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A Smart Trolley with Cost Alert and Automated SpeedControl

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ABSTRACT

In metro cities we can see a huge rush at shopping malls on holidays and weekends. This becomes even more when there are huge offers and discounts. Nowadays people purchase a variety of items and put them in the trolley. After total purchasing one should approach the counter for billing purposes, which is a time consuming process .This results in long queues at the billing counters. This project presents an idea to develop a system in shopping malls to overcome the above problem. To achieve this all products in the mall should be equipped with RFID tags and all trolleys should be equipped with a RFID reader and LCD screen .When one puts any product in the trolley its code will be detected automatically, the item cost will be displayed on the LCD, thereby the cost gets added to the total bill. This system also provides the option to add and remove the product from trolley. A smart feature of setting pre-defined total amount is also incorporated in this system, which alerts the user in case of set total amount reaches. The pre-defined amount can be changed by the user. In addition, an automatic speed control of trolley is achieved based on the floor inclination.

I. INTRODUCTION

A. IOT (Internet of things)

The Internet of things (IoT) describes physical objects (or groups of such objects) with sensors, processing ability, software and other technologies that connect and exchange data with other devices and systems over the Internet or other communications networks.The concept of the "Internet of things" and the term itself, first appeared in a speech by Peter T. Lewis, to the Congressional Black Caucus Foundation 15th Annual Legislative Weekend in Washington, D.C., published in September 1985. According to Lewis, "The Internet of Things, or IoT, is the integration of people, processes and technology with connectable devices and sensors to enable remote monitoring, status, manipulation and evaluation of trends of such devices The term "Internet of things" was coined independently by Kevin Ashton of Procter & Gamble, later of MIT's Auto-ID Center, in 1999, though he prefers the phrase "Internet for things". At that point, he viewed radio-frequency identification (RFID) as essential to the Internet of things, which would allow computers to manage all individual things. The main theme of the Internet of things is to embed short-range mobile transceivers in various gadgets and daily necessities to enable new forms of communication between people and things, and between things themselves.

B. Manufacturing

The IoT can connect various manufacturing devices equipped with sensing, identification, processing, communication, actuation, and networking capabilities. Network control and management of manufacturing equipment, asset and situation management, or manufacturing process control allow IoT to be used for industrial applications and smart manufacturing. IoT intelligent systems enable rapid manufacturing and optimization of new products and rapid response to product demands. Digital control systems to automate process controls, operator tools and service information systems to optimize plant safety and security are within the purview of the IoT. IoT can also be applied to asset management via predictive maintenance, statistical evaluation, and measurements to maximize reliability.

C. Energy management

Significant numbers of energy-consuming devices (e.g. lamps, household appliances, motors, pumps, etc.) already integrate Internet connectivity, which can allow them to communicate with utilities not only to balance power generation but also helps optimize the energy consumption as a whole. These devices allow for remote control by users, or central management via a cloud-based interface, and enable functions like scheduling . The smart grid is a utility-side IoT application; systems gather and act on energy and power-related information to improve the efficiency of the production and distribution of electricity. Using advanced metering infrastructure (AMI) Internet-connected devices, electric utilities not only collect data from end-users, but also manage distribution automation devices like transformers.

D. Trends and characteristics

The IoT's major significant trend in recent years is the explosive growth of devices connected and controlled via the Internet. The wide range of applications for IoT technology mean that the specifics can be very different from one device to the next but there are basic characteristics shared by most. The IoT creates opportunities for more direct integration of the physical world into computer-based systems, resulting in efficiency improvements, economic benefits, and reduced human exertions.The number of IoT devices increased 31% year-over-year to 8.4

billion in the year 2017 and it is estimated that there will be 30 billion devices by 2020.

E. Intelligence

IoT intelligence can be offered at three levels: IoT devices, Edge/Fog nodes, and Cloud computing. The need for intelligent control and decision at each level depends on the time sensitiveness of the IoT application. This fast decision making would not be possible through transferring data from the vehicle to cloud instances and return the predictions back to the vehicle. Instead, all the operation should be performed locally in the vehicle. Integrating advanced machine learning algorithms including deep learning into IoT devices is an active research area to make smart objects closer to reality. Moreover, it is possible to get the most value out of IoT deployments through analyzing IoT data, extracting hidden information, and predicting control decisions. A wide variety of machine learning techniques have been used in IoT domain ranging from traditional methods such as regression, support vector machine, and random forest to advanced ones such as convolutional neural networks, LSTM, and variational autoencoder.

In the future, the Internet of things may be a non-deterministic and open network in which auto-organized or intelligent entities (web services, SOA components) and virtual objects will be interoperable and able to act independently (pursuing their own objectives or shared ones) depending on the context, circumstances or environments. Autonomous behaviour through the collection and reasoning of context information as well as the object's ability to detect changes in the environment (faults affecting sensors) and introduce suitable mitigation measures constitutes a major research trend, clearly needed to provide credibility to the IoT technology. Modern IoT products and solutions in the marketplace use a variety of different technologies to support such context-aware automation, but more sophisticated forms of intelligence are requested to permit sensor units and intelligent cyber-physical systems to be deployed in real environments.

F. Network architecture

The Internet of things requires huge scalability in the network space to handle the surge of devices. IETF 6LoWPAN can be used to connect devices to IP networks. With billions of devices being added to the Internet space, IPv6 will play a major role in handling the network layer scalability. IETF's Constrained Application Protocol, Zero MQ, and MQTT can provide lightweight data transport. In practice many groups of IoT devices are hidden behind gateway nodes and may not have unique addresses. Also the vision of everything-interconnected is not needed for most applications as it is mainly the data which need interconnecting ata higher layer.

