Sudan University of Science and Technology

College of Engineering

Electronics Engineering Department

Automatic Number Plate Recognition Using Radio Frequency Identification

A Research Submitted in Partial fulfillment for the Requirements of the Degree of B.Sc. (Honors) in Electronics Engineering

Prepared By:

1. Mohammed Al-waleed Taj-Elsir Altayeb
2. Ali Ahmed Ali Al-noor
3. Magdi Saeed Hasab-Alrasoul Dafa-allah
4. Mustafa Hussein Ali Mustafa

Supervised By:

Dr. Yasser Obaid

October 2017

DECLARATION

باسم الله والحمدلله والصلاة والسلام على رسول الله وعلى آله وصحبه أجمعين ،أما بعد ..

قال تعالى:

"وَقُل رَّبِّ زِدْنِي عِلْمًا"

سورة طه آية 114

DEDICATION

We dedicate this research to our parents, who raised us well, told us right from wrong, make sure we had a good education and help us reach this point of higher education, without them we wouldn’t be here.

Also, this research is dedicated to brothers, sisters and family for sharing our journey with us, for make sure that we have all the support we need.

Our friends are never forgotten, for always providing us with much love and support.

ACKNOWLEDGEMENTS

We express our deep sense of gratitude to ALLAH, for giving us the opportunity to reach this point in our life.

We are very grateful for Dr. Yasser Obeid Mohammed, Project Supervisor for his valuable guidance, keen interest and encouragement at various stages of our research.

ABSTRACT

The main purpose of this report is to evidently prove proper functionality of the system that allows only authorized people or vehicles to enter a particular area of an establishment through a security Beam Gate and developing a system that achieves this by using RFID technology. We used an Arduino-based RFID reader that uses an electromagnetic field which interacts with unique tags. Each tag contains a unique identification code with which a person could access the area. By emitting low-level radio frequency magnetic field the RFID energizes the tag. By bringing the tag closer to the sensor the tag responds via radio waves transmitting its unique identification data and the gate automatically opens if the tag holds information confirmed by the main server. If it doesn’t confirm the data the gate remains closed. The system presented in this work is implemented using described components and means of operation. During different test sets the system confirms its proper operation achieving our design objectives.

المستخلص

الهدف الاساسي من هذا البحث هو توضيح وشرح طريقة عمل بوابة أمن تعمل بتقنية التعرف بالترددات الراديوية لإدخال الاشخاص او العربات المخول لها الى المنشئة سواء كانت مؤسسة حكومية او شركة خاصة وتطوير نظام يقوم بتحقيق هذه العملية بصورة اتوماتيكية. تم استخدام قارئ يستخدم المجالات الكهرومغناطيسية تتفاعل معها مجموعة خاصة من البطاقات الممغنطة، تحمل كل بطاقة بيانات هوية الحامل او الموظف، وبتقريب البطاقة من القارئ تقوم بإرسال البيانات عبر الموجات الراديوية الى القارئ ومن ثم الى النظام (السيرفرز-الخوادم) ليتم تقرير ما اذا سيتم فتح الباب او لا اعتمادا على وجود او توافق البيانات الموجودة على البطاقة مع البيانات المسجلة مسبقا في النظام كفاتها. بنيت الدائرة الموضحة في هذا العمل باستخدام العناصر المختارة وخلال اختبارات متعددة اكدت كفاءة عملها ونجاعتها في تحقيق الاهداف التي بنيت من اجلها.

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	DECLARATION	I
	DEDICATION	II
	ACKNOWLEDGEMENTS	III
	ABSTRACT	IV
	ABSTRACT IN ARABIC	V
	TABLE OF CONTENTS	VI
	LIST OF FIGURES	VIII
	LIST OF ABBREVIATIONS	IX
1	**INTRODUCTION**	1
	1.1 Introduction	3
	1.2 Problem Statement	4
	1.3 Proposed Solution	4
	1.4 Methodology	4
	1.5 Research Outlines	5
2	**Literature Review**	6
	2.1 Literature Review	8
3	**System components**	10
	3.1 Radio-frequency identification (RFID)	12
	3.1.1 Frequency Bands	14
	3.1.2 Benefits of RFID	15
	3.1.3 Limitations of RFID	16
	3.1.4 Applications OF RFID	16
	3.1.5 MFRC522	17

	3.1.6 RFID Transponders (tags)	18
	3.2 Arduino	19
	3.2.1 Arduino Boards	19
	3.2.2 Advantages of Using Arduino Boards	20
	3.2.3 Features of Arduino Boards	21
	3.2.4 Types of Arduino Boards	22
	3.2.4.1 Arduino Uno	22
	3.2.4.2 LilyPad Arduino Board	22
	3.2.4.3 RedBoard Arduino Board	23
	3.2.4.4 Arduino Mega Board	24
	3.2.4.5 Arduino Leonardo Board	24
	3.2.4.6 The Arduino Shields	25
	3.3 Servo Motor	26
	3.3.1 Types of Servo Motors	27
	3.3.1.1 Positional rotation servo	27
	3.3.1.2 Continuous rotation servo	27
	3.3.2 Linear servo	28
	3.3.3 Analog vs. Digital Servos	28
	3.3.3.1 Analog Servos	28
	3.3.3.2 Digital Servos	28
4	**System Description**	29
5	**Conclusion and Recommendation**	33
	5.1 Conclusion	35
	5.2 Recommendation	35
	References	37

