DEVELOPMENT AND IMPLEMENTATION OF AUTOMATIC TROLLEY SYSTEM FOR DISABLED, AGED AND PEOPLE

Submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Computer Science and Engineering

By

SENTHILVEL (REG.NO:39110921)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SCHOOL OF COMPUTING

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited with Grade "A" by NAAC

JEPPIAAR NAGAR, RAJIV GANDHISALAI,

CHENNAI - 600119

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SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the Bonafide work of **SENTHILVEL (Reg.No: 39110921)** who carried out the project entitled "**DEVELOPMENT AND IMPLEMENTATION OF AUTOMATIC TROLLEY SYSTEM FOR DISABLED, AGED AND PEOPLE**" under my supervision from June 2021 to November 2021.

Internal Guide

DR. L. SUJIHELEN, M.E, Ph.D.

Head of the Department

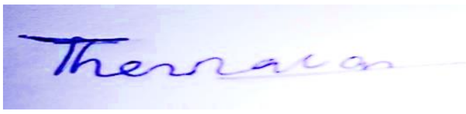
Dr. L. LAKSHMANAN, M.E., Ph.D.

Submitted for Viva voce Examination held on 20.4.2023

Internal Examiner **External Examiner**

DECLARATION

I, **SENTHILVEL (Reg.No:39110921)** hereby declare that the project report entitled "**DEVELOPMENT AND IMPLEMENTATION OF AUTOMATIC TROLLEY SYSTEM FOR DISABLED, AGED AND PEOPLE"** done by me under the guidance of **DR. L. SUJIHELEN, M.E, Ph.D.** is submitted in partial fulfilment of the requirements for the award of Bachelor of Engineering Degree in Computer Science and Engineering.



DATE:20.4.2023

PLACE: Chennai **SIGNATURE OF THE CANDIDATE**

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ABSTRACT

Every day in different countries, shopping is carried out by every category of people. Currently, people going shopping have to push around trolleys loaded with a lot of merchandise and this is so stressful and difficult to push around. We aim to solve the current problem stated above and also ease mobility during shopping as customers such as nursing mothers with more than one child to take care of find it stressful to shop. To overcome this, we plan on automating the current trolley system by controlling the robotic trolley with hand gestures. The transmission device interfaces with an Arduino ATMEGA microcontroller, which receives signals and propels the robot based on its user's hand gesture. It reduces the stress of pushing around a shopping cart and can be controlled by hand gestures.

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CHAPTER - 1

INTRODUCTION

In recent years, robot technology has developed significantly. Most of the traditional robots are still commonly used for industrial applications, such as in car assembly factories. Meanwhile, intelligent robots have become popular in daily life applications. Human-friendly robots are now used for taking care of the elderly. The purpose of a human following a robot is to improve the relationship between people and the robot. For instance, the robot can carry heavy loads for people in hospitals, airports and shopping centres. The robot can provide services to humans as an assistant in different kinds of situations. In robotic research, vision-based robots have gained growing interest for navigation, however, the traditional method of line following navigation still plays an important role in mobile robot technology.

This is because a robot with line following capability requires a lower cost to build and has a simple design. Besides, the application of Radio Frequency Identification (RFID) technology for robots nowadays has become popular, especially in the localization scheme. It is a non-touching recognition system that can tag and send tag data wirelessly at various distances. In this project, a portable robot with human and line following functions is developed. In the next section, we highlight the research background on the problems related to shopping trolleys.

1.1 ARDUINO UNO:

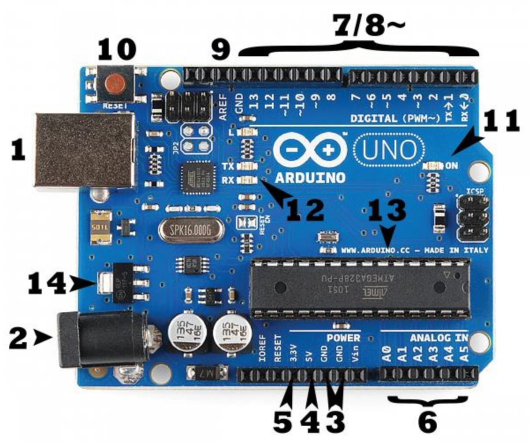
Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

The Arduino platform has become quite popular with people just starting out with electronics, and for good reason.

Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board – you can simply use a USB cable.

Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the microcontroller into a more accessible package.

The Uno is one of the more popular boards in the Arduino family and a great choice for beginners.



Power (USB / Barrel Jack)

- Every Arduino board needs a way to be connected to a power source. The Arduino UNO can be powered from a USB cable coming from your computer or a wall power supply (like this) that is terminated in a barrel jack. In the picture above the USB connection is labelled **(1)** and the barrel jack is labelled **(2)**.
- The USB connection is also how you will load code onto your Arduino board. More on how to program with Arduino can be found in our Installing and Programming Arduino tutorial.
- **NOTE:** Do NOT use a power supply greater than 20 Volts as you will overpower (and thereby destroy) yourArduino. The recommended voltage for most Arduino models is between 6 and 12 Volts.

Pins (5V, 3.3V, GND, Analog, Digital, PWM, AREF)

The pins on your Arduino are the places where you connect wires to construct a circuit (probably in conjunction with a breadboard and some wire.

They usually have black plastic ‘headers’ that allow you to just plug a wire right into the board. The Arduino has several different kinds of pins, each of which is labelled on the board and used for different functions.

- **GND (3)**: Short for ‘Ground’. There are several GND pins on the Arduino, any of which can be used to ground your circuit.
- **5V (4) & 3.3V (5)**: As you might guess, the 5V pin supplies 5 volts of power, and the 3.3V pin supplies 3.3 volts of power. Most of the simple components used with the Arduino run happily off of 5 or 3.3 volts.
- **Analog (6)**: The area of pins under the ‘Analog In’ label (A0 through A5 on the UNO) are Analog In pins. These pins can read the signal from an analog sensor (like a temperature sensor) and convert it into a digital value that we can read.
- **Digital (7)**: Across from the analog pins are the digital pins (0 through 13 on the UNO). These pins can be used for both digital input (like telling if a button is pushed) and digital output (like powering an LED).
- **PWM (8)**: You may have noticed the tilde (~) next to some of the digital pins (3, 5, 6, 9, 10, and 11 on the UNO). These pins act as normal digital pins, but can also be used for something called Pulse-Width Modulation (PWM). We have a tutorial on PWM, but for now, think of these pins as being able to simulate analog output (like fading an LED in and out).
- **AREF (9)**: Stands for Analog Reference. Most of the time you can leave this pin alone. It is sometimes used to set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog input pins.