Fog computing is a viable alternative to prevent such a large burst of data flow through the Internet. The edge devices' computation power to analyze and process data is extremely limited. Limited processing power is a key attribute of IoT devices as their purpose is to supply data about physical objects while remaining autonomous. Heavy processing requirements use more battery power harming IoT's ability to operate. Scalability is easy because IoT devices simply supply data through the internet to a server with sufficient processing power.

G. Applications

The extensive set of applications for IoT devices is often divided into consumer, Organizations, industrial, and Agriculture.

1. Consumer- A growing portion of IoT devices is created for consumer use, including connected vehicles, home

automation, wearable technology, connected health, and appliances with remote monitoring capabilities.

Home Automation-IoT devices are a part of the larger concept of home automation, which can include lighting, heating and air conditioning, media and security systems and camera systems. Long-term benefits could include energy savings by automatically ensuring lights and electronics are turned off or by making the residents in the home aware of usage. A smart home or automated home could be based on a platform or hubs that control smart devices and appliances.

2. *Organizations- Medical and healthcare*

The **Internet of Medical Things** (**IoMT**) is an application of the IoT for medical and health-related purposes, data collection and analysis for research, and monitoring. The IoMT has been referenced as "Smart Healthcare", as the technology for creating a digitized healthcare system, connecting available medical resources and healthcare services. IoT devices can be used to enable remote health monitoring and emergency notification systems. These health monitoring devices can range from blood pressure and heart rate monitors to advanced devices capable of monitoring specialized implants, such as pacemakers, Fitbit electronic wristbands, or advanced hearing aids. Some hospitals have begun implementing "smart beds" that can detect when they are occupied and when a patient is attempting to get up. It can also adjust itself to ensure appropriate pressure and support are applied to the patient without the manual interaction of nurses.

3. *Industrial*

Also known as IIOT, industrial IoT devices acquire and analyze data from connected equipment, operational technology (OT), locations, and people. Combined with operational technology (OT) monitoring devices, IIOT helps regulate and monitor industrial systems. Also, the same implementation can be carried out for automated record updates of asset placement in industrial storage units as the size of the assets can vary from a small screw to the whole motor spare part, and misplacement of such assets can cause a loss of manpower time and money.

4. *Agriculture*

There are numerous IoT applications in farming such as collecting data on temperature, rainfall, humidity, wind speed, pest infestation, and soil content. This data can be used to automate farming techniques, take informed decisions to improve quality and quantity, minimize risk and waste, and reduce the effort required to manage crops. The overall goal is that data from sensors, coupled with the farmer's knowledge and intuition about his or her farm, can help increase farm productivity, and also help reduce costs.

5. *Environmental monitoring*

Environmental monitoring applications of the IoT typically use sensors to assist in environmental protection by monitoring air or water quality, atmospheric or soil conditions, and can even include areas like monitoring the movements of wildlife and their habitats. Development of resource-constrained devices connected to the Internet also means that other applications like earthquake or tsunami early-warning systems can also be used by emergency services to provide more effective aid. IoT devices in this application typically span a large geographic area and can also be mobile. It has been argued that the standardization that IoT brings to wireless sensing will revolutionize this area.

H. Internet of Battlefield Things

The **Internet of Battlefield Things** (**IOBT**) is a project initiated and executed by the U.S. Army Research Laboratory (ARL) that focuses on the basic science related to the IoT that enhance the capabilities of Army soldiers. In 2017, ARL launched the Internet of Battlefield Things Collaborative Research Alliance (IOBT-CRA), establishing a working collaboration between industry, university, and Army researchers to advance the theoretical foundations of IoT technologies and their applications to Army operations.

1. *Ocean of Things*

The **Ocean of Things** project is a DARPA-led program designed to establish an Internet of things across large ocean areas for the purposes of collecting, monitoring, and analyzing environmental and vessel activity data. The project entails the deployment of about 50,000 floats that house a passive sensor suite that autonomously detect and track military and commercial vessels as part of a cloud-based network.

2. *Product digitalization*

There are several applications of smart or active packaging in which a QR code or NFC tag is affixed on a product or its packaging. The tag itself is passive, however, it contains a unique identifier (typically a URL) which enables a user to access digital content about the product via a smartphone. Strictly speaking, such passive items are not part of the Internet of things, but they can be seen as enablers of digital interactions. The term "Internet of Packaging" has been coined to describe applications in which unique identifiers are used, to automate supply chains, and are scanned on large scale by consumers to access digital content. Authentication of the unique identifiers, and thereby of the product itself, is possible via a copy-sensitive digital watermark

II. RELARED WORKS

Title: Real-Time Decision Making and Path Planning for Robotic Autonomous Luggage Trolley Collection at Airports
Year: 2022
Author: Jiankun Wang; Max Q.-H. Meng

Methodology

In this article, a two-level planner is proposed to provide a solution to the autonomous luggage trolley collection problem at the airport. In the higher level planner, a decision- making problem is tackled where a sequence of luggage

trolleys is determined with which the robot can collect them one by one. Based on the traditional traveling salesman problem (TSP), this decision-making problem is formulated as an open dynamic traveling salesman problem with fixed start (ODTSP-FS). Incorporating the modified transition rule, elitist global update rule, and additional local update rule, an efficient algorithm is proposed to handle this decision-making problem. The experimental results demonstrate that the proposed algorithm achieves fast convergence and smaller cost compared with the state-of- the-art algorithms. In the lower level planner, based on the pipeline of rapid-exploring random tree (RRT) scheme, a novel real-time path planning algorithm is introduced, which

can adjust itself to moving obstacles and moving targets by retaining the whole tree and using two rewiring strategies. Finally, the proposed two-level planner is evaluated in a simulation environment similar to the airport to validate the effectiveness and efficiency of the proposed algorithm.