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE
3.1	RFID Security Gate	12
3.2	An RF passive RFID tag	15
3.3	MFRC522	17
3.4	Simplified Block Diagram of the MFRC522	18
3.5	RFID Tags	19
3.6	Arduino Uno	22
3.7	LilyPad Arduino Board	22
3.8	RedBoard Arduino Board	23
3.9	Arduino Mega Board	24
3.10	Arduino Leonardo Board	24
3.11	The Arduino Shields	25
3.12	A Servo Motor	26

LIST OF ABBREVIATIONS

3D	Three Dimension
AC	Alternative Current
AIDC	Automatic Identification and Data Capture
CNC	Computer Numerical Control
DC	Direct Current
DOD	Department of Defense
EAS	Electronic Article Surveillance
FIFO	First In First Out
FTDI	Future Technology Devices International
GSM	Global System for Mobile
HF	High Frequency
I2C	Inter-Integrated Circuit
IC	Integrated Circuit
IDE	Integrated Development Environment
IEC	International Electrotechnical Commission
IFF	Identification Friend or Foe
IOT	Internet of Things
ISO	International Standardization Organization

LCD	Liquid Crystal Display
LF	Low Frequency
PC	Personal Computer
PWM	Pulse Width Modulation
RFID	Radio Frequency Identification
SRAM	Static Random Access Memory
SPI	Serial Peripheral Interface
UART	Universal Asynchronous receiver-transmitter
UHF	Ultra High Frequency
USB	Universal Serial Bus

Chapter one

Introduction

Chapter One
Introduction

1.1 Introduction
1.2 Problem Statement
1.3 Proposed Solution
1.4 Methodology
1.5 Research Outlines

Chapter One
Introduction

1.1 introduction:

The deployment and use of Radio Frequency Identification (RFID) technology is growing rapidly across many different industries. Developers apply the technology not only in traditional applications such as asset or inventory tracking, but also in security services such as electronic passports and RFID-embedded credit cards. However, RFID technology also raises a number of concerns regarding privacy, security and law enforcement.

Radio Frequency Identification (RFID) technology is a non-contact, automatic identification technology that uses radio signals to identify, track, sort and detect a variety of objects including people, vehicles, goods and assets without the need for direct contact (as found in magnetic stripe technology) or line of sight contact (as found in bar code technology).

RFID technology can track the movements of objects through a network of radio-enabled scanning devices over a distance of several meters. A device called an RFID tag (or simply a tag) is a key component of the technology. An RFID tag usually has at least two components:

1. An integrated circuit for modulating and demodulating radio signals and performing other functions.

2. An antenna for receiving and transmitting the signal.

An RFID tag can perform a limited amount of processing and has small amount of storage.

Systems that make use of RFID technology are typically composed of three key elements:

1. An RFID tag, or transponder, that carries object-identifying data.
2. An RFID tag reader, or transceiver, that reads and writes tag data.
3. A back-end database, that stores records associated with tag contents.

Each tag contains a unique identity code. An RFID reader emits a low-level radio frequency magnetic field that energizes the tag. The tag responds to the reader’s query and announces its presence via radio waves, transmitting its unique identification data. This data is decoded by the reader and passed to the local application system via middleware. The middleware acts as an interface between the reader and the RFID application system. The system will then search and match the identity code with the information stored in the host database or backend system. In this way, accessibility or authorization for further processing can be granted or refused, depending on results received by the reader and processed by the database.

1.2 Problem Statement:

Getting only authorized people or cars to enter a particular area of an establishment using RFID technology.

1.3 Proposed Solution:

To develop and implement an electronic circuit capable of recognizing the RFID tags, the authorized persons are provided with unique tags, using which they can access that area.

1.4 Methodology:

To gather most of the information needed from the internet and books. After acquired important information through reading relevant books such as basic electronic books and digital electronics with the consultation of our supervisor. Then develop the system, assemble and finally test it for proper operation.

1.5 Research outlines:

Chapter 1: Introduces the work and describes the work problem and proposed solution along with research approach and outlines.

Chapter 2: presents a literature review.

Chapter 3: describes system components.

Chapter 4: provides details of system operation and components interconnection.

Chapter 5: gives work conclusion and recommendation.

Chapter two

Literature Review

Chapter Two

Literature Review

2.1 Literature Review

Chapter Two

Literature Review

2.1 Literature Review:

The first RFID application was the "Identification Friend or Foe" system (IFF) and it was used by the British in the Second World War. Transponders were placed into fighter planes and tanks, and reading units could query them to decide whether to attack. Successors of this technology are still used in armies around the world.