BOARD DESCRIPTION:

Arduino board can be powered by using the USB cable from your computer. All you need to do is connect the USB cable to the USB connection (1).

Power (Barrel Jack)

Arduino boards can be powered directly from the AC mains power supply by connecting it to the Barrel Jack (2).

Voltage Regulator

The function of the voltage regulator is to control the voltage given to the Arduino board and stabilize the DC voltages used by the processor and other elements.

Crystal Oscillator

The crystal oscillator helps Arduino in dealing with time issues. How does Arduino calculate time? The answer is, by using the crystal oscillator. The number printed on top of the Arduino crystal is 16.000H9H. It tells us that the frequency is 16,000,000 Hertz or 16 MHz.

Arduino Reset

You can reset your Arduino board, i.e., start your program from the beginning. You can reset the UNO board in two ways. First, by using the reset button (17) on the board. Second, you can connect an external reset button to the Arduino pin labelled RESET (5).

Pins (3.3, 5, GND, Vin)

- 3.3V (6) − Supply 3.3 output volt
- 5V (7) − Supply 5 output volt
- Most of the components used with Arduino board works fine with 3.3 volt and 5 volt.
- GND (8)(Ground) − There are several GND pins on the Arduino, any of which can be used to ground your circuit.
- Vin (9) − This pin also can be used to power the Arduino board from an external power source, like AC mains power supply.

4.2.LCD (LIQUID CRYSTAL DISPLAY):

LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation. LEDs have a large and varying set of use cases for consumers and businesses, as they can be commonly found in smartphones, televisions, computer monitors and instrument panels. It is is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector. Each pixel consists of a column of liquid crystal molecules suspended between two transparent electrodes, and two polarizing filters, the axes of polarity of which are perpendicular to each other. Without the liquid crystals between them, light passing through one would be blocked by the other. The liquid crystal twists the polarization of light entering one filter to allow it to pass through the other.

Types of LCDs

Types of LCDs include:

- Twisted Nematic (TN)- which are inexpensive while having high response times. However, TN displays have low contrast ratios, viewing angles and color contrasts.

- In Panel Switching displays (IPS Panels)- which boast much better contrast ratios, viewing angles and colour contrast when compared to TN LCDs.

- Vertical Alignment Panels (VA Panels)- which are seen as a medium quality between TN and IPS displays.

- Advanced Fringe Field Switching (AFFS)- which is a top performer compared IPS displays in colour reproduction range.

Many microcontroller devices use 'smart LCD' displays to output visual information. LCD displays designed around LCD NT-C1611 module, are inexpensive, easy to use, and it is even possible to produce a readout using the 5X7 dots plus cursor of the display. They have a standard ASCII set of characters and mathematical symbols. For an 8-bit data bus, the display requires a +5V supply plus 10 I/O lines (RS RW D7 D6 D5 D4 D3 D2 D1 D0). For a 4-bit data bus it only requires the supply lines plus 6 extra lines(RS RW D7 D6 D5 D4). When the LCD display is not enabled, data lines are tri-state and they do not interfere with the operation of the microcontroller.

FEATURES:

(1) Interface with either 4-bit or 8-bit microprocessor.

(2) Display data RAM

(3) 80x□8 bits(80 characters).

(4) Character generator ROM

(5). 160 different 5 □□7 dot-matrix character patterns.

(6). Character generator RAM

(7) 8 different user programmed 5 □□7 dot-matrix patterns.

(8)Display data RAM and character generator RAM may be Accessed by the microprocessor.

(9) Numerous instructions

(10) Clear Display, Cursor Home, Display ON/OFF, Cursor ON/OFF, Blink Character, Cursor Shift, Display Shift.

(11). Built-in reset circuit is triggered at power ON.

(12). Built-in oscillator.

PIN DESCRIPTION:

PIN	SYMBOL	FUNCTION
1	Vss	Power Supply(GND)
2	Vdd	Power Supply(+5V)
3	Vo	Contrast Adjust
4	RS	Instruction/Data Register Select
5	R/W	Data Bus Line
6	E	Enable Signal
7-14	DB0-DB7	Data Bus Line
15	A	Power Supply for LED B/L(+)
16	K	Power Supply for LED B/L(-)

FEATURES:

- 5 x 8 dots with cursor
- Built-in controller (KS 0066 or Equivalent)
- + 5V power supply (Also available for + 3V)
- 1/16 duty cycle
- B/L to be driven by pin 1, pin 2 or pin 15, pin 16 or A.K (LED)

- N.V. optional for + 3V power supply

4.3.EM-18 RFID READER:

EM-18 RFID reader is one of the commonly used RFID readers to read 125KHz tags. It features low cost, low power consumption, small form factor and easy to use. It provides both UART and Wiegand26 output formats. It can be directly interfaced with microcontrollers using UART and with PC using an RS232 converter.

1.2 Reset Button

- Just like the original Nintendo, the Arduino has a reset button **(10)**. Pushing it will temporarily connect the reset pin to ground and restart any code that is loaded on the Arduino.
- This can be very useful if your code doesn't repeat, but you want to test it multiple times. Unlike the original Nintendo however, blowing on the Arduino doesn't usually fix any problems.

1.3 Power LED Indicator

Just beneath and to the right of the word “UNO” on your circuit board, there's a tiny LED next to the word ‘ON’ **(11)**. This LED should light up whenever you plug your Arduino into a power source. If this light doesn't turn on, there's a good chance something is wrong. Time to re-check your circuit!