Title: Development and Implementation of Automatic Trolley System for Disabled, Aged and Nursing using Arduino
Year: 2022
Author: Akiti Kenneth Tetteh; George K. Agordzo Amenya Bright.,

Methodology

Every day in different countries, shopping is carried out by every category of persons. 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.

Title: Intelligent Mart System Using NLP For Smart Cities
Year: 2022
Author: M. Kavitha, R. Kavitha, R. Srinivasan and M. K. Kumar,

Methodology

Shops and malls offer a wide variety of products. Products like clothes, beverages, books, and food can be considered products of domestic use. The purpose of supermarkets is to make shopping convenient for customers and to save their time, but sometimes the customer is dissatisfied while standing in line for the cash register and sometimes the customer is upset while weighing everything before they are billed. Shopping malls in large cities are packed with crowds during the weekends. Multiple sales and discounts further complicate the situation. Many items are purchased today and subsequently placed in the shopping basket. Billing process takes a lot of time for this process to be completed. The intelligent trolley is intended for a world where everyone has access to information and technology. By using IoT, the trolleys can be paired with main counters and package counters. Using the system, customers can easily locate the products by following the right path. The trolley is equipped with Liquid Crystal Display (LCD) screen and barcode scanner so users can scan the data on products. After the barcode is scanned, a display on the LCD screen accurately displays the product name and cost, and the counter updates accordingly. In addition to this feature, the customer will also be able to delete unwanted products and the check-out counter will be updated. With the swiping machine that is attached to the trolley, customers can pay using the Unified Payment Option (UPI) that is displayed on the monitor. By implementing the proposed system, the time

a customer spends in line for billing is reduced. This systemallows the customer to pay for their bill easily and to collect their items without delay in the Exit Pack. In addition, the system facilitates cash payments at separate counters without any delay for the customer. IBM cloud, an open platform for data manipulators, is used to retrieve, store and manipulate customer data through the cloud database. Using natural language processing (NLP), language conversion is possible.

Title: Survey on Smart Trolley Billing System
Year: 2022
Author: Mortale, Sonali, et al.

Methodology
Shopping is really exciting and fascinating, but it becomes tiring due to standing in long queue for payment of the bills. But due to this Smart Trolley Billing System project, it has become efficient because the customer need not have to wait for his/her turn in the queue , the customer can pay the bills at the trolley itself due to the advanced devices in the trolley. This is not possible in the existing trolley. For this, some devices has been used like RFID reader and tag, Arduino, IR sensor etc. Thus RFID reader is being employed to scan the products for billing, to send the data online to store it in the transaction database for future reference for the shop-owner and for providing customers the e-bill. Essence of this approach involves using the RFID system to keep the details of each product. Each label in the products are stored with its name, id, and price. So when it comes in contact with the RFID reader, the reader reads out all those information and add it to the cart. Once the products are selected, the customer can proceed to the billing part. Each customer is given with their smart cards, which contain their id and their balance amount in the card.

III. PROPOSED METHOD 1.HARDWARE AND SOFTWARE SPECIFICATION

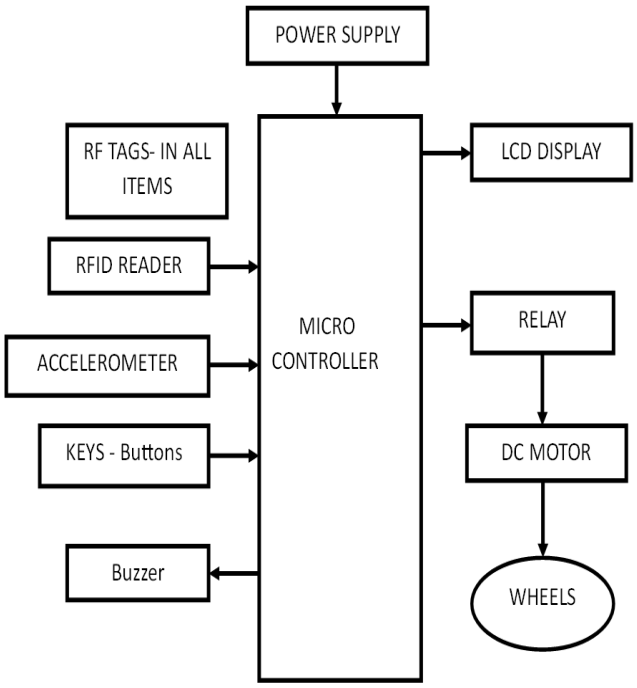


Fig :Hardware And Software Specification

Hardware Specification

- Power supply
- Arduino micro controller
- RFID Reader
- Accelerometer sensor
- KEYS – Buttons
- Buzzer
- Lcd display
- DC Moto Relay

Software specification

- Arduino Ide
- Embedded C

HARDWARE DISCRIPTION

1.*POWER SUPPLY*

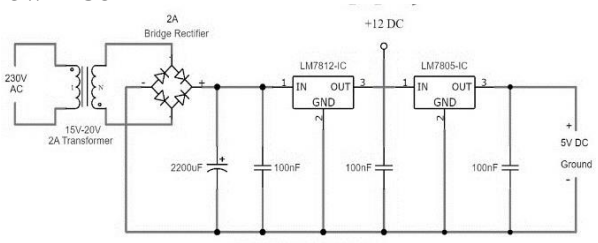


Fig: Hardware Discription

2.Transformer:

The transformer contains two huge copper coils, one between the two terminals of the input power supply and other between the two terminals of the output. Here we use a step-down transformer which means it will convert high voltage to low voltage. The number of turns of the coil inside will determine the voltage supported at input and output both.

i.e. Vin/Vout=Nin/Nout

Vin = Input AC voltage Vout
= Output AC voltage
Nin = Number of turns at the input terminal of transformer
Nout = Number of turns at the output terminal of transformer

3.Rectifier:

Now comes the rectifier part. This converts the AC voltage output of the transformer to a DC voltage. It just reverses thepolarity of one half of the period of the AC signal. This willmake both parts have the same polarity. Here we use a full wave bridge rectifier to convert the AC signal to DC.

