can be used for long distance low attenuation through fiber wave guides. [3] Thus most of the sensors are being used to detect variety of signals related to optoelectronic fields such as biomedical, communication, etc. Thus this type of investigations are important to find out and understanding such important signal detecting OIR sensor behavior as such sensors attached with many important day-to-day utilizing devices in such fields in Sri Lankan atmosphere.

1.1. Infrared sensors

Infrared (IR) technology has been successfully employed in demanded applications for years in manufacturing industries for ongoing temperature measurement and control. Even though this technology offers many proven advantages for end users, instrumentation suppliers continue to develop new solutions further improving the accuracy, reliability and ease-of-use of IR systems in demanding production environments [4].

2. EXPERIMENTAL

In this research both the OIR transmitter and receiver have used to test the OIR sensor characteristics. For this purpose four OIR sensors were chosen namely;

TSOP18, TSOP1738, SFH505A, IR LED

The two circuits constricted for optoelectronic source and sensor under local environment were connected as the circuit diagram shown in Figure 1

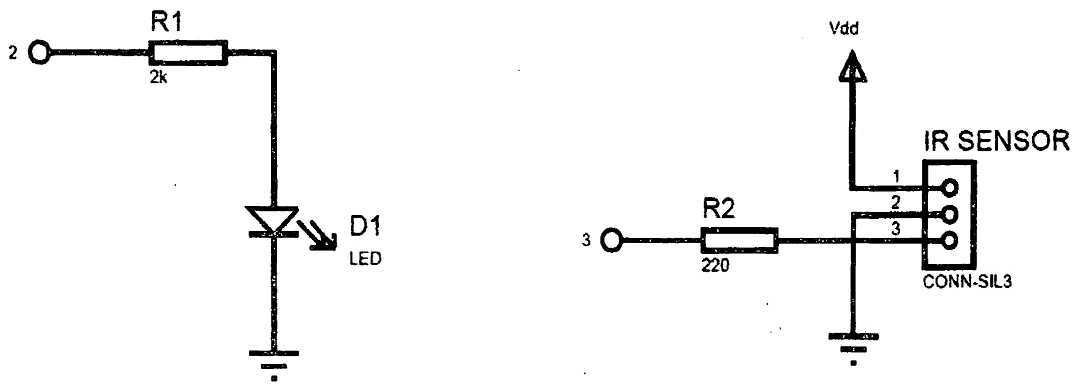

Figure 1: Circuits for OIR LED and OIR sensor respectively

Where

- 2 kΩ, 220 Ω = resistors
- GND = ground
- Vdd = valtage supply

Two multimeters were connected in order to measure the supply voltage and supply current by varying the supply voltage. The readings for current and voltages were measured and recorded. The temperature was recorded at the time of the experiment is carried out. The same experiment was done at a different place of Sri Lanka. Above process was continued for all IR receivers in different places and all the records of Voltages verses Current were recorded and plotted and graphical analysis were done. All the data sheets from the manufacturing companies were collected for each OIR receiver. The plotted curves were compared to analyze whether there is an effect due to the deference in atmospheric condition in Sri Lanka other than the manufacturing country environmental condition dependency of the place.

3. RESULTS AND DISCUSSION

The characteristic curves shown below obtained by plotting the data obtained for IR sources and for all the receivers were illustrated in below Figures

3.1. OIR Receivers and OIR LED

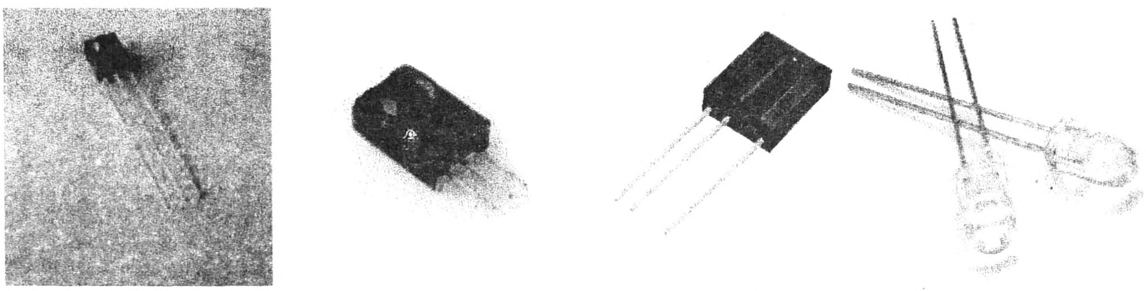

Figure 2: TSOP18, SFH505, TSOP17 OIR Receivers and IR LED respectively

3.2. TSOP18 OIR Detector

The data sheet had an exact leaner graph for the IR receiver and the current varying between 1mA and 1.2 mA. The data sheet values had taken in dark ambient and the data for the experiment was taken in the room temperature at Colombo.