TX RX LEDs

- TX is short for transmit RX is short for receive. These markings appear quite a bit in electronics to indicate the pins responsible for serial communication.
- In our case, there are two places on the Arduino UNO where TX and RX appear once by digital pins 0 and 1, and a second time next to the TX and RX indicator LEDs **(12)**.

- These LEDs will give us some nice visual indications whenever our Arduino is receiving or transmitting data (like when we're loading a new program onto the board).

1.4 Main IC

- The black thing with all the metal legs is an IC, or Integrated Circuit **(13)**. Think of it as the brains of our Arduino.
- The main IC on the Arduino is slightly different from board type to board type, but is usually from the AT mega line of IC's from the ATMEL company.
- This can be important, as you may need to know the IC type (along with your board type) before loading up a new program from the Arduino software.
- This information can usually be found in writing on the top side of the IC. If you want to know more about the difference between various IC's, reading the datasheets is often a good idea.

1.5 Voltage Regulator

- The voltage regulator **(14)** is not actually something you can (or should) interact with on the Arduino. But it is potentially useful to know that it is there and what it's for.
- The voltage regulator does exactly what it says – it controls the amount of voltage that is let into the Arduino board. Think of it as a kind of gatekeeper; it will turn away an extra voltage that might harm the circuit. Of course, it has its limits, so don't hook up your Arduino to anything greater than 20 volts

1.6 ATMEGA328 Microcontroller

- The Atmel AVR® core combines a rich instruction set with 32 general purpose working registers.
- All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in a single instruction executed in one clock cycle.

- The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers.
- The ATmega328/P provides the following features:
- 32Kbytes of In-System Programmable Flash with Read-While-Write capabilities, 1Kbytes EEPROM, 2Kbytes SRAM, 23 general purpose I/O lines, 32 general purpose working registers, Real Time Counter (RTC), three flexible Timer/Counters with compare modes and PWM, 1 serial programmable USARTs , 1 byte-oriented 2-wire Serial Interface (I2C), a 6- channel 10-bit ADC (8 channels in TQFP and QFN/MLF packages) , a programmable Watchdog Timer with internal Oscillator, an SPI serial port, and six software selectable power saving modes.

- The Boot program can use any interface to download the application program in the Application Flash memory.
- Software in the Boot Flash section will continue to run while the Application Flash section is updated, providing true Read-While-Write operation.
- By combining an 8-bit RISC CPU with In-System Self-Programmable Flash on a monolithic chip, the Atmel ATmega328/P is a powerful microcontroller that provides a highly flexible and cost-effective solution to many embedded control applications.

1.7 DC MOTOR

A DC motor is an electric motor that runs on direct current power. In an electric motor, the operation is dependent upon simple electromagnetism. A current-carrying conductor generates a magnetic field, when this is then placed in an external magnetic field, it will encounter a force proportional to the current in the conductor and to the strength of the external magnetic field. It is a device that converts electrical energy to mechanical energy. It works on the fact that a current-carrying conductor placed in a magnetic field experiences a force that causes it to rotate with respect to its original position. Practical DC Motor consists of field windings to provide the magnetic flux and armature which acts as the conductor.

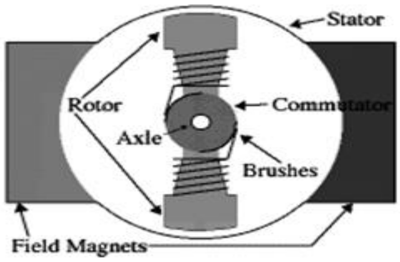
The input of a brushless DC motor is current/voltage and its output is torque. Understanding the operation of the DC motor is very simple from a basic diagram is shown below. DC motor basically consists of two main parts. The rotating part is called the rotor and the stationary part is also called the stator. The rotor rotates with respect to the stator.

The rotor consists of windings, the windings being electrically associated with the commutator. The geometry of the brushes, commutator contacts, and rotor windings are such that when power is applied, the polarities of the energized winding and the stator magnets are misaligned and the rotor will turn until it is very nearly straightened with the stator's field magnets.

As the rotor reaches alignment, the brushes move to the next commutator contacts and energize the next winding. The rotation reverses the direction of current through the rotor winding, prompting a flip of the rotor's magnetic field, driving it to keep rotating.

1.8 Construction of DC Motor

The construction of the DC motor is shown below. It is very important to know its design before knowing it's working. The essential parts of this motor include armature as well as stator.



The armature coil is the rotating part whereas the stationary part is the stator. In this, the armature coil is connected toward the DC supply which includes the brushes as well as the commutators. The main function of the commutator is to convert the AC to DC which is induced in the armature. The flow of current can be supplied by using the brush from the motor's rotary part toward the inactive outside load. The arrangement of the armature can be done in between the two poles of the electromagnet or permanent.

CHAPTER – 2

LITERATURE SURVEY

As per our knowledge only few papers were found in the literature for the automated shopping trolley for supermarkets using RFID. The automated shopping trolley for supermarket billing system implemented by Sainath (2014), exploited barcode for billing of products, where customer scans the product using barcode technology.The bill will be forwarded to the central billing system where customer will pay them by showing unique id. The limitation of barcode scanning requires line of sight for scanning and it should be fixed within its boundary.

Cash register lines optimization system using RFID technology by Budic (2014), developed a system for shopping using RFID. The RFID is employed for scanning products and the information is stored in the database which could be paid online or in a central bill. It also uses web application to maintain entire shopping details. It requires maintenance of web application server. No necessary steps have been taken for the products that are accidentally dropped into the trolley by the customer.

IOT-based intelligent trolley for shopping mall by Dhavale Shraddha (2016), applied RFID technology for billing during purchase in shopping malls and IOT is used for bill management by means of ESP module. The payment details will be sent to the server by which central billing unit will deal with customer's payment. The ESP module will be working as a short distance Wi-Fi chip for wireless communication. But there is a drawback which includes constraints such as distance and interference. Server will be busy if customers are high and internet connectivity should be stable for finishing the process.