4.Filter:

The output from the rectification stage is DC, but hardly constant. So, we use capacitive filtering to smoothen the output. In this example, using a simple low pass filter at the output of the rectifier, however in real life, higher order filters may be used, which would give a much more smoother output.

5.Regulator:

The filtering significantly smoothens the output, but even after that small ripples remain. If we use this directly to charge our phones, the constant fluctuation in the voltage may damage the device. It is very important to have a steady output voltage with minimal fluctuations. This is where the regulator stage kicks in.

Here we have used a simple zener diode based regulator.The tendency of a zener diode is to have a fixed voltagebetween its two terminals when reversed biased. So wheninput voltage changes, the current through the zener diodealso changes inversely so that the output is constant. Thisregulator is quite simple to create, but its is that it wastes alot of power. So, the cell phone chargers typically use ICvoltage regulators, such as IC 7805, IC 7806, IC 7812 etc The filtering significantly smoothens the output, but even afterthat small ripples remain. If we use this directly to charge ourphones, the constant fluctuation in the voltage may damage the device. It is very important to have a steady output voltage withminimal fluctuations. This is where the regulator stage kicks in. Here we have used a simple zener diode based regulator. The tendency of a zener diode is to have a fixed voltage between itstwo terminals when reversed biased. So when input voltagechanges, the current through the zener diode also changesinversely so that the output is constant. This regulator is quitesimple to create, but its is that it wastes a lot of power. So, thecell phone chargers typically use IC voltage regulators, such asIC 7805, IC 7806, IC 7812 etc.

6.ARDUINO UNO

The Arduino Uno Rev3 SMD is a microcontroller board based onthe ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapteror battery to get started.

The Uno differs from all preceding boards in that it does not usethe FTDI USB-to-serial driver chip

"Uno" means "One" in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform.

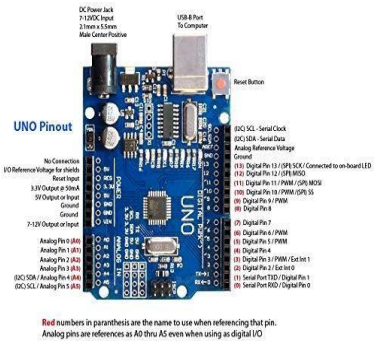


Fig: Arduino UNO

Additional features coming with the R3 version are:
ATmega16U2 instead 8U2 as USB-to-Serial converter.
1.0 pinout: added SDA and SCL pins for TWI communication placed near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board and the second one is a not connected pin, that is reserved for future purposes.
stronger RESET circuit.

7. Power:

The Arduino Uno board can be powered via the USB connection or with an external power supply. The power source is selected automatically.
External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the GND and Vin pin headers of the POWER connector.

8. Working Explanation:

The board can operate on an external supply from 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may become unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.
The power pins are as follows:
Vin. The input voltage to the Arduino/Genuino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
5V.This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board. We don't advise it.
3V3. A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
GND. Ground pins.
IOREF. This pin on the Arduino/Genuino board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs to work with the 5V or 3.3V.

9. Memory

The ATmega328 has 32 KB (with 0.5 KB occupied by the bootloader). It also has 2 KB of SRAM and 1 KB of EEPROM (which can be read and written with the EEPROM library).

Input and Output

High performance micro chip developed by Atmel .It is a 8bit

AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1024B EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, a 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volt

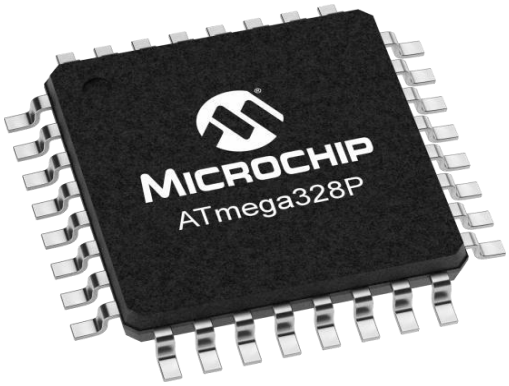


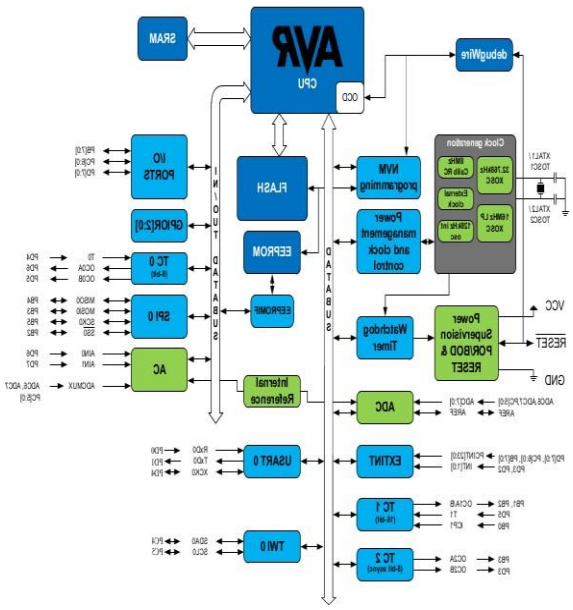
Fig: Microchip ATmega328 Pin Mapping

10. ATmega328 Pin Mapping:

Each of the 14 digital pins on the Uno can be used as an input oroutput, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive 20 mA as recommended operating condition and has an internal pull-up resistor (disconnected by default) of 20-50k ohm. A maximum of 40mA is the value that must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller.