The first commercial RFID application was the "Electronic Article Surveillance" (EAS). It was developed in the seventies as a theft prevention system. It was based on tags that can store a single bit. That bit was read when the customer left the store and the system would sound alarm when the bit was not unset. In the end-seventies RFID tags made its way into the agriculture for example for animal tagging.

Commercial applications of RFID can be found today in supply chain management, automated payment systems, airline baggage management, and so on. According to RFIDupdate.com, one of the catalysts for the RFID industry has been mandates issued by Wal-Mart and the US Department of Defense (DOD) for their suppliers to adopt RFID technology. Although the market has not grown quickly or as large as originally expected, these two mandates continue to be important drivers in development of the industry.

In June 2003, the world's largest retailer, Wal-Mart, sent out a request to its top 100 suppliers to put RFID tags on all cases and pallets of consumer goods shipped to a limited number of Wal-Mart distribution centers and stores. While the deployment of the RFID project continued, Wal-Mart indicated in 2006 that "out-of-stock items carrying RFID tags could be replenished three times faster than they were before the project began. However, not all companies have found RFID technology that helpful. A number of smaller Wal-Mart suppliers have had trouble justifying the investment in implementing RFID in their supply chain in order to meet Wal-Mart's expectations.

Similar to Wal-Mart, the US Department of Defense (DOD) began a policy in July 2004, requesting vendors supplying goods directly or indirectly to the DOD integrate RFID into their shipping procedures. This mandate triggered a number of DOD suppliers to test RFID, or run pilot projects in order to comply with the new requirements.

Another adoption of RFID technology has been by governments, with the electronic passport project. In a number of countries, traditional paper passports are gradually being replaced with passports embedded with a small integrated circuit. Biometric information, such as face recognition, fingerprints or iris scans are stored in the electronic passport. The electronic passport project was initiated by the US, requesting all countries participating in the Visa Waiver Program issue passports with integrated circuits. The main objectives are for automated identity verification, and for greater border protection and security

Chapter Three

System Components

Chapter Three

System components

3.1.1 Radio Frequency Identification (RFID)
3.1.2 Frequency Bands
3.1.3 Benefits of RFID
3.1.4 Limitations of RFID
3.1.5 Applications OF RFID
3.1.6 MFRC522
3.1.7 RFID Transponders (tags)
3.2 Arduino
3.2.1 Arduino Boards
3.2.2 Advantages of Using Arduino Boards
3.2.3 Features of Arduino Boards
3.2.4 Different Types of Arduino Boards
3.2.5 Arduino Uno
3.2.6 LilyPad Arduino Board
3.2.7 RedBoard Arduino Board
3.2.8 Arduino Mega Board
3.2.9 Arduino Leonardo Board
3.2.10 The Arduino Shields
3.3.1 Servo Motor
3.3.2 Types of Servo Motors
3.3.3 Analog vs. Digital Servos

Chapter Three
System components

The system is built using three main components that work together to accomplish design objectives, these are:

- RFID circuit.
- Arduino Uno.
- Servo motor.

Figure 3.1: RFID Security Gate

3.1 Radio Frequency Identification (RFID):

Radio-Frequency Identification (RFID) system like the one of Figure 3-1, uses electromagnetic fields to automatically identify and track tags attached to objects. The tags contain electronically stored information. Passive tags collect energy from a nearby RFID reader's interrogating radio waves. Active tags have a local power source such as a battery and may operate at hundreds of meters from the RFID reader. Unlike a bar-code, the tag need not be within the line of sight of the reader, so it may be embedded in the tracked object. RFID is one method for Automatic Identification and Data Capture (AIDC).

RFID tags are used in many industries, for example, an RFID tag attached to an automobile during production can be used to track its progress through the assembly line; RFID-tagged pharmaceuticals can be tracked through warehouses; and implanting RFID microchips in livestock and pets allows for positive identification of animals.

Since RFID tags can be attached to cash, clothing, and possessions, or implanted in animals and people, the possibility of reading personally linked information without consent has raised serious privacy concerns. These concerns resulted in standard specifications development addressing privacy and security issues.

RFID tagging is an ID system that uses small radio frequency identification devices for identification and tracking purposes. An RFID tagging system includes the tag itself, a reader device, and a host system application for data collection, processing, and transmission. An RFID tag (sometimes called an RFID transponder) consists of a chip, some memory and an antenna.

RFID tags that contain their own power source are known as active tags. Those without a power source are known as passive tags. A passive tag is briefly activated by the radio frequency (RF) scan of the reader. The electrical current is small -- generally just enough for transmission of an ID number. Active tags have more memory and can be read at greater ranges.

Increasingly, RFID tagging is used in supply chain management as an alternative to bar code technology. Although more expensive to use than the bar code stickers, RFID tags don't get dirty or fall off or require an unobstructed line-of-sight between the tag and the reader.

There are almost endless possible uses for RFID tagging. Injectable ID chips have been used to track wildlife and livestock for over a decade. An injectable RFID tag called the VeriChip can be used to help medical personnel identify a patient who is unable to speak -- and even provide access to the person's medical records.