Smart shopping trolley using RFID by KomalAmbekar (2015), implemented smart way of shopping trolley with RFID and ZigBee by which bill is generated by scan of products in the reader and bill transmitted to central billing department by which bill can be paid at the counter which is a major difficulty for the customer. Smart shopping cart with customer-oriented service by Hsin-Han Chiang (2016), accomplished a concept of automated shopping trolley with automated billing where they used face recognition for customer authentication. It is not a simple process as face recognition of customers during shopping hours will not be easy and accurate as malls can be crowded.

CHAPTER – 3

METHODOLOGY

3.1 EXISTING SYSTEM

Arduino mega 2560 is used as the main microcontroller to interface with all hardware used in this project All of the hardware and components are programmed in the main microcontroller. The line following sensor allows the shopping trolley to move according to the detected black line. ultrasonic sensors are put on the front of the shopping trolley in order to avoid obstacles in front of it. RFID tag cards that act as location indicator are placed on the cardboard along the black line. The communication between smartphone and robot is via Bluetooth connection. The movement of the shopping trolley is controlled by using a smartphone.

3.2 ADVANTAGES

1. The proposed system is a simple, easy to use and inexpensive hardware for implementing.
2. It will help to disabled person to control wheelchair through to MPU6050 gyroscope.

3.3 PROPOSED SYSTEM:

A shopping trolley is a necessary tool for shopping in supermarkets or grocery stores. We have used hand gesture motion to drive the trolly. A transmitting device is placed in the user's hand, which contains the RF Transmitter and accelerometer to transmit a command to the robot so that it can perform the required task of moving forward, back, turning left, right and stop. These tasks will be identified using the hand gesture.

3.4 DISADVANTAGES

- The main disadvantage is every user need to install application for controlling the trolly.
- Existing project using line sensor, so all the trolleys are move one by one it’s the main drawback of existing system.

3.5 PROPOSED SYSTEM

Basically, this system has consisted of two parts one for driving a gesture robot and the other components for controlling and tracking it. The system has been controlled by gesture commands which have saved in Bluetooth voice recognition module. where the disabled person has to prepare and save his orders as a gesture command in order to manage his wheelchair.

The commands are controlling the driving wheelchair in different directions. The disabled person can easily change the gesture movement “forward” so the wheelchair would move forward till the disabled change position to normal

3.6 HARDWARE REQUIREMENTS

- ARDUINO UNO
- NODEMCU
- HAND GESTURE RECOGNITION SENSOR
- POWER SUPPLY
- MOTOR DRIVE
- MOTOR

3.7 SOFTWARE REQUIREMENTS

- EMBEDDED C LANGUAGE
- ARDUINO IDE

3.8 WORKING OF EM-18 RFID READER MODULE:

The module radiates 125KHz through its coils and when a 125KHz passive RFID tag is brought into this field it will get energized from this field. These passive RFID tags mostly consist of CMOS IC EM4102 which can get enough power for its work from the field generated by the reader. Fig4.4.6: RFID – System Principle

By changing the modulation current through the coils, tag will send back the information contained in the factory-programmed memory array.

3.9 RFID TAG:

RFID tags are a type of tracking system that uses smart barcodes in order to identify items. RFID is short for ―radio frequency identification,‖ and as such, RFID tags utilize radio frequency technology. These radio waves transmit data from the tag to a reader, which then transmits the information to an RFID computer program. RFID tags are frequently used for merchandise, but they can also be used to track vehicles, pets, and even patients with Alzheimer's disease. An RFID tag may also be called an RFID chip. RFID tag includes a microchip with a radio antenna mounted on a substrate which carries 12 Byte unique Identification number.

Fig4.4.7: RFID Tag

Fig 4.4.8: RFID Tag Inside.

There are two main types of RFID tags: battery-operated and passive. As the name suggests, battery-operated RFID tags contain an onboard battery as a power supply, whereas a passive RFID tag does not, instead working by using electromagnetic energy transmitted from an RFID reader. Battery operated RFID tags might also be called active RFID tags.

Passive RFID tags are a much more economical choice than active RFID tags, and cost around 20 cents each. This makes them a popular choice for supply chain management, race tracking, file management, and access control applications. While a passive RFID tag does not require a direct line of sight to the RFID reader, it has a much shorter read range than an active RFID tag. They are small in size, lightweight, and can potentially last a lifetime.

WORKING OF RFID TAGS:

An RFID tag works by transmitting and receiving information via an antenna and a microchip — also sometimes called an integrated circuit or IC. The microchip on an RFID reader is written with whatever information the user wants. Passive RFID tags use three main frequencies to transmit information: 125 – 134 KHz, also known as Low Frequency (LF), 13.56 MHz, also known as High Frequency (HF) and Near-Field Communication (NFC), and 865 – 960 MHz, also known as Ultra High Frequency (UHF). The frequency used affects the tag's range.

When a passive RFID tag is scanned by a reader, the reader transmits energy to the tag which powers it enough for the chip and antenna to relay information back to the reader. The reader then transmits this information back to an RFID computer program for interpretation. There are two main types of passive RFID tags: inlays and hard tags. Inlays are typically quite thin and can be stuck on various materials, whereas hard tags are just as the name suggests, made of a hard, durable material such as plastic or metal.

APPLICATIONS:

Although RFID tags have similar applications to barcodes, they are far more advanced. For instance, reading information from a RFID tag does not require line-of-sight and can be performed over a distance of a few meters. This also means that a single tag can serve multiple readers at a time, compared to only one for a bar code tag.

These tags can be attached to almost any object. Although the usual target objects are apparel, baggage, containers, construction materials, laundry and bottles, they also may be attached to animals, humans and vehicles. Some RFID tags are designed for rugged, outdoor-based applications. These are built to endure natural and incandescent light, vibration, shock, rain, dust, oil and other harsh conditions. They are normally passive in that to function; they do not require batteries and can operate 24/7 without risk of power loss. Such heavy-duty tags are usually attached to trucks, cargo containers and light rail cars for cargo tracking, fleet management, vehicle tracking, vehicle identification and supply container tracking, among others.