Here I choose Atmega32p TQFP package; it mainly has 8channel 10 bit it ADC, Flash memory of 32 k and EEPROM of 1K, and

23 general purpose input output line,it consists of 2 8-bit Timer/Counters and one 16-bit Timer/Counters



In addition, some pins have specialized functions:

Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip. External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attach Interrupt() function for details.

PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analog Write() function.
SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication using the SPI library.
LED: 13. There is a built-in LED driven by digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.
TWI: A4 or SDA pin and A5 or SCL pin. Support TWI communication using the Wire library.
The Uno has 6 analog inputs, labeled A0 through A5, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analogReference() function.
There are a couple of other pins on the board:
AREF. Reference voltage for the analog inputs. Used with analogReference().
Reset. Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

11.Communication:
Arduino/ Genuino Uno has a number of facilities for communicating with a computer, another Arduino/ Genuino board, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The 16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, a .inf file is required. The Arduino Software (IDE) includes a serial monitor which allows simple textual data to be sent to and from the board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial communication on pins 0 and 1).
A Software Serial library allows serial communication on any of the Uno's digital pins.
The ATmega328 also supports I2C (TWI) and SPI communication. The Arduino Software (IDE) includes a Wire library to simplify use of the I2C bus; see the documentation for details. For SPI communication, use the SPI library.

Fig: Arduino UNO

Specifications:-
Microcontroller : ATmega328 SMD.
Operating Voltage : 5V.
Supply Voltage recommended : 7-12V DC.
Digital I/O Pins : 14 (of which 6 provide PWM output).
Analog Input Pins : 6.
DC Current per I/O Pin : 40 mA.
DC Current for 3.3V Pin : 50 mA.

Description:
This UNO R3 uses surface mount version of the Atmega328P instead of the through-hole version. the board is based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.
UNO R3 SMD is the open source Embedded Development board based on Atmega328 SMD Package Microcontroller. Because Atmel is moving more and more of their production capacity to surface mount ICs, the DIP packaged ATmega is becoming more and more difficult to get. To keep up with demand, we now offer the Uno R3 with an SMD ATmega. The board is identical to the PTH version of the Uno, but you won't be able to remove the ATmega without some hot-air. This change shouldn't affect most users.

12.RFID READER:

Fig:RFID Reader

Specifications:
Flash Memory : 32 KB (ATmega328) of which 0.5 KB used by bootloader.
SRAM : 2 KB (ATmega328).
EEPROM : 1 KB (ATmega328).
Clock Speed : 16 MHz.

5VDC through USB (External 5V supply will boost range of the module)
Current:
<50mA
Operating Frequency:
125KhzRead Distance:
10cm
Size of RFID reader module: 32mm(length) * 32mm(width) *8mm(height)
Low-cost method for reading passive RFID EM4100 family transponder tags
Reading Distance 5-10cm of the reader

13. Em-18 RFID Reader Module:

RFID (radio frequency identification) systems use data strings stored inside RFID tags or transponders) to uniquely identify people or objects when they are scanned by an RFID reader.
Because passive tags require a strong RF field to operate, their effective range is limited to an area in close proximity to the RFIDreader.
Each RFID Card / tag contains a unique identifier that can be readby this RFID Reader Module and transmitted to the host via a simple serial interface.
This module directly connects to any microcontroller UART or through a RS232 converter to PC.
It gives UART/Wiegand26 output. This RFID Reader Module works with any 125 KHz RFID tags.

Pin function:

VCC	5V
GND	Ground
BEEP	BEEP and LED
ANT	No Use
ANT	No Use
SEL	HIGH selects RS232, LOW selects WEIGAND

TX UART TX, When RS232 is Selected
D1 WIEGAND Data 1
D0 WIEGAND Data 0

Working of EM-18 RFID 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 working from the field generated by the reader.
By changing the modulation current through the coils, tag will send back the information contained in the factory programmed memory array.

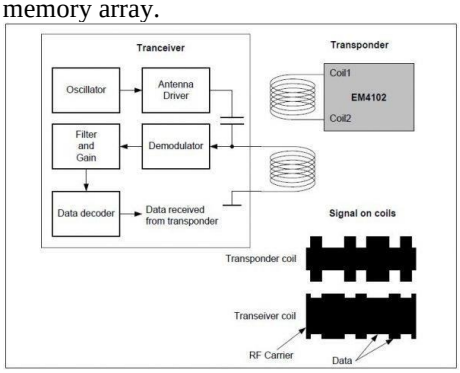


Fig:Working of EM-18RFID Module

14. RF ID CARD

Features:
Contactless transmission of data and supply energy (no battery needed)
Anticollision
EEPROM
1Kbit, organized in 16 sectors, each district two passwords
User definable access conditions for each memory block
Data retention of 10 years.
Write endurance 100 000 cycles

15..Security
Individual key set per sector (per application) to support multi-application with key hierarchy
A unique serial number for each device
Transport key protects access to EEPROM on-chip delivery

Fig:
Description
This is 125KHz RFID Card used for Contactless transmission of data and supplies energy with no battery needed. Its Operating distance is Up to 100mm depending on antenna geometry. Operating frequency is 125KHz and Data transfer speed is 106 kbit/s.
It is featured with Data integrity of 16 Bit CRC, parity, bit coding

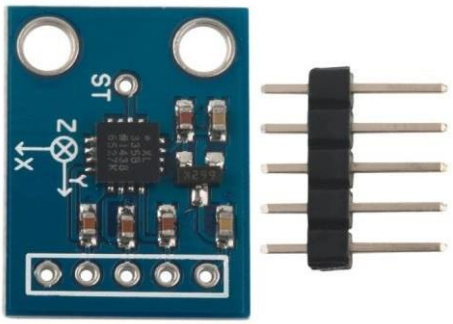


Fig: Accelerater ADXL335

Description:
bit counting which allows Anti-collision. These cards are typically used in ticketing transaction: <100 ms including backup management.

