



# **DESIGN AND IMPLEMENT OF INTELLIGENT VARIABLE FREQUENCY DRIVE**

A thesis submitted to the  
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C degree of Master of Engineering

by  
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## Abstract

Variable voltage variable frequency (VVVF) or  $V/f$  is the most common method of speed control of three phase induction motors. Majority of those operate in applications not requiring high accuracy position control or high accuracy speed control. A variety of  $v/f$  drives are available in market and the speed, acceleration time, deceleration time are set manually. The key feature of the proposed  $v/f$  drive is its ability to sense the external environment and take decisions intelligently. This is ideal when considering a production line. Automation of an induction motor for a particular production line can be done easily with this  $v/f$  drive. The brain of this drive is a Peripheral Interface Controller (PIC). It has 3 PWM outputs. PIC was programmed in assembly language. MPLAB software compiles assembly to hex codes. Three PWM signals generated from PIC are sent to three IGBT drivers which are capable of introducing interlock in order to drive one IGBT on the same leg. The signals are sent through four opto couplers to isolate the controller from disturbances from power side. A speed reference is provided by a potentiometer connected to analog channel. When a speed is input by potentiometer, interrupt service routine activates and the motor could be run at that speed. Numerous other applications are possible with this drive in industry, One is dispenser controller. Another application is flow control and many more. However further research could develop the features of this controller particularly the closed loop feature.

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## DECLARATION

The work submitted in this thesis is the result of my own investigation, except where otherwise stated. It has not already been accepted for any degree, and is also not being concurrently submitted for any other degree.

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## NOMENCLATURE

$C_{GATE}$	gate charge
$C_{gc}$	gate to collector capacitance
$C_{ge}$	gate to emitter capacitance
$E_{OFF}$	turn off energy
$E_{ON}$	turn on energy
$F_S$	switching frequency
$I_{ave}$	collector-to-emitter average current
$I_C$	collector current
$I_{rms}$	drain-to-source rms current
$P_{DFD}$	forward power dissipation of diode
$P_{GATE}$	power dissipation at gate
$P_{SW}$	switching losses
$P_{TDF}$	forward power dissipation of IGBT
$P_{TOT}$	total losses in IGBT
$R_{CE}$	$\Delta V_{CE}/\Delta I_C$
$R_{DS-ON}$	drain-to-source on-state resistance



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$R_{THJC}$	junction to case thermal resistance
$T_C$	case temperature
$T_{JMAX}$	maximum junction temperature
$T_{on}$	turn on delay time
$T_{off}$	turn off delay time
$V_{CE(SAT,MAX)}$	collector to emitter saturation voltage-maximum value
$V_{CE(SAT,TYP)}$	collector to emitter saturation voltage-typical value
$V_{TO(MAX)}$	maximum collector emitter voltage at zero current
$V_{CE0}$	collector emitter voltage at zero current
$V_{CE-SAT}$	collector-to-emitter saturation voltage
$V_{F0}$	diode forward voltage at zero current
$V_{GATE}$	gate voltage



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