3.2 RFID IMPLEMENTATION:

The RFID chip has come a long way since its invention, see the journey below:

1940's - Radar technology was used to identify enemy and friendly aircrafts in WWII. Technically this was the first use of RFID

1948 - Scientist and inventor Harry Stockman creates RFID and is credited with the invention.

1963 - Inventor RF Harrington formulates new RFID ideas which include scattering data and information.

1977 - The first RFID transmitting license plate is created.

2000 - By this time over 1000 patents have been submitted using the RFID technology.

Experts believe that Rfid will be ubiquitous in 20 years, this may be hard to believe if you are not one of the business on the cutting edge of RFID technology but may have adopted this technology to reduce the cost and streamline operation.

Radio frequency identification (RFID) is a general term that is used to describe a system that transmits the identity (in the form of a unique serial number) of an object wirelessly, using radio waves.

RFID technologies are grouped under the more generic Automatic Identification (Auto ID) technologies.

The barcode labels that triggered a revolution in identification systems long time ago, are inadequate in an increasing number of cases. They are cheap but the stumbling block is their low storage capacity and the fact that they cannot be reprogrammed.

A feasible solution was putting the data on silicon chips. The ideal situation is contactless transfer of data between the data carrying device and its reader. The power required to operate the electronic data carrying device would also be transferred from the reader using contactless technology.

These procedures give RFID its name.

One grand commercial vision for RFID is to change the way demand-supply chain moves. In the current almost stone-age scenario, manufacturer produces goods based on forecasts and hopes all of them will be consumed before the shelf life gets them. Good, if the market is consistent. Horrible, if a sudden surge makes the supply fall short and hence everyone in the chain miss on profits. Disastrous, if demand dies suddenly and losses are passed along the chain.

In a not so distant future, RFID enabled stores will monitor the consumption in real time. Shelf will signal the inventory when it needs more stuff and inventory will pull supplies from the manufacturer based on its level of stock.

Simple concept, not-so-difficult implementation and revolutionary results in the pipeline. That’s RFID, in short.

3.3RFID Technology and Architecture:

Before RFID can be understood completely, it is essential to understand how Radio Frequency communication occurs.

RF (Radio Frequency) communication occurs by the transference of data over electromagnetic waves. By generating a specific electromagnetic wave at the source, its effect can be noticed at the receiver far from the source, which then identifies it and thus the information.

In an RFID system, the RFID tag which contains the tagged data of the object generates a signal containing the respective information, which is read by the RFID reader, which then may pass this information to a processor for processing the obtained information for that application.

Thus, an RFID System can be visualized as the sum of the following three components:

1. RFID tag or transponder
2. RFID reader or transceiver
3. Data processing subsystem

An RFID tag is composed of an antenna, a wireless transducer and an encapsulating material. These tags can be either active or passive. While the active tags have on-chip power, passive tags use the power induced by the magnetic field of the RFID reader. Thus, passive tags are cheaper but with lower range (<10mts) and more sensitive to regulatory and environmental constraints, as compared to active tags.

An RFID reader consists of an antenna, transceiver and decoder, which sends periodic signals to inquire about any tag in vicinity. On receiving any signal from a tag, it passes on that information to the data processor. The data processing subsystem provides the means of processing and storing the data.

3.4RFID Standards

Standards are critical in RFID. Be it payment systems or tracking goods in open supply chains. A great deal of work has been going on to develop standards for different RFID frequencies and applications.

RFID standards deal with the following: -

- Air Interface Protocol - The way tags and readers communicate
- Data Content - Organizing of data
- Conformance - Tests that products meet the standard
- Applications - How applications are used.

The way the world has gone about developing the standards is a bit complex. There are two major and somewhat conflicting organizations into the business - ISO and Auto-ID Centre (now handled by EPC Global). Without going too much into the conflict, we'll review the standards proposed by both these organizations.

Tags are required to be disposable (manufacturer may not get the tags back from the retailer to reuse it). Hence, the primary mission for any standard developer is to make the tags low cost. It should operate in UHF, as only UHF delivers read range needed for supply chain applications. And since the goods are needed to be tracked as they move across the globe, the standards must be open and globally accepted. There should also be an accompanying network architecture, which would enable anyone to look up information associated with a serial number stored on a tag. The network too needs to be based on open standards.

EPC standards for tags are the class 0 and class 1 tags:

Class 1: a simple, passive, read-only backscatter tag with one-time, fieldprogrammable non-volatile memory.

Class 0: read-only tag that was programmed at the time the microchip was made.

Class 1 and Class 0 have a couple of shortcomings, in addition to the fact that they are not interoperable. One issue is that they are incompatible with ISO standards. The new EPC standard ~V Gen2 is designed to be fast tracked with ISO standards but for some disagreements over the 8-bit Application Family Identifier (AFI).

ISO has developed RFID standards for automatic identification and item management. This standard, known as the ISO 18000 series, covers the air interface protocol for systems likely to be used to track goods in the supply chain. They cover the major frequencies used in RFID systems around the world.

The seven parts are:

- 18000~V1: Generic parameters for air interfaces for globally accepted frequencies
- 18000~V2: Air interface for 135 KHz

- 18000~V3: Air interface for 13.56 MHz
- 18000~V4: Air interface for 2.45 GHz
- 18000~V5: Air interface for 5.8 GHz
- 18000~V6: Air interface for 860 MHz to 930 MHz
- 18000~V7: Air interface at 433.92 MHz

3.5RFID Applications:

There are two main area of applications, defined broadly as proximity (short range) and vicinity (long range).

Long range or vicinity applications can generally be described as track and trace applications, but the technology provides additional functionality and benefits for product authentication.

RFID enables greater automation of data collection process. Most companies spend considerable effort in knowing what's in their warehouse. RFID will help them dig deeper and much more easily, tracking to the detail of even each unit, long after it has left the factory or warehouse.

RFID allows all this data to be transferred securely. Companies use independent suppliers, data from each of them can be carried on tags and uploaded to the Company's central system.

Imagine the control that the Company will have on a product's life cycle. The creation of successes and defeats can be better understood. There have been numerous instances when companies had to recall the entire product due to a fault in a minor component. Imagine the costs involved in recalling a whole car for a mistake in the AC system! RFIDs can make such recalls much more focussed.

