Electrical & Electronic Engineering: Theory and Applications
Series 1: Embedded System, Mechatronic and Image Processing

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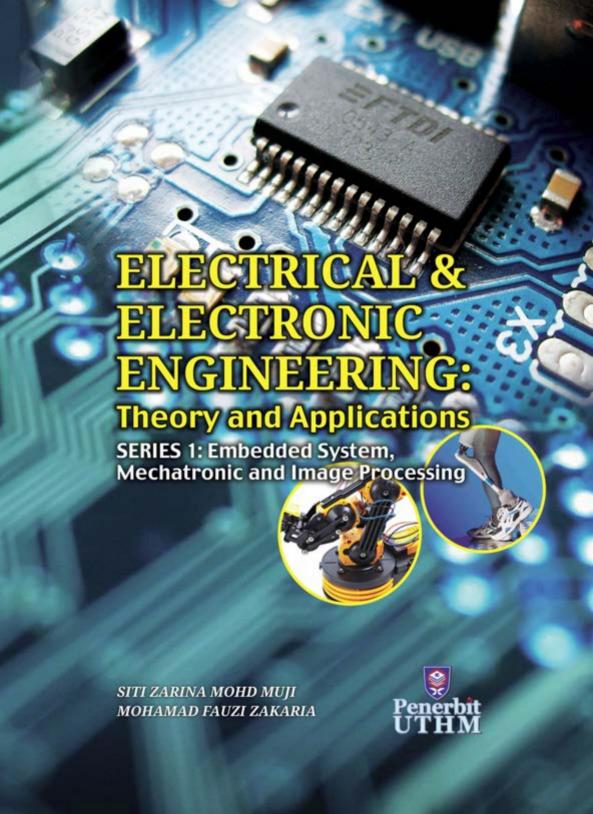Siti Zarina Mohd Muji[1], Mohamad Fauzi Zakaria[2]
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Abstract: There are seven chapters in this book under computer engineering and robotics field. Among the topics that come from different disciplines of knowledge, including optimization algorithms, sensor technology, Arduino, FPGA, equipment, robots and systems on chip (SoC). All the topics discussed from basic to help readers understand easily. There are also included the source code for a particular topic, so it can motivate readers to study it in depth and can use the source code for further investigations.

This book is suitable for university students and researchers also fans of Electrical Engineering courses to enhance their knowledge. Undergraduate students can get a rough idea about certain topics that may be useful for their study and a final year project. Postgraduate students may find this book to help them in getting new knowledge that will be used as input to their research. While the fans can carry out certain techniques in this book to create an innovative project.

Keywords: GLCM1, ultrasonic, arduino, proteus, FPGA

ELECTRICAL & ELECTRONIC ENGINEERING:
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Penerbit
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2015

Contents

Preface

This book is the first of a books series produced by Embedded Computing System (Emcos) Research Focus Group and Advanced Mechatronic Research Group (ADMIRE) Faculty of Electrical and Electronic Engineering (FKEE), Universiti Tun Hussein Onn Malaysia (UTHM). This book is the result of research and development as well as research conducted by the staff of FKEE. It can guide other researchers to improve their knowledge in the field of research, particularly in the area of Electrical and Electronic Engineering.

There are seven chapters in this book under computer engineering and robotics field. Among the topics that come from different disciplines of knowledge, including optimization algorithms, sensor technology, Arduino, FPGA, equipment, robots and systems on chip (SoC). All the topics discussed from basic to help readers understand easily. There are also included the source code for a particular topic, so it can motivate readers to study it in depth and can use the source code for further investigations.

This book is suitable for university students and researchers also fans of Electrical Engineering courses to enhance their knowledge. Undergraduate students can get a rough idea about certain topics that may be useful for their study and a final year project. Postgraduate students may find this book to help them in getting new knowledge that will be used as input to their research. While the fans can carry out certain techniques in this book to create an innovative project.

