LIGHTING SYSTEM FOR CAMERA BARCODE DETECTOR

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This work is dedicated to my beloved Father Dr.Syed Ahmed Al-Gailani

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ABSTRACT

Lighting control system for Camera based barcode reader is a system that automatically controls the illumination of the barcode lighting device by sensing the light intensity reflected off the barcode. Automatic light sensing, comparing the intensity level and illumination control have been developed in order to reduce light reflection from the barcodes. In this project, microcontroller is used to implement the light control strategies such as turn on or off the number of LEDs automatically and thus controls the brightness of the light source. The system has been designed in such a way that, it can capture the barcodes and process them perfectly under different lighting conditions. The different lighting conditions are produced by barcodes printed on different objects such as shiny covers, plastic wraps, round shaped bottle etc. The camera lens is used to detect the light intensity and to send the correct signal to microcontroller to perform the suitable actions. Thus, it reduced the use of extra sensor circuit for light sensing. A digital to analog convertor is used to convert the binary codes into analog voltages. This voltage is supplied to the power circuit for controlling the light intensity. The microcontroller is pre-programmed to do this task efficiently. Finally, some laboratory experiments have been conducted to validate the efficiency of the control circuit.

ABSTRAK

Sistem kawalan lampu untuk Camera berpangkalan pembaca kod bar adalah satu sistem yang secara automatik kawal pencahayaan itu bagi lampu kod bar peranti dengan merasakan keamatan cahaya itu dipantulkan atas kod bar. Penderiaan cahaya automatik, membandingkan aras keamatan dan kawalan pencahayaan telah dimajukan dengan tujuan mengurangkan pantulan cahaya daripada barcodes. Dalam projek ini, mikropengawal adalah sudah biasa melaksanakan cahaya strategi-strategi kawalan seperti memasang atau dari jumlah bagi LEDs secara automatik dan oleh itu kawal kecerahan itu punca cahaya. Sistem itu telah mereka sememangnya satu cara bahawa, ia akan dapat menawan barcodes dan proses mereka dengan sempurna di bawah keadaan cahaya berbeza. Keadaan cahaya berbeza itu adalah dihasilkan oleh barcodes dicetak tentang objek-objek berbeza seperti sampul berkilat, membalut plastik, botol berbentuk bulat dan sebagainya. Kanta kamera digunakan bagi mengesan keamatan cahaya dan bagi menghantar isyarat yang betul untuk mikropengawal membuat persembahan tindakan-tindakan sesuai itu. Oleh itu, ia mengurangkan penggunaan tambahan itu litar penderia untuk penderiaan cahaya. Satu digital untuk analog convertor adalah sudah biasa menukar kod-kod perduaan itu kepada voltan analog. Voltan ini dibekalkan untuk litar kuasa untuk mengawal keamatan cahaya. Mikropengawal dipraprogramkan melakukan tugas ini dengan cekap. Akhirnya, eksperimen-eksperimen makmal beberapa telah dijalankan untuk mensahihkan kecekapan litar kawalan.

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LIST OF ABBREVIATIONS

A/D	-	Analogue to Digital Convertor
CCD	-	Charged Coupled Device.
CD	-	Compact Disk
CDS	-	Cadmium Sulfide
CLK	-	Clock
CMOS	-	Complementary Metal Oxide
COM	-	Communication
CPU	-	Central Processing Unit
3-D	-	Three Dimensional
D/A	-	Digital to Analogue Convertor
EBCS	-	Electronic Barcode Stimulator
FET	-	Field Effect Transistor
FPS	-	Frame Per Second
I/O	-	Input- Output
IR	-	Infrared Red
K	-	Kilo-pixel
LDR	-	Light Dependent Resistor
LED	-	Light Emitting Diode

LVDS	-	Low Voltage Differential Signal
mA	-	Mill ampere
MCU	-	Microcontroller Unit
OP-AMP	-	Operational Amplifier
PC	-	Personal Computer
PDA	-	Personal Digital Assistant
RAM	-	Read Access Memory
ROM	-	Read Only Memory
SI	-	Start Integration
USB	-	Universal Serial Bus
VGA	-	Video Graphics Array

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CHAPTER 1

INTRODUCTION

1.1 Overview

Nowadays cameras are integrated almost in every handheld devices such as mobile phones, and PDAs and they could be an ideal alternatives for dedicated barcode scanner such as, Laser, CCD, and Pen type [1][2]. Moreover, the multi purpose camera based barcode readers such as; web camera has become popular due to its convenience and low-price [3]. But, camera based barcode readers are not dedicated for barcode reading hence; it requires a light source for illumination. Compared to laser readers, camera-based systems provide highly reliable and accurate reading. They can read barcodes from different angles. Since most of the barcodes are printed on complex surfaces such as glossy back cover of books, shiny objects, round shaped bottles or tin cans, the camera based barcode readers often need to read barcodes which are distorted and blurred.

This project intends to provide a lighting control system for camera based barcode reader that can automatically control the illumination which will allow the reader to read barcode under difficult conditions. It is well understood that the quality and appropriateness of lighting for barcode reader are critical aspects for

reading the barcode correctly. In addition to an understanding of illumination types, techniques, different control circuit for barcode light control, a thorough analysis of different complex environment for barcode is investigated. Based on these, several solutions have been proposed to design an effective camera-barcode lighting solution.

1.2 Problem Statements

The problem statements of this project are stated in the following points.

1.2.1 Complex Background Design

Barcodes are printed on all kinds of products. As shown in Figure 1.1, complex cover designs including words and pictures increases the difficulty of barcode reading by barcode reading cameras.

Figure 1.1(a) Barcode printed on shiny book cover. (b) Barcode printed on plastic wrap

1.2.2 Environment Illumination

Barcode may be captured in different illumination environment conditions. For example, in low light, the gray levels of bars and spaces in captured barcode images are greatly affected as shown in Figure 1.2

Figure 1.2 A barcode in low light

1.2.3 Light Reflection

A camera barcode scanner may be affected by reflective properties of the object while reading barcodes. This includes light reflection from the light source of the barcode scanner.

Figure 1.3 Specula effect caused by the light reflected from the camera light source.

1.2.4 Position Adjustment

A robust camera barcode recognition system should be able to capture a barcode image from a wide range of angles and distances. But, the light source does not fall evenly on the barcode from all angles which may greatly affect the recognition process. This will cause uneven illumination.

Figure 1.4 uneven illuminations on barcode from unusual angle

1.2.5 Round and Shiny Surfaces

Barcodes may appear on the cover of cans or bottles as well. Since they are round and shiny such as, the tin surface as shown in Figure 1.5, it is hard for a camera to decode because the bars are distorted due to the reflection of light.

Figure 1.5 Barcode printed on a shiny round object

1.3 Objective

The objective of this project is to develop a proper lighting system for camera barcode reader in order to overcome glare and uneven illumination.

1.4 Scope of Work

This project comprises the following parts;

- Hardware design for lighting system controller.
- Lighting problems:
- Uneven illumination
- Reflection.
- Based on microcontroller.
- Used existing barcode reader software - PC.
- Communication to PC is through serial port.
- Focused type LED based.
- Circuit design using Eagle-win-5.6.0 software

1.5 Proposal Outline

This project report consists of four chapters beginning with a brief introduction. Literature review shall be discussed in the following chapter. The methodology for this research will be revealed in the subsequent chapter. Conclusion and result are presented in Chapter 4. Finally, future improvements are discussed in chapter 5.

1.6 Summary

This chapter defines the importance of this research, the aims and objectives, scope of work as well as the problem statement observed. The outline of the proposal has been described as well.