There would be better data about postproduction performance. A car could have individually tagged components. Data could be collected everywhere, accident sites, repair shops, even the garage. Even inside the factory, tags could enable faster and focussed fault tracing.

The Just in Time (JIT) practice followed by many companies, where components are used when they are delivered and delivered just before being needed, can lead to out of stock situations. RFID will eliminate the problem. The eventual aim of RFID in retail and manufacturing ~W eliminate the intermediary. A perfect supply chain would require no distribution center. Products would be delivered directly from the factory to the retail center.

Some other areas where passive RFID has been applied in recent past are:

- Person Identification
- Food Production Control
- Vehicle Parking Monitoring

- Toxic Waste Monitoring
- Valuable Objects Insurance Identification
- Asset Management
- Access Control

Short range or proximity applications are typically access control applications. Some main areas are:

- Access control • Mass transit ticketing

3.5.1 RFID Security:

Through RFID in the near future, every single object will be connected to the Internet through a wireless address and unique identifier, was quipped by the global head of life science and consumer product industries at Sun Microsystems Inc.

Certainly, feels impressive, and let me just help your imagination by setting a perfect scenario.

You are sitting at your home watching television on a Sunday afternoon, and you know that your television is connected to the internet. Your couch, table even your dining set is connected to the internet. That is great for the automation!? Now, imagine your shirt, jeans, even your undergarments connected to the internet! It is only a futuristic setup, but the privacy implications of RFID are equivalent in any application of RFID.

The basic privacy concerns associated with an RFID system is the ability of ubiquitous tracking of anybody without consent. And with RFID tags getting smaller and smaller, it is now even possible to hide tags in such a way that the consumer may be unaware of the presence of tags.

For example, the tags may be sewn up within garment, or moulded within plastic or rubber. To the extent that researchers have already developed tiny coded beads invisible to human eye that can be embedded in inks to tag currency and other documents, or added to substances like automobile paint, explosives, or other products that law enforcement officers or retailers have a strong interest in tracking. Researchers say that the technology should be ready for commercial use in 3-6 years.

In summary we can note the following ways in which RFIDs can be used to bypass personal privacy:

- By placing RFID tags hidden from eyes and using it for stealth tracking.
- Using the unique identifiers provided by RFID for profiling and identifying consumer pattern and behaviour.

- Using hidden readers for stealth tracking and getting personal information.

With all these privacy concerns, there is bound to be some effort to thwart such attempt at privacy and maintain the popularity of RFIDs. Researches at various places have yielded the following methods of avoiding above-mentioned attacks.

- RSA Blocker Tags: These tags are similar in size and appearance to RFID tags, helps in maintaining the privacy of consumer by SpammingT any reader that attempts to scan tags without the right authorization, thus confusing the reader to believe that there are many tags in its proximity.

- Kill Switches: Newer RFID tags are being shipped with a SkillSwitch, which will allow the RFID tags to be disabled. Thus, a consumer will be given an option of disabling the RFID tag before leaving the store, thus avoiding the possibility of stealth tracking and profiling.

Consider a Couple of Situations:

- You are in a mall buying a lot of things and now you have to wait in the queue for a long time and when your time comes, the person at the counter checks each item for its barcode, scans it and then the computer processes it slowly. Overall, it's a quiettime-consuming job both for you and the person at the counter.

- You are supposed to make a database of the students in a school or college or employees of any organization, present at any day. Manually checking the id of each person, making a database, updating it is quite a consuming work to do.

So how about considering an alternative, by the virtue of which you can just pick up things from the mall, place your bag on the scanner and just pay the bill and leave. Also, in the educational institutions or Organizations where you can just assign an ID tag to each member, check their attendance on any particular day through the ID tag. To achieve the above alternatives, the solution or the technology used is RFID.

3.6A Basic RFID System:

3 Main Components of a RFID System

- A RFID tag: It consists of a silicon microchip attached to a small antenna and mounted on a substrate and encapsulated in different materials like plastic or glass veil and with an adhesive on the back side to be attached to objects.

- A reader: It consists of a scanner with antennas to transmit and receive signals and is responsible for communication with the tag and receiving the information from the tag.

- A Processor or a Controller: It can be a host computer with a Microprocessor or a microcontroller which receives the reader input and process the data.

3.6.1TYPES OF RFID TAGS:

Passive Tags – It is the cheaper version using no battery. The Tag uses radio energy transmitting from the reader. So, the Reader must be close to the tag to transfer energy to power the Tag. Since the tags have unique serial number, the reader can recognize them individually.

Active Tags– These have an on-board battery and periodically transmits ID signals to the reader.

Battery Assisted Passive or BAP– These Tags have small battery on board and will be activated in the presence of signals from the reader.

Read only Tags – These have a unique factory assigned serial number used as the key for the data base.

Read/ Write Tags – These can write object specific data give by the system user.

Field programmable Tags– These can write once but read many times. Black tags can be written with an electronic product code by the user.

3.7Operating Frequencies:

Different types of RFID systems operate at different radio frequency. Eachradio frequency has its own read distance, power requirements and performance. The choice of frequency depends on the application. Mostly four types of frequencies are used in RFID technology:

A. Low frequency (120-140 KHz) - Low frequency RFID tags operate in low frequency range. Low frequency tags are used for depositing and withdraw and controlling following with the assets.

B. High frequency (13.56 MHz) - High frequency RFID tags operate in high frequency range. HF tagsare useful for asset-tracking applications, contactless credit cards and ID badges.

C. The ultra-high frequency (869 MHz-928 MHz)-UHF RFID tag operate in 869 MHz - 928MHz.UHFtags are used in supply chain management applications. tags offer the longer reading range and arecheaper to manufacture in bulk.

D. Microwave (2.4 GHz-2.5 GHz) - Microwave system offers higher read rate. Microwave tags areexpensive than UHF tags. Microwave tags are used in electronic toll applications.