Therefore, this book should be part of the reference for everyone in the field of Electrical Engineering to guide and improve their knowledge. It is our hope that this booklet is able to produce a smart idea to all readers.

CLASSROOM SURFACE IDENTIFICATION USING GLCM AND MODIFIED ZERNIKE MOMENTS

Fathin Liyana Zainudin
Abd Kadir Mahamad
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Musli Nizam

1.1   INTRODUCTION

One of an important function of a classroom is to ensure the sound resonating from the speaker can be heard clearly by all the recipients. The vital points for reaching the optimum reverberation time are the design on the classroom itself and the surface material chosen. For existing classroom especially it is beneficial if the surface material can be identified directly, thus the sound engineer can re-calculate and re-design the room to enhance the classroom sound overall.

Each material has its own unique texture that varies in its roughness or smoothness, composition, also the groove and curve of its surface. Therefore, for identification of material surfaces in a classroom, the texture of the surface will play a big part. Different methods and

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INTRODUCTION TO ULTRASONIC

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Haizureen Halimi
Siti Syuaibi Nasruddin

2.1   INTRODUCTION

Ultrasonic sensors (also known as transceivers when they both send and receive, but more generally called transducers) work on a principle similar to radar or sonar. This ultrasonic module measures the distance accurately which provides 0cm - 400cm with a gross error of 3cm (Cytron technologies,2013). Ultrasonic sensors generate high frequency sound which is received back by the sensor. Sensors calculate the time interval between trigger sending the signal and echo receiving the signal to determine the distance to an object. We use the ultrasonic sensor to detect the intruders that try to enter a resident house. We divided the distance by 3 parts which are over 100cm, between 30cm to 100cm, and less than 30cm. First part is more than 100cm, that means nobody coming and then the green LED will ON. Second part is between 30cm to 100cm, which means got some people coming and then the yellow LED will ON. The last one is less than 30cm, which means got people nearby our house and the red LED will ON.

For the distance of 26cm which is less than 30cm, the result shown in Figure 2.18, the LCD display "WARNING! INTRUDER 25.8cm" and red LED is on. There has an error of 0.2cm (26cm-25.8cm).

Figure 2.18: The result for the distance in 26cm

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ARDUINO AND PROTEUS

Nurashlida Ali
Siti Zarina Mohd Muji

3.1   GENERAL OVERVIEW

This chapter introduces the way to blink Light-Emitting Diode(LED) in Proteus using Arduino code as program source before test inside real circuit.

3.2   ARDUINO

Arduino is an open –source electronic that easy to use with hardware and software in the same time. Arduino also can sense the environment by receiving input from variety of sensor that can affect by surrounding control. The single board microcontroller board design around an 8-bit Atmel Alf Vegard RISC Processor (AVR) or 32 bit Atmel Advanced RISC Machines (ARM). It also have Universal Serial Bus (USB) interface, 6 analog pins as well as 14 digital I/O pin that attach to extension board. Arduino programs are written using C or C++ to make it user friendly. The founder of brilliant software is Massimo Banzi et. al, 2006.

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ABBREVIATIONS

Atmel ARM   - Advanced RISC Machine

Atmel AVR   - Alf Vegard RISC Processor

LCD   - Liquid Crystal Display

LED   - Light Emitting Diode

PC   - Personal Computer

PCB   - Printed Circuit Board

USB   - Universal Serial Bus

VSM   - Virtual System Modeling

THE FIRST STEP
IN FPGA

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4.1   INTRODUCTION

FPGA or Field Programmable Gate Array is an integrated circuit designed
to be configurable or programmable by a designer after manufacturing.
It can be imagine as a block of lego that we will arrange and create
something new after we make a combination of that lego. FPGA is a
good prototyping for example network processing. It also advantages
for developing a real time system. FPGA design must be consists of
hardware and software development. Thus, before operating the FPGA
hardware, we have to design our system on software. The design software
that we used is a sophisticated CAD system which is Altera Quartus II.
Altera Quartus II design software provides a comprehensive integrated
design environment (IDE) for the digital systems design. There are
various releases of Altera Quartus II design software which is available
in subscription and web editions. The used of Altera Quartus II Web
Edition release 9.0 is very good for educational purpose, however it
is outdated. If we use Quartus II Web Edition release 10 and above

