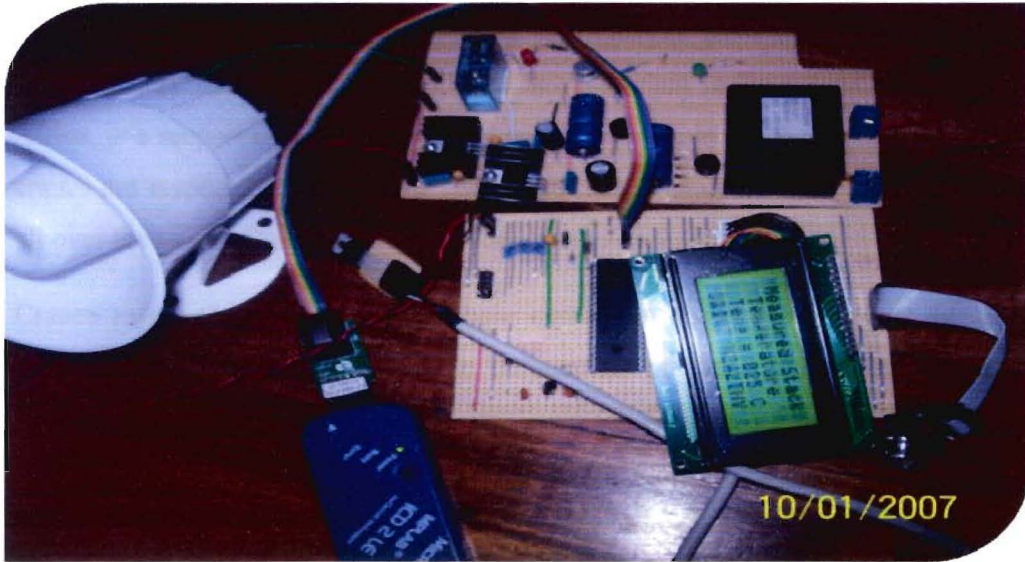




National University of Science and Technology
Faculty of Industrial Technology
Department of Electronic Engineering



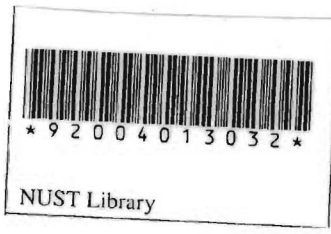
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Project Title: Industrial Thermal Manager

Student Name:

Malvin Nkomo

Student Number:



N0041337M

Supervisor:

Mrs. S.A. Bebova

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Electronic Engineering*

'Failure is not an option' ... Gene Kranz...Apollo 13 Flight Controller

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Abstract

The automation industry is a versatile and most important branch of today's engineering world in that it provides means and mechanisms that enable a small input signal to move mountains of loads. Economies boom as a result of international trade. No man is an island. Chief in trade is the Logistics industry. Tonnes of cargoes are transported from the four cardinal points. Of particular interest is the Drives and Automation Industry which is responsible for industrial automation processes. At sea ports of entry such as the Durban Container Terminal in Kwa-Zulu Natal in South Africa, is a seaport that is the hub of international trade in Southern Africa. Container cranes are responsible for loading and off-loading containers from cargo ships from all over the world. On average a container crane weighs 40 tonnes.

Cranes responsible for conveying these containers contain very robust Electronic Drives that are responsible for the automation of the crane. These are power electronics optimised controllers. A small electrical signal (typically 24V) from an input joystick is converted to drive motors that can produce 500 Kilowatts of power through the drive electrical and electronics unit to hoist the loads. Such huge power conversions suggest heat is lost during the processes. Thyristors are the power devices resident in Electronic Drives that are responsible for the switching on and off of the drives output power. The Thyristors are mounted on heat sinks and the overall layout of the Thyristors and heat sink is termed a **stack**. The stack temperature is an important parameter in the efficient running of the system. If the temperature of the stack exceeds the rated values, the Thyristors may blow up and therefore bring production levels low in that the whole crane needs to be shut down for repair. Hence an efficient thermal management system is needful for the Crane System. The environment in which these drives are operated is very noisy. An alert system is also an important aspect.

A cost-effective means of managing resources in the Crane System is necessary. The drives electronics consists of 12 Thyristors bridge, fully controlled rectifiers. Each Thyristors costs about ZAR5000.00. In the event that all 12 Thyristors fail and blow up because of excess heating, ZAR60 000.00 is needed for repair. If the Crane system has an efficient thermal management system that will see to it that the driver of the crane is warned if the stack temperature approaches its failure point, then whatever

operation was underway can be quickly wrapped off and natural cooling of the stack is allowed to happen. The heat sink has a cooling fan already in operation to continually cool the stack. The design seeks to implement a thermal management system that will closely monitor the stack temperature and give a warning signal in the event that the stack temperature are approaching the system rated temperatures. The design also consist a remote monitoring system in the form of a Graphic User Interface (GUI) to enable monitoring from an office Desktop Personal Computer (PC) or Laptop. Due to the shift to the digital domain that is characterising the electronics arena, state-of-the art thermal sensors, display unit and controllers are utilised in the quest to find an optimal thermal management system.

Durban Container Terminal in Kwa-Zulu Natal, Durban, South Africa