RFID tagging is somewhat controversial because the tags could theoretically be cloned or used for illicit tracking.

3.1.1Frequency Bands:

RFID tags fall into three regions in respect to frequency:

- Low frequency (LF, 30 - 500 kHz).
- High frequency (HF, 10 - 15MHz).
- Ultra high frequency (UHF, 850 - 950MHz, 2.4 - 2.5GHz, 5.8GHz).

LF tags are cheaper than any of the higher frequency tags. They are fast enough for most applications, however for larger amounts of data the time a tag has to stay in a readers range will increase. Another advantage is that low frequency tags are least affected by the presence of fluids or metal. The disadvantage of such tags is their short reading range. The most common frequencies used for low frequency tags are 125 - 134.2 kHz and 140 - 148.5 kHz.

HFtags have higher transmission rates and ranges but also cost more than LF tags. Smart tags are the most common member of this group and they work at 13.56MHz.

UHF tags have the highest range of all tags. It ranges from 3-6 meters for passive tags like the RF tag shown in Figure 3-2 and 30+ meters for active tags.

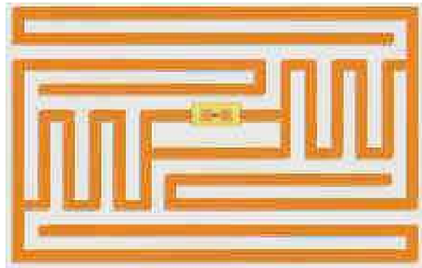

Figure 3-2: An RF passive tag

In addition the transmission rate is also very high, which allows to read a single tag in a very short time. This feature is important where tagged entities are moving with a high speed and remain only for a short time in a readers range. UHF tags are also more expensive than any other tag and are severely affected by fluids and metal. Those properties make UHF mostly useful in automated toll collection systems. Typical frequencies are 868MHz (Europe), 915MHz (USA), 950MHz (Japan), and 2.45GHz.

Frequencies for LF and HF tags are license exempt and can be used worldwide; however frequencies for UHF tags differ from country to country and require a permit.

3.1.2Benefits of RFID:

Though RFID is not likely to entirely replace commonly used barcodes in the near future, the following advantages suggest to additionally apply RFID for added value of identification:

- Tag detection not requiring human intervention reduces employment costs and eliminates human errors from data collection.
- As no line-of-sight is required, tag placement is less constrained.
- RFID tags have a longer read range than, e. g., barcodes.

- Tags can have read/write memory capability.
- An RFID tag can store large amounts of data additionally to a unique identifier.
- Unique item identification is easier to implement with RFID.
- Its ability to identify items individually rather than generically.
- Tags are less sensitive to adverse conditions (dust, chemicals, physical damage etc.).
- Many tags can be read simultaneously.
- RFID tags can be combined with sensors.
- Automatic reading at several places reduces time lags and inaccuracies in an inventory.
- Tags can locally store additional information.

3.1.3Limitations of RFID:

A. Standardization.
B. Cost The cost of tags depends on their type.
C. Collision Attempting to read several tags at a time may result in signal collision and ultimately to data loss.
D. Security and privacy it may become necessary to prevent unauthorized persons from reading or writing data stored on or transmitted from tags.

3.1.4Applications of RFID:

1. Security and access control:

   RFID has long been used as an electronic key to control who has access to office buildings or areas within office buildings. The first access control systems used low-frequency RFID tags. Recently, vendors have introduced 13.56 MHz systems that offer longer read range.

2. Payment systems:

RFID is all the rage in the supply chain world, but the technology is also catching on as a convenient payment mechanism. One of the most popular uses of RFID today is to pay for road tolls without stopping.

3. Supply chain management:

   RFID technology has been used in closed loop supply chains or to automate parts of the supply chain within a company's control for years.

4. Manufacturing:

   RFID has been used in manufacturing plants for more than a decade. It's used to track parts and work in process and to reduce defects, increase throughput and manage the production of different versions of the same product.

5. Asset Tracking:

   It's no surprise that asset tracking is one of the most common uses of RFID. Companies can put RFID tags on assets that are lost or stolen often, that are underutilized or that are just hard to locate at the time they are needed.

3.1.5MFRC522:

Figure 3-3: MFRC522

Figure 3-3 presents an MFRC522 which is a highly integrated reader/writer IC for contactless communication at 13.56 MHz the MFRC522 reader supports ISO/IEC 14443 A/MIFARE and NTAG the MFRC522's internal transmitter is able to drive a reader/writer antenna designed to communicate with ISO/IEC 14443 A/MIFARE cards and transponders without additional active circuitry.

The receiver module provides a robust and efficient implementation for demodulating and decoding signals from ISO/IEC 14443 A/MIFARE compatible cards and transponders. The digital module manages the complete ISO/IEC 14443 a framing and error detection (parity and CRC) functionality.

The MFRC522 which is presented in block diagram format in Figure 3-4supports contactless communication and uses MIFARE higher transfer speeds up to 848 kBoud in both directions.