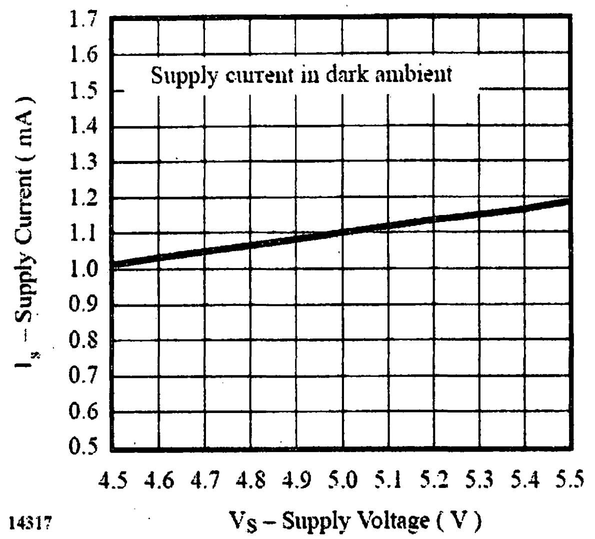

Figure 4: Experimental I-V curve

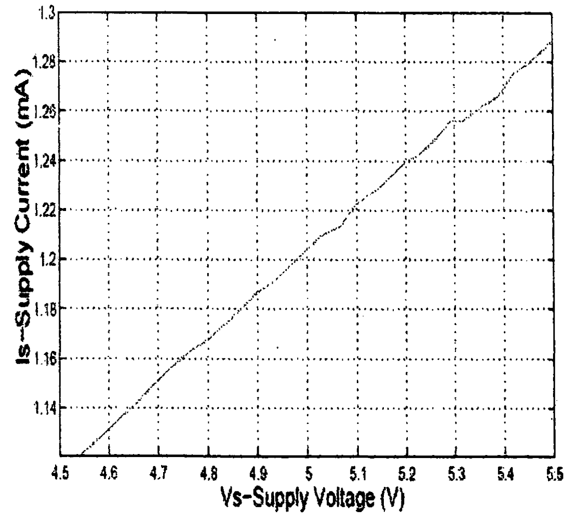

Figure 3: I-V curve from Data sheet

Although there are slight differences between 2 graphs the difference between two graphs can be negligible when considering the environmental temperature.

3.3. SFH505 OIR Receiver

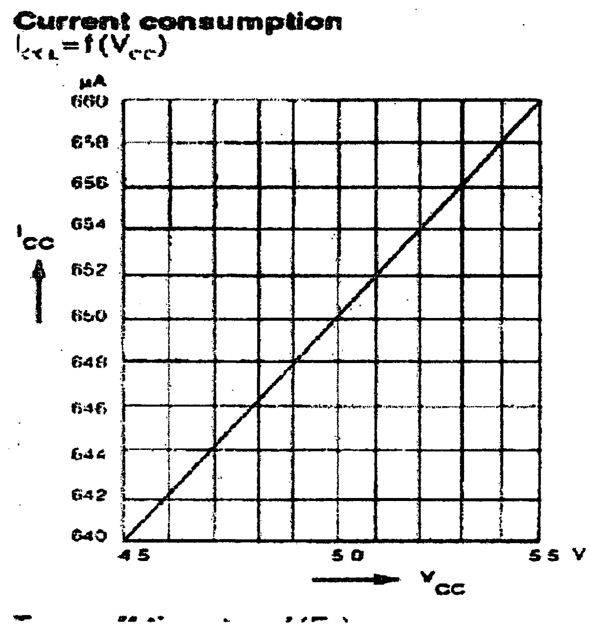

Figure 6: Experimental I-V curve

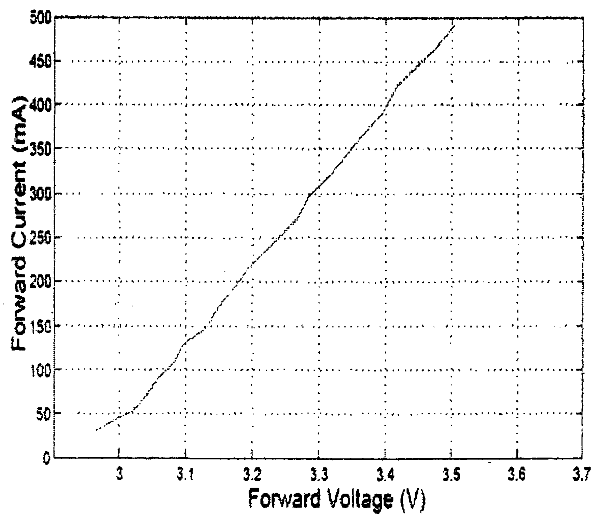

Figure 5: I-V curve from Data sheet

Both graphs have the same linearity except the Supply current is higher in the experiment graph than the graph taken from the data sheet.