16. ACCELEROMETER ADXL335:

The ADXL335 is a small, thin, low-power, complete 3-axis accelerometer with signal conditioned voltage outputs. The ADXL335 Module 3-axis Analog Output Accelerometer measures acceleration with a minimum full-scale range of ±3 g.

It can measure the static acceleration of gravity in tilt-sensingapplications, as well as dynamic acceleration resulting frommotion, shock, or vibration. This breakout board comes with anonboard voltage regulator and works at both 3.3V & 5V (3-5V). An accelerometer is an electro-mechanical device that willmeasure acceleration forces. These forces may be static, like theconstant force of gravity pulling at your feet, or they could bedynamic – caused by moving or vibrating the accelerometer.

Features :

Onboard LDO Voltage regulator
Can be interfaced with a 3V3 or 5V Microcontroller.All necessary Components are populated.
Ultra-Low Power: 40uA in measurement mode, 0.1uAin standby@ 2.5V
Tap/Double Tap DetectionFree-Fall Detection Analog output
Build-in ultra-low noise linear LDO voltage regulator
Built-in onboard filters, which reduce noise from the motor andother high current electronics
Power LED
Designed for 5V logic level Accelerometer work

An accelerometer works using an electromechanical sensor that is designed to measure either static or dynamic acceleration. Static acceleration is the constant force acting on a body, like gravity or friction. These forces are predictable and uniform to a large extend. For example, the acceleration due to gravity is constant at 9.8m/s, and the gravitation force is almost the same at every point on earth. Dynamic acceleration forces are non-uniform, and the best example is vibration or shock. A car crash is an excellent example of dynamic acceleration. Here, the acceleration change is sudden when compared to its previous state. The theory behind accelerometers is that they can detect acceleration and convert it into measurable quantities like electrical signals.

17. SLIDE SWITCH

Definition of a slide switch is: It is a mechanical switch that is used to control the flow of current in a circuit by sliding the slider from the OFF (open) position to the ON (close) position known as a slide switch. This switch simply controls the current within a circuit without cutting a wire manually. These switches will stay in one position until changed into another position manually. The slide switch symbol is shown below.

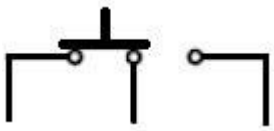


Fig :Slide Switch

Slide Switch Specifications:

The **specifications of the slide switc**h include the following which vary based on manufacturers.

The max voltage across the switch or voltage rating is up to 24 Vdc.

The max current throughout the device or switches current rating is up to 500 mA.

The height of the actuator is flat or raised.

The pitch or distance between pins is 2.54 mm or 5.08 mm.

These switches can oppose dust & moisture.

Contact rating is 12 V DC, 200 mA.

Contact resistance is below 50 mOhms.

Insulation resistance is above 100 MOhms @ 500 V DC.

The strength of the dielectric is 500 V, 50 Hz for a 1-minute duration of time.

Operating temperature ranges from -10o C to + 60o C.

Minimum mechanical life 5000 operations.

Contacts are silver-plated and phosphor bronze.

Terminals are brass silver-plated.

Contact timing is non-shorting.

Slide Switch Work:

Slide switches work by using a slider to move from the OFF position to the ON position. They control the flow of current within a circuit in small projects. These switches are designed in two ways by using a metal slide and a metal seesaw.

The metal slides are used in most common designs that make contact through the flat metal parts on the switch. When the slider on the switch is moved, then metal slide contacts can move from one set of metal contacts to the other to activate the switch.

Similarly, the secondary design utilizes a metal seesaw. The slider of this switch includes a spring that pushes down on one face of the metal seesaw otherwise the other. These are maintained-contact switches, so they wait in one state until activated into the latest state and after that stay in that state until performed upon again.

18. BUZZER

An audio signaling device like a beeper or buzzer may be electromechanical or piezoelectric or mechanical type. The main function of this is to convert the signal from audio to sound. Generally, it is powered through DC voltage and used in timers, alarm devices, printers, alarms, computers, etc.

Fig:Buzzer

It includes two pins namely positive and negative. The positive terminal of this is represented with the '+' symbol or a longer terminal. This terminal is powered through 6Volts whereas the negative terminal is represented with the '-'symbol or short terminal and it is connected to the GND terminal.

Type Of Buzzers:

Buzzers come in a variety of construction, size, and specifications. Different types and sizes of buzzers are used for different applications. Based on construction, there are the following kinds of buzzers:

1. Piezoelectric buzzers.
2. Magnetic buzzers.
3. Electromagnetic buzzers.
4. Mechanical buzzers.
5. Electromechanical buzzers.

Description:

The working principle of a buzzer depends on the theory that, once the voltage is given across a piezoelectric material, then a pressure difference is produced. A piezo type includes piezo crystals among two conductors.

Once a potential disparity is given across these crystals, then they thrust one conductor & drag the additional conductor through their internal property. So this continuous action will produce a sharp sound signal.