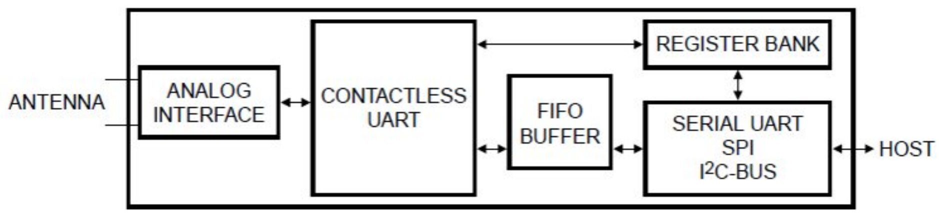

Figure 3-4: Simplified block diagram of the MFRC522

The following host interfaces are provided:

- Serial Peripheral Interface (SPI).
- Serial UART.
- I2C-bus interface.

The analog interface handles the modulation and demodulation of the analog signals. The contactless UART manages the protocol requirements for the communication protocols in cooperation with the host. The FIFO buffer ensures fast and convenient data transfer to and from the host and the contactless UART and vice versa. Various host interfaces are implemented to meet different customer requirements.

3.1.6RFID Transponders (tags):

Figure 3-5: RFID Tags

An RFID tag similar to those of Figure 3-5 contains the component listed next:

- Microchip.
- Antenna.
- Case.
- Battery (for active tags only).

The size of the chip depends mostly on the Antenna. Its size and form is dependent on the frequency the tag is using. The size of a tag also depends on its area of use. It can range from less than a millimeter for implants to the size of a book in container logistic. In addition to the microchip, some tags also have rewritable memory attached where the tag can store updates between reading cycles or new data like serial numbers.

3.2 Arduino:

3.2.1 Arduino Boards:

Arduino board was designed in the Ivrea Interaction Design Institute intended for students. This board started altering to adapt to new requirements and challenges, separating its present from simple 8-bit boards to products for IoT (Internet of Things) applications, 3D printing, wearable, and embedded surroundings. All boards are entirely open-source, allowing users to build them separately and finally adapt them to their exact needs. Over the years the Arduino boards has been used to build thousands of projects, from daily objects to compound scientific instruments. An international community of designers, artists, students, programmers, hobbyists and experts has gotten together around this open source stage, their donations have added up to an unbelievable amount of available knowledge that can be of immense help to beginners and specialists alike.

Arduino board is an open-source platform used to make electronics projects. It consists of both a microcontroller and a part of the software or Integrated Development Environment (IDE) that runs on your PC, used to write & upload computer code to the physical board. The platform of an Arduino has become very famous with designers or students just starting out with electronics, and for an excellent cause.

3.2.2 Advantages of using Arduino boards:

Arduino board has been used for making different engineering projects and different applications. The Arduino software is very simple to use for beginners, yet flexible adequate for advanced users. It runs windows, Linux and Mac. Teachers and students in the schools utilize it to design low cost scientific instruments to verify the principles of physics and chemistry. There are numerous other microcontroller platforms obtainable for physical computing. The Net media's BX-24, Parallax Basic Stamp, MIT’s Handy board, Phi get and many others present related functionality.

Arduino also makes simpler the working process of microcontroller, but it gives some advantages over other systems for teachers, students and beginners.

- Inexpensive
- Cross-platform
- Simple, clear programming environment
- Open source and extensible software
- Open source and extensible hardware

3.2.3 Features of Arduino Boards:

The list of Arduino boards includes the following:

- Arduino Uno.
- LilyPad Arduino.
- Red Board.
- Arduino Mega.
- Arduino Leonardo.

Main features of Arduino board are presented in tabular form in table 3-1.

Table 3-1: Arduino boards features

Arduino Board	**Processor**	**Memory**	**Digital I/O**	**Analogue I/O**
Arduino Uno	16Mhz ATmega328	2KB SRAM, 32KB flash	14	6 input, 0 output
Arduino Due	84MHz AT91SAM3X8E	96KB SRAM, 512KB flash	54	12 input, 2 output
Arduino mega	16MHz ATmega2560	8KB SRAM, 256KB flash	54	16 input, 0 output
Arduino Leonardo	16MHz ATmega32u4	2.5KB SRAM, 32KB flash	20	12 input, 0 output

3.2.4 Types of Arduino Boards:

3.2.4.1Arduino Uno:

Figure 3-6: Arduino Uno

The Uno shown in Figure 3-6 is a huge option for your initial Arduino. It consists of 14-digital I/O pins, where 6-pins can be used as PWM (pulse width modulation outputs), 6-analog inputs, a reset button, a power jack, a USB connection and more. It includes everything required to hold up the microcontroller; simply attach it to a PC with the help of a USB cable and give the supply to get started with an AC-to-DC adapter or battery.

