

## الآية

يقول الله تعالى في كتابه الكريم:

\* (وَسَخَّرَلَكُمْ مَا فِي السَّمَاوَاتِ وَمَا فِي الْأَرْضِ جَمِيعًا مِنْهُ ج

إِنَّ فِي ذَلِكَ لَآيَاتٍ لِّقَوْمٍ يَتَفَكَّرُونَ) \*

الجائية 13

## Dedication

*“In response to those who say to stop dreaming and face reality,  
I say keep dreaming and make reality”*

*“Every Challenging work needs self-effort as well as the guidance  
of those who come before you especially those who are close to  
you.”*

*In our humble efforts we dedicate this to our families,  
friends, co-worker’s teachers and mentors to everyone who’s  
involved in the making this paper appear.*

*Thank you ....*

# ACKNOWLEDGEMENT

First and foremost, we praise and thank Allah for guiding us complete this work, we are also obliged to thank our research supervisors, **Dr.Awadallah Taifour Ali**, Without his assistance and dedicated involvement in every step throughout the process, this paper would have never been accomplished, we would like to thank you very much for your support and understanding over these past years.

# **ABSTRACT**

This project presents a driverless metro train system, which is used in most of the developed countries. Driverless trains are equipped with a control system, which is programmed to make them follow a specific path. The metro train system door automatically opens and closes and if any obstacle appears in front of the train it will be detected. The train is programmed for a specific path between two stations. Warnings are automatically generated by a buzzer. A prototype of such metro train system implemented using Arduino Mega 2560. Simulation for the system's circuit is done with Proteus software. The hardware circuits are interfaced with sensors for automation purposes. The Language used for programming is Arduino C.

## المستخلص

يقدم هذا المشروع نظام مقطورة بدون سائق ، والذي يستخدم في معظم الدول المتقدمة. تحتوي هذه المقطورة على نظام تحكم مبرمج للعمل في مسار محدد. يتم فتح وإغلاق أبواب المقطورة بصورة آلية. في حالة ظهور أي عائق في مسار العربة فإنها تتوقف بصورة آلية. تعمل هذه العربة في مسار محدد بين محطتين. يوجد صوت تنبيه في حالة وجود أي عوائق. النموذج المصغر لهذا النظام تم تطبيقه باستخدام متحكم من نوع Arduino Mega. أستخدم برنامج Proteus لعمل محاكاة للدائرة الكهربائية للنظام. أستخدمت أنواع مختلفة من المحسسات لأغراض التحكم. اللغة المستخدمة في البرمجة هي Arduino C.

# TABLE OF CONTENTS

	Page NO.
الآية	i
DEDICATION	ii
ACKNOWLEDGEMENT	iii
ABSTRACT	iv
المستخلص	v
TABLE OF CONTENTS	vi
LIST OF FIGURES	viii
LIST OF ABBREVIATIONS	xi
<b>CHAPTER ONE</b>	
<b>INTRODUCTION</b>	
1.1 General	1
1.2 Problem Statement	1
1.3 Research Objectives	1
1.4 Methodology	2
1.5 Project Layout	2
<b>CHAPTER TWO</b>	
<b>THEORETICAL BACKGROUND</b>	
2.1 Introduction	3
2.2 Automatic Control	3
2.3 A Brief History of Automatic Control	4
2.4 Arduino Controller	5
2.5 Railway System	6
2.5.1 History of Railway Evolution	7

2.5.2 Railway Electrification System	7
2.5.3 Railway Intelligent Transportation System	8
<b>CHAPTER THREE</b>	
<b>SYSTEM'S HARDWARE AND SOFTWARE</b>	
3.1 System Description	10
3.2 System Hardware	11
3.2.1 Arduino Mega 2560	11
3.2.2 Ultrasonic HC-SR04	12
3.2.3 IR Sensor Module	14
3.2.4 L239D Motor Driver IC	15
3.2.5 LDR	15
3.2.6 5V co2 Laser Red pointer	16
3.2.7 Buzzer	17
3.3 System Software	17
3.3.1 System Code	17
3.3.2 system Simulation	18
<b>CHAPTER FOUR</b>	
<b>SYSTEM IMPLEMENTATION</b>	
<b>CHAPTER FIVE</b>	
<b>CONCLUSION AND RECOMMENDTIONS</b>	
5.1 Conclusion	26
5.2 Recommendations	26
Appendix	27
References	37

## LIST OF FIGURES

Figure NO.		Page NO.
3.1	Automatic control of a railway system	10
3.2	Arduino Mega 2560	12
3.3	HC-SR04 ultrasonic	13
3.4	Operation of Ultrasonic	13
3.5	IR sensor module	14
3.6	IR indirect mode	14
3.7	L239D Motor driver IC pins	15
3.8	LDR Internal structure	16
3.9	5v co2 Laser Red Pointer	16
3.10	Buzzer	17
3.11	Flow chart of proposed system	18
3.12	System Simulation	19
4.1	The Arduino joined with the breadboard	21
4.2	Plugging in the motor driver to the breadboard	21
4.3	Plugging in the regulator to the breadboard	21
4.4	connections between the motor driver and regulator	22
4.5	the two ultrasonic connected to the Arduino Mega	23
4.6	IR sensors connected to the Arduino	23
4.7	Red laser pointer fabricated to the body	24
4.8	Installation of dc motor	24
4.9	Wires connection of dc motor	24
4.10	Buzzer plugged to the board and the Arduino	25
4.11	The assembled hardware system	25



## LIST OF ABBREVIATIONS

CPU	Central Processing Unit
IR	Infra-Red
LCD	Liquid Cristal Display
IC	Integrated Circuit
USB	Universal Serial Bus
AC	Alternating Current
DC	Direct Current
I/O	Input/output
IDE	Integrated Development Environment
R	Resistor
GND	Ground
VCC	5 Volt
LDR	light dependent resistor
DPSS	Diode Pumped Solid State

## LIST OF SYMBOLS

v	Volt
mA	Milliampere
kB	Kilo byte
MHz	Mega hertz
mm	Millimeter
g	Gram
cm	Centimeter
s	Distant (meter)
v	Speed (meter/second)
MΩ	Mega ohm