19. LCD DISPLAY

The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multi-segment light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc.

LCD 16×2 pin diagram:

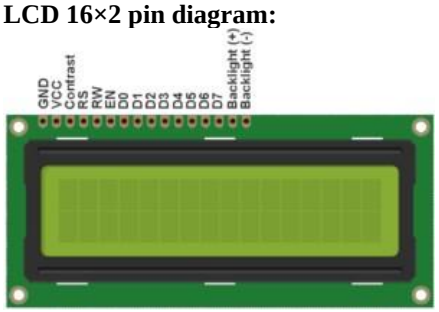


Fig: LCD Display

***Features of LCD16x2*:**

The features of this LCD mainly include the following.The operating voltage of this LCD is 4.7V-5.3V

It includes two rows where each row can produce 16-characters.The utilization of current is 1mA with no backlight

Every character can be built with a 5×8 pixel box

The alphanumeric LCDs alphabets & numbers
Is display can work on two modes like 4-bit & 8-bit
These are obtainable in Blue & Green Backlight
It displays a few custom generated characters

LCD Pin Diagram Description:

Pin1 (Ground/Source Pin): This is a GND pin of display, used to connect the GND terminal of the microcontroller unit or power source.
Pin2 (VCC/Source Pin): This is the voltage supply pin of the display, used to connect the supply pin of the power source.
Pin3 (V0/VEE/Control Pin): This pin regulates the difference of the display, used to connect a changeable POT that can supply 0 to 5V.
Pin4 (Register Select/Control Pin): This pin toggles among command or data register, used to connect a microcontroller unit pin and obtains either 0 or 1(0 = data mode, and 1 = command mode).
Pin5 (Read/Write/Control Pin): This pin toggles the display among the read or writes operation, and it is connected to a microcontroller unit pin to get either 0 or 1 (0 = Write Operation, and 1 = Read Operation).
Pin 6 (Enable/Control Pin): This pin should be held high to execute Read/Write process, and it is connected to the microcontroller unit & constantly held high.
Pins 7-14 (Data Pins): These pins are used to send data to the display. These pins are connected in two-wire modes like 4-wire mode and 8-wire mode. In 4-wire mode, only four pins are connected to the microcontroller unit like 0 to 3, whereas in 8-wire mode, 8-pins are connected to microcontroller unit like 0 to 7.
Pin15 (+ve pin of the LED): This pin is connected to +5V
Pin 16 (-ve pin of the LED): This pin is connected to GND.

4-bit and 8-bit Mode of LCD:

The LCD can work in two different modes, namely the 4-bit mode and the 8-bit mode. In **4 bit mode** we send the data nibble by nibble, first upper nibble and then lower nibble. For those of you who don't know what a nibble is: a nibble is a group of four bits, so the lower four bits (D0-D3) of a byte form the lower nibble while the upper four bits (D4-D7) of a byte form the higher nibble. This enables us to send 8 bit data.

***Brief description on LCD modules*:**

16×2 LCD is named so because; it has 16 Columns and 2 Rows. There are a lot of combinations available like, 8×1, 8×2, 10×2, 16×1, etc. but the most used one is the 16×2 LCD. So, it will have (16×2=32) 32 characters in total and each character will be made of 5×8 Pixel Dots.
Now, we know that each character has (5×8=40) 40 Pixels and for 32 Characters we will have (32×40) 1280 Pixels. Further, the LCD should also be instructed about the Position of the Pixels. Hence it will be a hectic task to handle everything with the help of MCU, hence an **Interface IC like HD44780** is used, which is mounted on the backside of the LCD Module itself. The function of this IC is to get the **Commands and Data** from the MCU and process them to display meaningful information onto our LCD Screen. You can learn how to interface an LCD using the above mentioned links. If you are an advanced programmer and would like to create your own library for interfacing your Microcontroller with this LCD module then you have to understand the HD44780 IC working and commands which can be found its datasheet.

20. BO Motor

Features of 200 RPM Dual Shaft BO Motor - Straight:-
Cost-effectiveness of the injection-molding process.
Elimination of machining operations.
Low density: lightweight, low inertia.
Uniformity of parts.

Capability to absorb shock and vibration as a result of elasticcompliance.
Ability to operate with minimum or no lubrication, due to inherentlubricity.
The relatively low coefficient of friction.
Corrosion-resistance; elimination of plating, or protective coatings.
The quietness of operation.
Tolerances are often less critical than for metal gears, due in partto their greater resilience.
Consistency with the trend to greater use of plastic housings andother components.

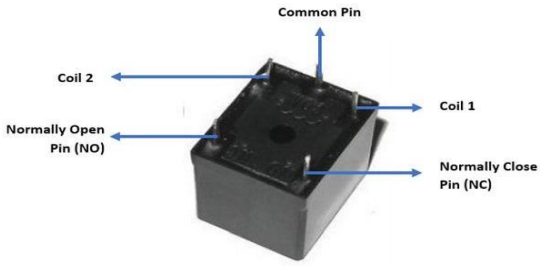
Fig: BO Motor

BO Motor Description:
The 200 RPM Dual Shaft BO Motor - Straight motor gives good torque and rpm at lower operating voltages, which is the biggest advantage of these motors.
Small shaft with matching wheels gives an optimized design for your application or robot. Mounting holes on the body & light weight makes it suitable for in-circuit placement. This motor can be used with 69mm Diameter Wheel for Plastic Gear Motors.
It is an alternative to our metal gear DC motors. It comes with an operating voltage of 3-12V and is perfect for building small and medium robots.
The motor is ideal for DIY enthusiasts. This motor set is inexpensive, small, easy to install, and ideally suited for use in a mobile robot car. They are commonly used in our 2WD platforms.