3.2.4.2LilyPad Arduino Board:

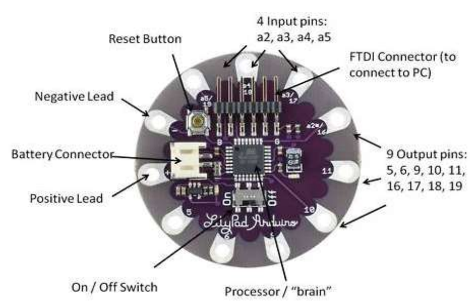

Figure 3-7: LilyPad Arduino Board

The Lily Pad Arduino board of Figure 3-7 is a wearable e-textile technology expanded by Leah "Buechley" and considerately designed by

“Leah and SparkFun”. Each board was imaginatively designed with huge connecting pads & a smooth back to let them to be sewn into clothing using conductive thread. This Arduino also comprises of I/O, power, and also sensor boards which are built especially for e-textiles. These are even washable.

3.2.4.3RedBoard Arduino Board:

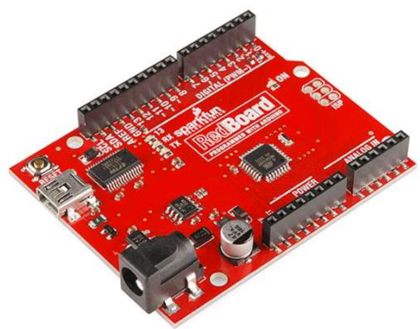

Figure 3-8: RedBoard Arduino Board

The RedBoard Aduino board that can be seen in Figure 3-8 can be programmed using a Mini-B USB cable using the Arduino IDE. It works on Windows 8 without having to modify your security settings.It is more constant due to the USB or FTDI chip we used and also it is entirely flat on the back. Creating it is very simple to utilize in the project design. Just plug the board, select the menu option to choose an Arduino UNO and you are ready to upload the program. You can control the RedBoard over USB cable using the barrel jack.

3.2.4.4Arduino Mega Board:

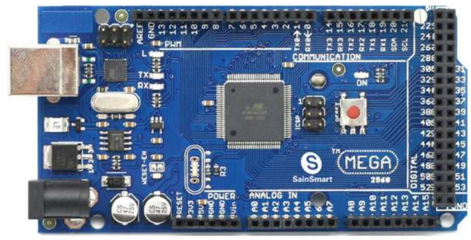

Figure 3-9: Arduino Mega Board

The Arduino Mega that looks as shown in Figure 3-9 is similar to the UNO's big brother. It includes lots of digital I/O pins (from that, 14-pins can be used as PWM o/ps), 6-analog inputs, a reset button, a power jack, a USB connection and a reset button. It includes everything required to hold up the microcontroller; simply attach it to a PC with the help of a USB cable and give the supply to get started with an AC-to-DC adapter or battery.The huge number of pins make this Arduino board very helpful for designing the projects that need a bunch of digital i/ps or o/ps like lots buttons.

3.2.4.5Arduino Leonardo Board:

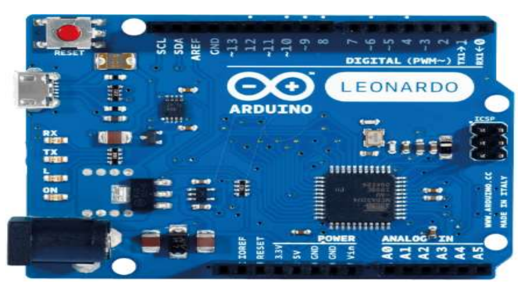

Figure 3-10: Arduino Leonardo Board

The first development board of an Arduino is the Leonardo board of Figure 3-10. This board uses one microcontroller along with the USB. That means, it can be very simple and cheap also. Because this board handles USB directly, program libraries are obtainable which let the Arduino board to follow a keyboard of the computer, mouse, etc.

3.2.4.6The Arduino Shields:

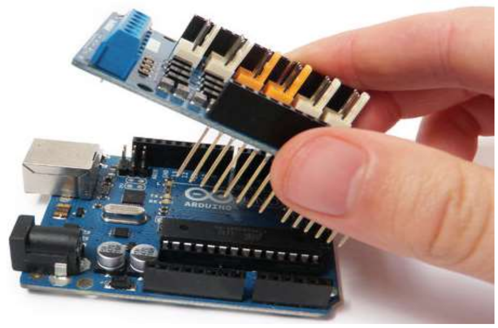

Figure 3-11: The Arduino Shields

Additionally, Arduino shields are pre built circuit boards used to connect to a number of Arduino boards. These shields like those of Figure 3-11 fit on the top of the Arduino compatible boards to provide an additional capabilities like connecting to the internet, motor controlling, providing wireless communication, LCD screen controlling, etc…

The different types of an Arduino shields are:

- Wireless Shields.
- The GSM Shield.
- The Ethernet Shield.
- The Proto Shields.

3.3 Servomotor:

Figure 3-12: a servo-motor

A servomotor that looks like what is presented in Figure 3-12 is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors.

Servo motors have been around for a long time and are utilized in many applications. They are small in size but pack a big punch and are very energy-efficient. These features allow them to be used to operate remote-controlled or radio-controlled toy cars, robots and airplanes. Servo motors are also used in industrial applications, robotics, in-line manufacturing, pharmaceutics and food services.

