

LOAD CELL AMPLIFIER AND INDICATOR FOR RUBBER TIRED TRANSFER CRANE IN THE SRI LANKA PORTS AUTHORITY

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ABSTRACT

The aim of this project is to design indicator system to indicate weight that Rubber Tired Transfer Cranes hold. Already this cranes have load cells to measure weight of the load. But the output of load cell is not large enough to be measured accurately. In that case, that output of load cell should be amplified. Also This system is consist of current to voltage converter, Microcontroller, Alarm and light system and Liquid Crystal Display (LCD). Current to voltage converter is used to amplify output of the load cell. Microcontroller is used to control the whole system. Alarm and light system acts like an indicator. If the holding weight is equal or less than four tons, green bulb will be lit. If the holding weight is greater than four tons and equal or less than six tones, yellow bulb will be lit. If the holding weight is greater than six toned and equal or less than seven tons, red bulb will be lit. If the holding weight is greater than seven tones, alarm will be ring. Also holding weight display on Liquid Crystal Display (LCD).

Keywords: Rubber tired transfer crane, Load Cell, Current to voltage converter, Indicator

1. INTRODUCTION

Sri Lanka Ports Authority is the state-owned operator of major commercial ports in Sri Lanka. In Sri Lanka Ports Authority, Jaya Container Terminal is one of the major terminal. In Jaya Container Terminal, Rubber Tired Transfer Cranes and Rail Mounted Gantry Crane are used to move cargo containers. In Rubber Tired Transfer Carnes, there are two types of Transfer Cranes. One type of transfer cranes are used to move loaded cargo containers. Other one is used to move empty cargo containers¹. Maximum weight of empty cargo container is seven

tones. Also the maximum holding limit of Transfer crane, which moves empty cargo containers is seven tones. Any attempt to hold more than seven tones will critically damage the total system. So, holding weight should be calculated. In transfer cranes, there are two load cells to measure weight in containers. Load cell is a sensor or transducer that converts a load force acting on it into an electronic signal. It produces small current which is proportional to the weight of the cargo container. But the output current of load cell is not large enough to be measured accurately². To use this current as a usable input, it should be amplified. Also if operator know weight of container that he hold, it will help to him for reduce damages. The aim of this project is to design indicator system to indicate weight that Rail Mounted Transfer Cranes hold. In this system, the output of load cell is amplified using current to voltage converter circuit.

2. EXPERIMENTAL

This system consists of two Current to Voltage converter circuits, Microcontroller, Alarm and Light indicator circuit and LCD. The output current of load cell is amplified using current to voltage converter. There are two load cells in this crane. Therefore two converter circuits are needed for this system. For the 0-7.5 tones, load cell produced $4-20 \times 10^{-3}$ A current. This converter circuit converts $4-20 \times 10^{-3}$ A current to 0-5v voltage. The output voltage of current to voltage converter is send to microcontroller as an input. 16F877A Microcontroller controls the indicator system. The program was written in mikroC PRO for PIC. There are Alarm and Light indicator circuit in this system. It designed to lit bulbs of several colors and ring alarm, according to holding weight of Crane. Microcontroller is used to compare holding weight with maximum weight that carne can hold. Alarm and light system acts like an indicator. Also holding weight display on LCD.

This current to voltage converter circuit (Figure 2) tested several times. Supplied $4-20 \times 10^{-3}$ A current and marked output voltage according to that current.

3. RESULTS AND DISCUSSION

Figure 1 shows the design of the system for Rubber Tired Transfer Crane. This crane has two load cells. Therefore two current to voltage converters were used for this system.

