

“Dedicated with love my lovely mother, Mrs. Anik Mukhlisoh, my dearest father, Mr. Muhammad Abdul Wahab, my sister, Nisa Isrofi...

...to my teachers, lecturers, especially ENGR HJ. Mohamad Fauzi B. Zakaria and Muhammad Aziz Muslim, ST., MT., Ph.D....

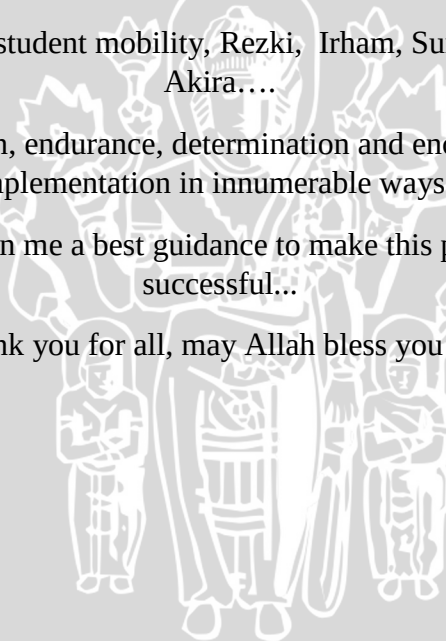
...all my friends, assistant Control System Laboratory, INVERTER 2011, students of Control System engineering UB 2011, UTHM family and all my seniors...

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...Thank you for given me a best guidance to make this project become more successful..

...Thank you for all, may Allah bless you all...”

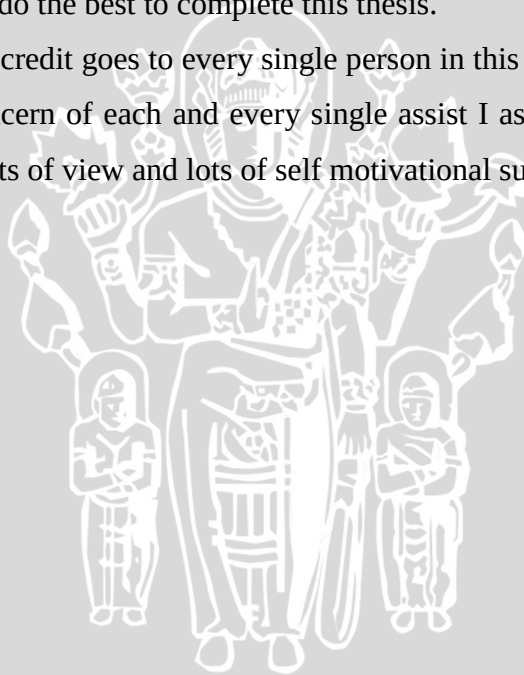


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ABSTRACT

Arrow-bot is a line following robot that have three infrared (IR) sensors and two direct current (DC) motors as configured for differential wheel drive. Its main controller is an ATmega328, which has Arduino UNO bootloader. All line following robots ideally should have a capability to follow the line with accurate, smooth and fast response. The easiest way, to create a line following algorithm is based on bang-bang controller that is providing the robot turn a fixed amount in a particular direction according to the line sensor. However, the robot movement is not smooth and accurate to follow the line. Therefore, it needs an efficient control system algorithm and in this project, the proportional-integral-derivative (PID) controller is used to improve the robot performance. In addition, a few approach has been studied to acquire more accuracy of line data either by using digital or analog sensor concept. Besides, a real-time operating system (RTOS) is used to produce logical and temporal correctness of PID calculation. This RTOS implementation relies on ChibiOS/RT library for AVR microcontroller. In this project, the best PID gains parameter are $K_p = 5.4117$, $K_i = 0.01$ and $K_d = 0.6108$. As a result, the Arrow-bot performs well when implement PID RTOS with analog sensors concept. In conclusion, the line following robot, Arrow-bot with PID algorithm has accurate, smooth, and fast response capability to navigate along the line compared to bang-bang controller algorithm.

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TABLE OF ABBREVIATIONS

RTOS	-	Real Time Operating System
DC	-	Direct Current
ADC	-	Analog To Digital Converter
PWM	-	Pulse Width Modulation
GND	-	Ground
Vcc	-	IC Power-Supply Pin
mm	-	Mili Metre
cm	-	Centi Metre
ms	-	Mili Second
s	-	Second
P	-	Proportional
I	-	Integral
D	-	Differential
PID	-	Proportional Integral Differential
s	-	Pole
IR	-	Infra Red
PCB	-	Printed Circuit Board
UART	-	Universal Asynchronous Receiver-Transmitter
Tx	-	Transmitter
Rx	-	Receiver
I/O	-	Input Output