Servomotors are used also in applications such as robotics, CNC machinery or automated manufacturing.

The type of motor is not critical to a servomotor and different types may be used. At the simplest, brushed permanent magnet DC motors are used, owing to their simplicity and low cost. Small industrial servomotors are typically electronically commutated brushless motors.

For large industrial servomotors, AC induction motors are typically used, often with variable frequency drives to allow control of their speed. For ultimate performance in a compact package, brushless AC motors with permanent magnet fields are used, effectively large versions of Brushless DC electric motors.

Most modern servomotors are designed and supplied around a dedicated controller module from the same manufacturer. Controllers may also be developed around microcontrollers in order to reduce cost for large-volume applications.

3.3.1Types of servo motors:

Servos come in many sizes and in three basic types: positional rotation, continuous rotation, and linear.

3.3.1.1 Positional rotation servo:

This is the most common type of servo motor. The output shaft rotates in about half of a circle, or 180 degrees. It has physical stops placed in the gear mechanism to prevent turning beyond these limits to protect the rotational sensor. These common servos are found in radio-controlled cars and water-and aircraft, toys, robots, and many other applications.

3.3.1.2 Continuous rotation servo:

This is quite similar to the common positional rotation servo motor, except it can turn in either direction indefinitely. The control signal, rather than setting the static position of the servo, is interpreted as the direction and speed of rotation. The range of possible commands causes the servo to rotate clockwise or counterclockwise as desired, at varying speed, depending on the command signal. You might use a servo of this type on a radar dish if you mounted one on a robot. Or you could use one as a drive motor on a mobile robot.

3.3.2 Linear servo:

This is also like the positional rotation servo motor described above, but with additional gears (usually a rack and pinion mechanism) to change the output from circular to back-and-forth. These servos are not easy to find, but you can sometimes find them at hobby stores where they are used as actuators in larger model airplanes.

3.3.3Analog vs. Digital Servos:

Analog and digital servos look exactly the same. The difference is in the way they signal and process information.

3.3.3.1 Analog Servos:

Operate based on on/off voltage signals that come through the PWM. When this type of servo is resting, the PWM is essentially off unless you transmit an action. Producing torque from the resting mode makes the initial reaction time sluggish, which can cause problems in advanced R/C applications.

3.3.3.2 Digital Servos:

Use a small microprocessor to receive and direct action at high frequency voltage pulses. The digital servo sends 300 pulses per second, where the analog only operates at 50 pulses per second. These faster pulses provide consistent torque for quicker and smoother response times. This is a great benefit, but digital servos consume a lot more power.

Chapter Four

System Description

Chapter Four

System Description

As mention earlier in chapter three, in our circuit RFID is used, servo motor and Arduino are used to accomplish design objective. Arduino board is the main controller of the system. All other components are directly connected to it.

The main idea is that there are tags that should be place in the vehicles of company x. Tags' information are registered and saved the system data base. Any employer in x have a car, his tag has identified number. An RFID readerlocated before the gate at approximately (5-10) meters sense the RF from the tag then send a signal to the controller, which analyzes the signal to acquire its original data then passes it to data base.At this point tag number is compared with those in the database, if this vehicle is an authorizedone the controller permits opening the gate and show the tag details like the name of employee, the car type, driver (if there is a driver), image of the car and the person, time of entrance and number of entries. After that these information is saved automatically to be available if it is need sometime later.

According to all those steps a car is allowed to enter then there is another tag reader after the gate for ascertainment of the entry process in order to immediately close the door automatically and whole process is done by the same algorithm.

Basically, an RFID system consists of three components: an antenna or coil, a transceiver (with decoder) and a transponder (RF tag) electronically programmed with unique information.In every RFID system, the transponder tags contain unique identifying information. This information can be as little as a single binary bit or a large array of bits representing any type of information that can be stored in digital binary format.

The RFID transceiver communicates with a passive tag. Passive tags have no power source of their own and instead derive power from the incident electromagnetic field. Commonly, at the heart of each tag is a microchip. When the tag enters the generated RF field, it is able to draw enough power from the field to access its internal memory and transmit its stored information. When the transponder tag draws power in this way, the resultant interaction of the RF fields causes the voltage at the transceiver antenna to drop in value. This effect is utilized by the tag to communicate its information to the reader. The tag is able to control the amount of power drawn from the field and by doing so it can modulate the voltage sensed at the transceiver according to the bit pattern it wishes to transmit.

Antennae are the conduits between the tag and the transceiver which control the system's data acquisition and communication. These are available in a variety of shapes and sizes. Often, the antenna is packaged with the transceiver and decoder to become a reader, which can be configured either as a hand held or a fixed-mount device. The reader emits radio waves in ranges of anywhere from 2.54 cm (one inch) to 30 meters or more, depending upon its power output and the radio frequency used. When an RFID tag passes through the electromagnetic zone, it detects the reader's activation signal. The reader decodes the data encode din the tag's integrated circuit (silicon chip) and the data is passed to the host computer for processing.