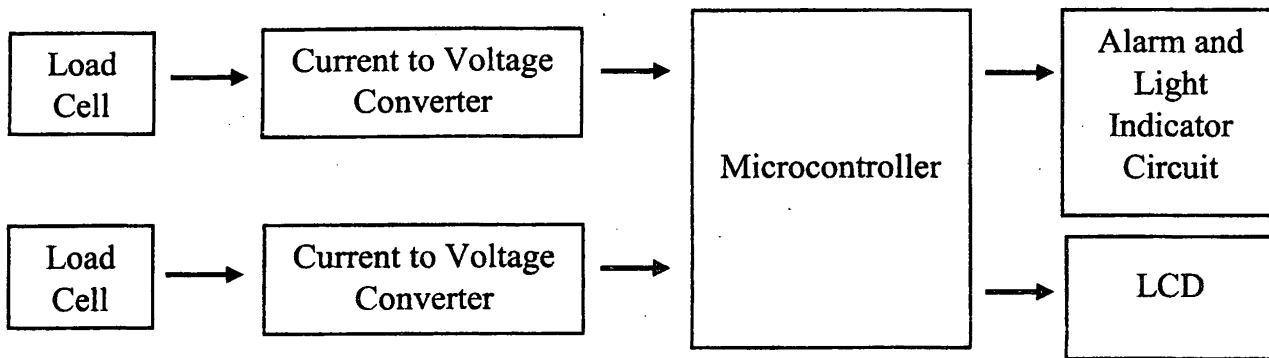


Figure 1: Design of the system

Figure 2 shows the schematic of the current to voltage converter. This converter circuit converts $4-20 \times 10^{-3}$ A current into 0-5 V voltage.

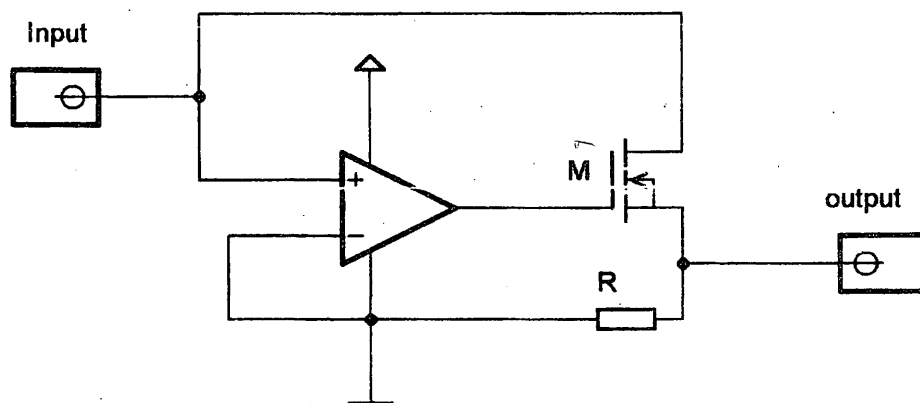


Figure 2: Schematic of current to voltage converter

M is mosfet and R is resistor.

This system is designed to indicate weight that Transfer Crane hold. Maximum weight of empty container is seven tone. Load cell produce current according to holding weight. That current is in between 4×10^{-3} A to 20×10^{-3} A. The output current of load cell convert to voltage using current to voltage converter. This current to voltage converter acts like an amplifier. Graph of the test values were shown in figure 3.

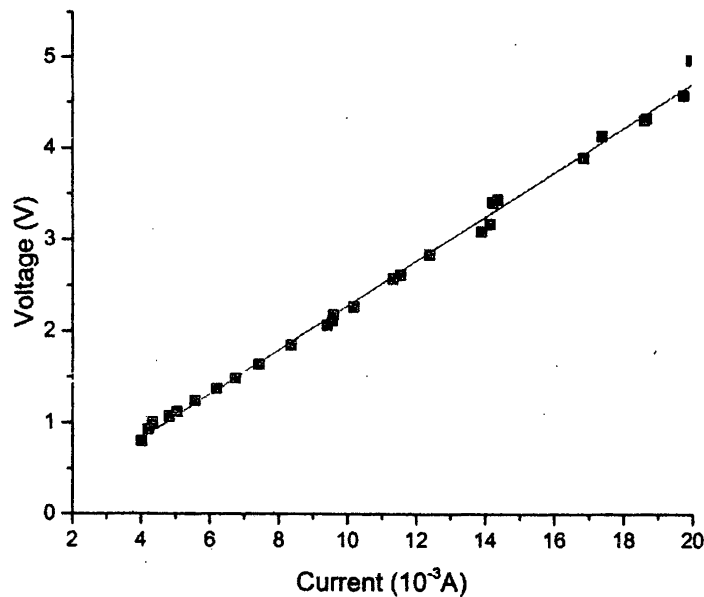


Figure 3: Graph of the tested values

Indicator system is consists of light and alarm system. Due to light system, Operator can identify weight that he hold. When crane hold load over maximum weight, immediately alarm will ring. Due to alarm sound, operator can stop holding that load.

4. CONCLUSION

This Rubber Tired Transfer Crane hold only empty containers. Maximum weight that this crane can hold is seven tone. Any attempt to hold load more than seven tone will critically damage to the whole system of the crane. In that case, if crane has overload protection system and container weight system, it will help to reduce these problems. Using designed system, can overcome these difficulties.

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