3.8RFID NEAR FIELD AND FAR FIELD:

Near-field RFID Faraday’s principle of magnetic induction is the basis of near-field coupling between a reader and tag. A reader passes a large alternating current through a reading coil, resulting in an alternating magnetic field in its locality. If you place a tag that incorporates a smaller coil in this field, an alternating voltage will appear across it. If this voltage is rectified and coupled to a capacitor, a reservoir of charge accumulates, which you can then use to power the tag chip. Tags that use near-field coupling send data back to the reader using load modulation. Because any current drawn from the tag coil will give rise to its own small magnetic field—which will oppose the reader's field—the reader coil can detect this as a small increase in current flowing through it. This current is proportional to the load applied to the tag's coil (hence load modulation). This is the same principle used in power transformers found in most homes today—although usually a transformer's primary and secondary coil are wound closely together to ensure efficient power transfer. However, as the magnetic field extends beyond the primary coil, a secondary coil can still acquire some of the energy at a distance, similar to a reader and a tag. Thus, if the tag's electronics applies a load to its own antenna coil and varies it over time, a signal can be encoded as tiny variations in the magnetic field strength representing the tag's ID. The reader can then recover this signal by monitoring the change in current through the reader coil. A variety of modulation encodings are possible depending on the number of ID bits required, the data transfer rate, and additional redundancy bits placed in the code to remove errors resulting from noise in the communication channel. Near-field coupling is the most straightforward approach for implementing a passive RFID system. This is why it was the first approach taken and has resulted in many subsequent standards, such as ISO 15693 and 14443, and a variety of proprietary solutions. However, near-field communication has some physical limitations. The range for which we can use magnetic induction approximates to $c/2\pi f$, where c is a constant (the speed of light) and f is the frequency. Thus, as the frequency of operation increases, the distance over which near-field coupling can operate decreases. A further limitation is the energy available for induction as a function of distance from the reader coil. The magnetic field drops off at a factor of 1/r3, where r is the separation of the tag and reader, along a center line perpendicular to the coil's plane. So, as applications require more ID bits as well as discrimination between multiple tags in the same locality for a fixed read time, each tag requires a higher data rate and thus a higher operating frequency. These design pressures have led to new passive RFID design. Far-field RFID tags based on far-field emissions capture EM waves propagating from a dipole antenna attached to the reader. A smaller dipole antenna in the tag receives this energy as an alternating potential difference that appears across the arms of the dipole. A diode can rectify this potential and link it to a capacitor, which will result in an accumulation of energy in order to power its electronics. However, unlike the inductive designs, the tags are beyond the range of the reader's near field, and information can't be transmitted back to the reader using load modulation. The technique designers use for commercial far-field RFID tags is back scattering. If they design anantenna with precise dimensions, it can be tuned to a frequency and absorb most of the energy that reaches it at that frequency. However, if an impedance mismatch occurs at this frequency, the antenna will reflect some of the energy (as tiny waves) toward the reader, which can then detect the energy using a sensitive radio receiver. By changing the antenna's impedance over time, the tag can reflect more or less of the incoming signal in a pattern that encodes the tag's ID. In practice, you can detune a tag's antenna for this purpose by placing a transistor across its dipole and then turning it partially on and off. As a rough design guide, tags that use far-field principles operate at greater than 100 MHz typically in the ultra-highfrequency (UHF) band (such as 2.45 GHz); below this frequency is the domain of RFID based on near-field coupling. A far-field system's range is limited by the amount of energy that reaches the tag from the reader and by how sensitive the reader's radio receiver is to the reflected signal. The actual return signal is very small, because it's the result of two attenuations, each based on an inverse square law—the first attenuation occurs as EM waves radiate from the reader to the tag, and the second when reflected waves travel back from the tag to the reader. Thus, the returning energy is 1/r4 (again, r is the separation of the tag and reader). Fortunately, thanks to Moore's law and the shrinking feature size of semiconductor manufacturing, the energy required to power a tag at a given frequency continues to decrease (currently as low as a few microwatts). So, with modern semiconductors, we can design tags that can be read at increasingly greater distances than were possible a few years ago. Furthermore, inexpensive radio receivers have been developed with improved sensitivity so they can now detect signals, for a reasonable cost, with power levels on the order of – 100 dBm in the 2.4-GHz band. A typical far-field reader can successfully interrogate tags 3 m away, and some RFID companies claim their products have read ranges of up to 6 m. EPCglobal's work was key to promoting the design of UHF tags , which has been the basis of RFID trials at both Walmart and Tesco . EPCglobal was originally the MIT Auto-ID Centre, a non-profit organization set up by the MIT Media Lab. The centre later divided into Auto-ID labs, still part of MIT, and EPCglobal, a commercial company. This company has defined an extensible range of tag standards, but its Class-1 Generation-1 96-bit tag is the one receiving the most attention of late. This tag can label over 50 quadrillion (50 1015) items, making it possible to uniquely label every manufactured item for the foreseeable future—not just using generic product codes. This isn't necessary for basic inventory control, but it has implications for tracing manufacturing faults and stolen goods and for detecting forgery. It also offers the more controversial post-sale marketing opportunities, enabling direct marketing based on prior purchases.

3. 8.1RFID communication:

1.Host manages Reader(s) and issues Commands

2.Reader and tag communicate via RF signal

3.Carrier signal generated by the reader

4. Carrier signal sent out through the antennas

5.Carrier signal hits tag(s) Tag receives and modifies carrier signal –

—sends back‖ modulated signal (Passive Backscatter – also referred to as —field disturbance device‖).

6.Antennas receive the modulated signal and send them to the Reader.

7.Reader decodes the data.

8.Results returned to the host application.

3.8.2Multiple Tags:

When multiple tags are in range of the reader: –

All the tags will be excited at the same time. Makes it very difficult to distinguish between the tags.

Collision avoidance mechanisms:

Probabilistic: – Tags return at random times

Deterministic: – Reader searches for specific tags

3.8.3Tag Collision Problem

Multiple tags simultaneously respond to query – Results in collision at the reader

Several approaches

- Tree algorithm
- Memoryless protocol
- Contactless protocol
- I -code protocol

These are several approaches of algorithms and protocols used for the Tag collision problems.