An RFID tag comprises a microchip containing identifying information and an antenna that transmits this data wirelessly to the reader. At its most basic, the chip will contain a serialized identifier, or license plate number, that uniquely identifies that item, similar to the way many bar codes are used today.Active transponders have their own transmitters and power source, usually in the form of a small battery. These remain in a low-power 'idle' state until they detect the presence of the RF field being sent by the reader. When the tag leaves the area of the reader, it again powers down to its idle state to conserve its battery. As a result, active tags can be detected at a greater range than passive tags.

Chapter Five

Conclusion and Recommendations

Chapter Five
Conclusion and Recommendation

5.1 Conclusion
5.2 Recommendation

Chapter Five
Conclusion and Recommendation

5.1 Conclusion:

This research work details a description of a system that provides a gate security control using RFID technology. This results in more privacy by allows only authorized people to enter any important and sensitive establishment by controlling entrance.

RFID mechanism depends on electromagnetic fields generated from the reader (sensor) by supplying constant value of power. Tag is read when the reader emits a radio signal that activates the transponder, which sends data back to the transceiver which acts as a middleware between tags and system server. Information (like person name, his picture, car number and type) of any unique tag should be already saved in data base associated with tag number plate or serial number. When a tag information matches a previous saved one this permits the gate to automatically open. System also able to save data of the process if we need it any time later.

The circuit to be developed is first tested by a simulation to examine correctness of operation and components values. Then the system is built using required hardware components and during almost all test trials made it performs properly which means work objectives are achieved.

5.2 Recommendation:

There are some points researchers should work in developing in the future:

- Surveillance of the entree process, system should include a camera to monitor the operation or any surveillance method.
- Incompatibility of different RFID tags from different manufactures represent a real issue have to be improved.

References

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Appendix:

Arduino Code:

```
#include <EEPROM.h>        // We are going to read and write PICC's UIDs from/to EEPROM
#include <SPI.h>           // RC522 Module uses SPI protocol
#include <MFRC522.h>           // Library for Mifare RC522 Devices
#include <Servo.h>
Servo myservo;
/////////////////////////////////////////////////////////////////////
#define redLed 7         // Set Led Pins
#define greenLed 6
/////////////////////////////////////////////////////////////////////
String readCard;
uint8_t successRead;           // Variable integer to keep if we have Successful Read from Reader
byte storedCard[4];             // Stores an ID read from EEPROM
//byte readCard;               // Stores scanned ID read from RFID Module
/////////////////////////////////////////////////////////////////////
// Create MFRC522 instance.
#define SS_PIN 10
#define RST_PIN 9
MFRC522 mfrc522(SS_PIN, RST_PIN);
//////////////////////////////////////// Get PICC's UID //////////////////////////////////
uint8_t getID() {
// Getting ready for Reading PICCs
```

```
if ( ! mfrc522.PICC_IsNewCardPresent()) {            //If a new PICC
placed to RFID reader continue
return 0;
}
if ( ! mfrc522.PICC_ReadCardSerial()) {          //Since a PICC placed
get Serial and continue
return 0;
}
//There are Mifare PICCs which have 4 byte or 7 byte UID care if you
use 7 byte PICC
// I think we should assume every PICC as they have 4 byte UID
//Until we support 7 byte PICCs
//Serial.println (F("Scanned PICC's UID:"));
for ( uint8_t i = 0; i < 4; i++) {
//readCard[i] = mfrc522.uid.uidByte[i];
byte inChar = mfrc522.uid.uidByte[i];
readCard += inChar;
}
Serial.print(readCard);
readCard="";
}
Serial.println("");
mfrc522.PICC_HaltA();       //Stop reading
return 1;
delay(3000);
}
//////////////////////////////////////////READ RFOM SERIAL/////////////////////////
```

```
void Read(){
if (Serial.available()){
int bite = Serial.read();
if(bite=='*'){
bite=Serial.read();
if(bite=='1'){
myservo.write(90);
digitalWrite(greenLed,HIGH);
digitalWrite(redLed,LOW);
//delay(2000);
//myservo.write(-90);
//digitalWrite(6,LOW);
}
else{
myservo.write(-90);
digitalWrite(redLed,HIGH);
digitalWrite(greenLed,LOW);
//myservo.write(0);
}
}
}}
///////////////////////////////////////// Setup ///////////////////////////////////
void setup() {
myservo.attach(3);
//Arduino Pin Configuration
pinMode(redLed, OUTPUT);
pinMode(greenLed, OUTPUT);
```

```
digitalWrite(7,HIGH);
//Protocol Configuration
Serial.begin(9600);       // Initialize serial communications with PC
SPI.begin();           //MFRC522 Hardware uses SPI protocol
mfrc522.PCD_Init();        // Initialize MFRC522 Hardware
//   Serial.println(F("smart parking using RFID"));       // For debugging
purposes
}
/////////////////////////////////////////// Main Loop ////////////////////////////////////
void loop () {
successRead = getID();         //sets successRead to 1 when we get read
from reader otherwise 0
Read();
}
```