This could be happen due to the temperature difference of the place of manufacture and the place experiment was conducted.

3.4. TSOP17 Receiver

In this IR receiver there was no Voltage vs. Current plotted graph. But the data sheet was containing a graph plotted between Current vs. temperature. It was unable to compare between graphs of Current vs. voltage and Current vs. Temperature. At the same time it was unable to measure the temperature below 15 C°. The readings were taken the temperature higher than 16 C°. The voltage was set to 5 V since the voltage should be constant in every instance of the experiment.

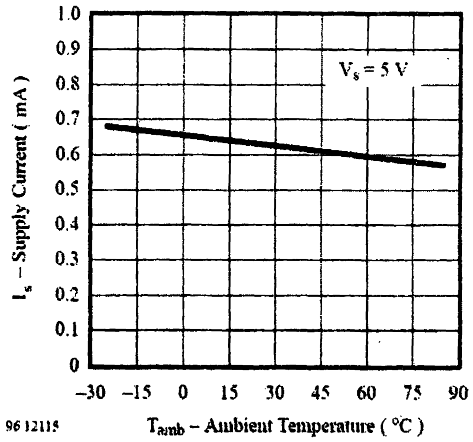

Figure 8: Data sheet I-T curve

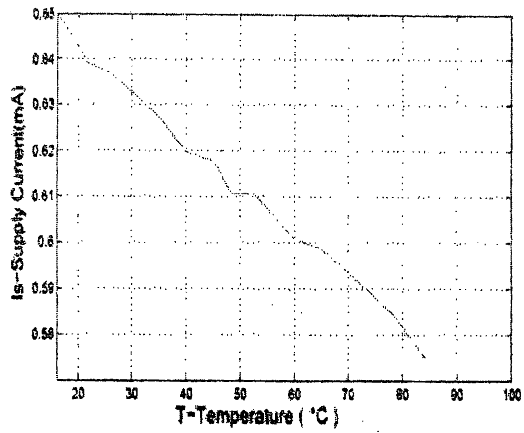

Figure 7: Experimental I-temperature curve

In this situation both graphs having similar graphs. From this graphs it can be identify that the temperature dependency of previous IR detectors can be happened.

3.5. IR LED

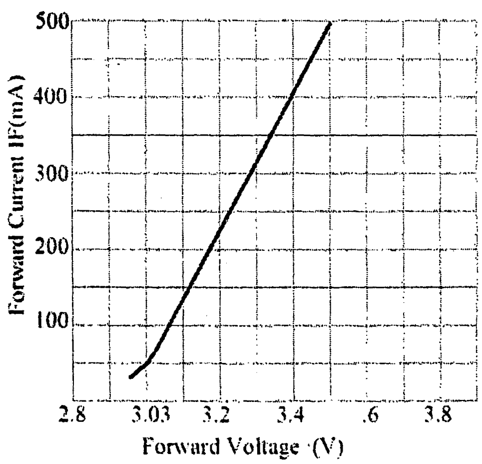

Figure 10: I-V Characteristic graph experimental

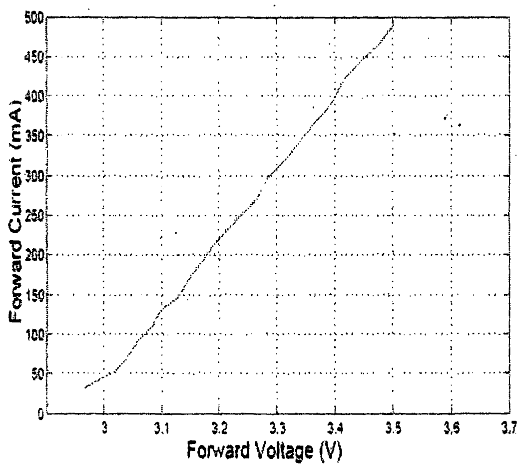

Figure 9: I-V Characteristic graph experimental

This situation also as same as the prevous situations which were taken the I-V charactoristic curves. Temperature dependency of the sensor as well as the LED was obvious.

All the components were dependent on the temperature. It is proven by the graph drawn for the SFH505 Receiver. But on the other hand the results can be varied according to the IR emission from the IR LED. The reason for the temperature dependency can be due to the temperature dependency of the IR LED but not due to the temperature independently.

4. CONCLUSION

In this project a multiple OIR receivers and IR LED were considered, which are used for many applications in Sri Lanka such as TV remote, counting lines, motion sensing, etc. The study was done with the purpose of identifying the dependency of IR receivers on the environment it operates. Selected OIR receivers were tested for characteristic curves. It was identified that the Optoelectronic IR equipment imported would somewhat sensitive for the environment it operates particularly for the OIR receivers they are depending on the temperature it operates.

5. ACKNOWLEDGEMENT

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