3.9 FUTURE SCOPE:

RFID technology uses radio waves to automatically identify people or objects. After sixty years of development RFID is being used in many fields. There are some problems needed to overcome before RFID technology becomes widespread in the world. One major problem is the high costs, the other is privacy issue. After avoiding problems, the RFID technology will be a big help to human. Price of RFID tags are expected to decrease. RFID tags will only become cheaper and more powerful with improving technology and design experience. Some standards for RFID system are under development. Also, there is improvement in tag life expectancy and durability in past few years. The RFID technology brings new opportunities as well as challenges to the AIDC infrastructure. Although RFID suffers from many limitations but still Demand for RFID systems is increasing day by day. RFID tags can combine with sensors of different kinds. This would allow the tag to report not simply the same information over and over but identifying information along with current data picked up by sensors. Over times, the proportion of ―scan-it-yourself‖ will increase. RFID technology does not replace barcode. This technology improves barcode by adding functions which existing barcode technology fail to achieve.

ALGORITHM:

Step 1: Initially the cart is reset.

Step 2: Then the Rfid TAG is read by the reader. if the tag is read an odd number of times then the item is added to the cart.

Step 3: If the Rfid TAG is read at an even number of times it gets subtracted from the cart.

Step 4: Again, after pressing the reset button the total billing amount is displayed on the LCD screen.

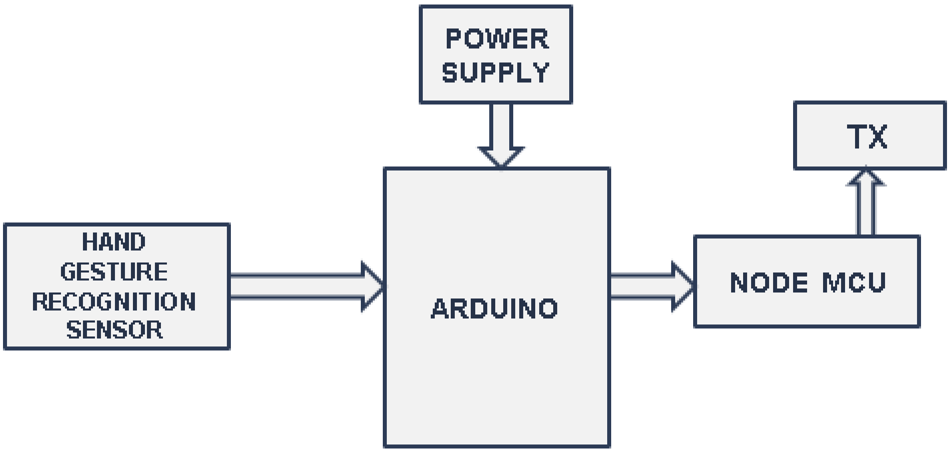
Step 5: Then using the pre-charged cart the amount is debited from the cart.

Step 6: After the final billing is done it is transmitted via HC-12 transmitter and it is observed at the billing section by the respective person.

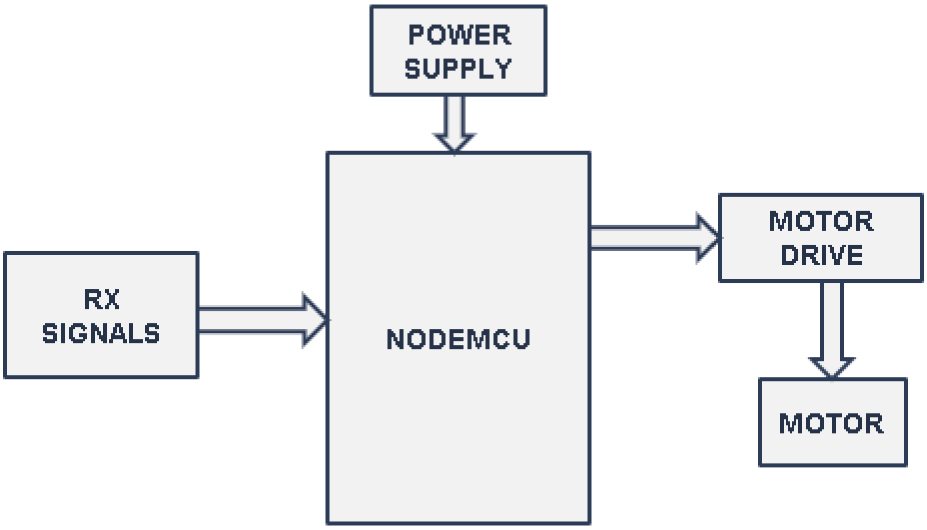
CHAPTER – 4

SYSTEM DIAGRAM AND IMPLEMENTATION

4.1 BLOCK DIAGRAM (TRANSMITTER SIDE):



4.2 BLOCK DIAGRAM (RECEIVER SIDE SIDE):



4.3 MODULES:

OUTPUT 1

The transmitter side the hand gesture recognition sensor senses the hand signals then the signals are transmitted.

OUTPUT 2

Signals are received by the corresponding action performed, like left, right, forward, and backward directions.

4.4 WORKING MODULE

- The proposed recognition system is implemented based on MEMS acceleration sensors.
- Since a heavy computation burden will be brought if gyroscopes are used for inertial measurement, our current system is based on MEMS accelerometers only and gyroscopes are not implemented for motion sensing.
- The system architecture of the proposed gesture recognition system is based on a MEMS accelerometer.
- The details of the individual steps are described below.
- In the area of safety, for example, many machines require operators to place each hand on a control switch before the controller starts any action. Instead of having operators move their hands to special switches, why not simply let them hold up their hands with a gesture sensor? This type of control could improve productivity, reduce the effects of repetitive motions, and improve safety.

4.5 FUTURE WORK:

In future, we add some other features for automotive robotic trolly like prepare automatic bill .it will reduce the time for user waiting to the billing section.

4.6 CONCLUSION:

This project provides the design and implementation of a smart trolley system. It is recommended to use this work in many large and small shopping centres in order to simplify shopping for help them to easily control the movement of the trolley. Users can enjoy the shopping without pushing the shopping trolleys themselves

CHAPTER - 5

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