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CROSS CORRELATION FLOW METERS FOR VERTICAL FLOW REGIME USING OPTICAL SENSOR

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Hanis Liyana Mohmad Ameran
Elmy Johana Mohamad
Omar Mohd. Faizan Marwah
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5.1   INTRODUCTION

The work presents an investigation on the use of optical sensors for velocity measurement. In today's, most process have involved the utilization of various pipes or vessels. They use mixture of products that are pumped along pipes (combination product). For example, particulate materials (plastic, grain, and catalysts) are disseminated along pipes by compressed air or pumps in liquid manufacturing process. However, the measurement of the amount delivered can only be done in one way which is using conventional flow meter. The limitation is not inherent to the pumping mechanism; it is simply because the technology for measuring the velocity is not yet being approached in the market. In this project, a twin plane sensor and cross correlation technique will be

100 ms. Using equation (5.1), we can determine the velocity of the bubble as shown below;

$$V = Dt$$
$$= 100 \ mm100ms$$
$$= 1ms\text{-}1$$

5.9   CONCLUSION

The potential of this technique can be applied in some industry process. For example in cooking oil industry, pump oil industry and petroleum industry. This research is expected to approach some mechanism that having ability to the liquid flow velocity. The information obtained is able to help in the process equipment designing, verification of existing computational modelling and simulation techniques. For the future work, this project was up grade with increase the number of pixels to enhance resolution. Besides that, the better laser accessory for transmitter will yield better result and it can collimate or focus the laser through the pipeline. Lastly, the arrangement of photodiode and laser must strategic and alignment.

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MULTI-FINGER ROBOT HAND DYNAMIC MODEL DERIVATION AND SIMULATION

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Mohamad Fauzi Zakaria
Mohamed Najib Ribuan
Sumaiya Mashori

6.1   INTRODUCTION

A mathematical model is a descriptive model that uses mathematical language to describe the behavior of a system. A mathematical model usually describes a system by a set of variables and a set of equations that establish relationships between the variables.

In the modeling analysis, the system can be expressed as a descriptive model to make a hypothesis on how the system should work, or to estimate on how an unforeseeable event could affect the system.

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INTRODUCTION TO SYSTEM ON CHIP (SOC)

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7.1   INTRODUCTION

The application being a complicated day by day, therefore, the use of System On Chip (SOC) is a must in such application. SOC is a complete system that can be implemented on a single chip. In SOC there include embedded processor (Nios , ARM, etc.), HW Accelarator or DSP Processor, memory module (RAM, ROM, Flash, etc,), glue logic, I/O peripheral (UART, USB, LED, etc.), analog interface (ADC, DAC), Others (DMA, timers, PLL).

7.2   THE DIFFERENT BETWEEN SoPC and Qsys

SoPC uses bus based architecture while Qsys uses network on chip architecture. The similarity between them is dynamic system generation and high level system visualization. The concept of Qsys is shown in Figure 7.1. However Qsys sacrify more logic.

```
#include <system.h>
#include <altera_avalon_pio_regs.h>
#include <io.h>
#include <unistd.h>
#include "altera_avalon_lcd_16207_regs.h"
#include "altera_avalon_lcd_16207.h"
int main()
{
FILE*fp;
fp=fopen("/dev/lcd", "w");
if (fp ==NULL) {
fprintf(stderr, "LCD open failed\n"); return 0;
}
fprintf(fp," UTHM Johor Malaysia\n");
fclose(fp);
return 0;
}
```

7.6   ACKNOWLEDGMENTS

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