21. RELAY:

Fig: Relay

Description:
This is the **12V relay** most commonly used switching device in electronics. It is commonly used in Home Automation projects toswitch AC loads, To Control (On/Off) Heavy loads at a pre- determined time/condition, Used in safety circuits to disconnect the load from supply in event of failure and much more.
To use this relay module first you have to decide whether you wantto connect or disconnect your load when relay is operated. Connectthe load across Common and NC terminal if you want to disconnect the load when relay is operated or across Common and NO terminal if you want to connect the load when relay is operated. As the coil trigger voltage is 5V, you can connect it to any GPIO pin of 5V operating Arduino like UNO or MEGA or



you can use any battery above 5V to operate the relay too.

SOFTWARE DESCRIPTION

1.Arduino IDE

For the example I'm showing you'll *only* need the Arduino UNO R3 board itself and the required USB cable to transfer the program from your computer to the board.

On the board left of the Arduino logo there's an LED, short for Light Emitting Diode, a small light, with the letter L next to it.We're going to switch it on and off and then look in to making it blink on and off for 2 seconds at a time.When you first plug your USB cable in to your Arduino and your computer, you may notice that this LED is blinking. Not to worry! It's the default program stored on the chip. We're going to override this.

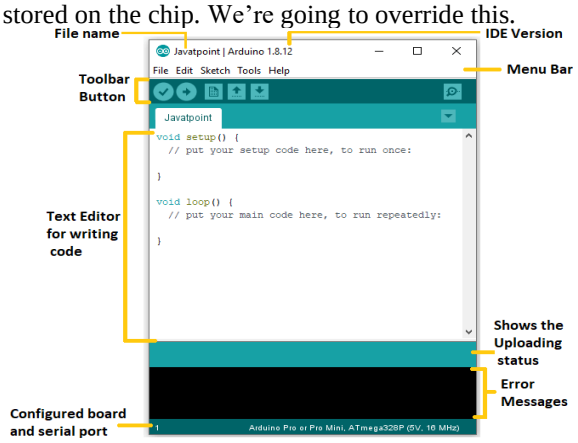


Fig: Arduino IDE

The USB cable powers the device. Arduinos can run standalone by using a power supply in the bottom left of the board. Once you're done programming and don't require it to be constantly connected to your machine you can opt to power it.

Once that happens you should see the TX and RX LEDs below the L LED flash. This is the communication going on between the computer and the Arduino. The L may flicker too. Once this dance is complete your program should be running.

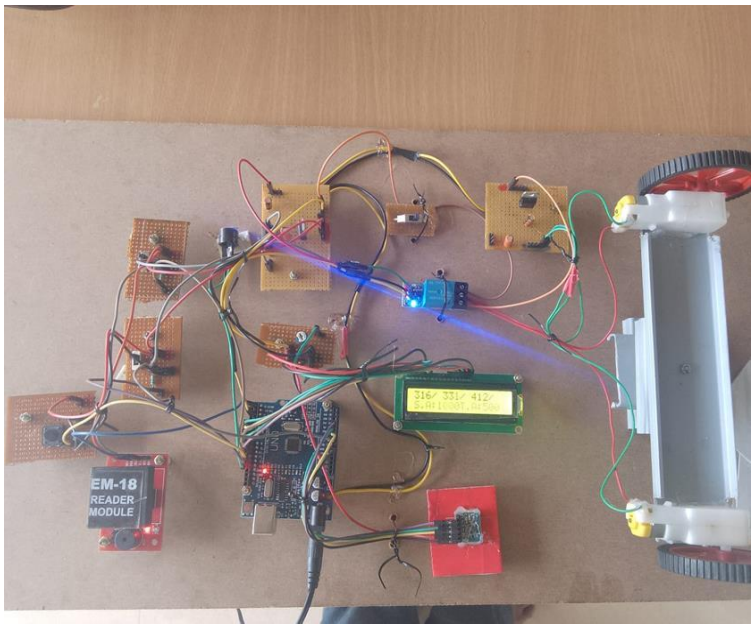
2.EMBEDDED C

Embedded C is a set of language extensions for the C programming language by the C Standards Committee to address commonality issues that exist between C extensions for different embedded systems. Embedded C programming requires nonstandard extensions to the C language in order to support exotic features such as fixed-point arithmetic, multiple distinct memory banks, and basic I/O operations. In 2008, the C Standards Committee extended the C language to address these issues by providing a common standard for all implementations to adhere to. It includes a number of features not available in normal C, such as fixed-point arithmetic, named address spaces and basic I/O hardware addressing. Embedded C uses most of the syntax and semantics of standard C, e.g., main() function, variable definition, data type declaration, conditiona, arrays and strings, structures and union, bit operations, macros, etc.l statements (if, switch case), loops (while, for), functions

Embedded systems programming is different from developing applications on a desktop computers. Key characteristics of an embedded system, when compared to PCs, are as follows: Embedded devices have resource constraints(limited ROM,limited RAM, limited stack space, less processing power) Components used in embedded system and PCs are different;embedded systems typically uses smaller, less power consumingcomponents. Embedded systems are more tied to the hardware.

Two salient features of Embedded Programming are code speed and code size. Code speed is governed by the processing power, timing constraints, whereas code size is governed by available program memory and use of programming language. Goal of embedded system programming is to get maximum features in minimum space and minimum time.

IV. RESULT



The Work is done with the help of RFID technology, EM-18 reader, RFID tags and Arduino. It's aim is to reduce the time of billing for the customers and to ease the process of shopping so that the customers gets benefited. It can be implemented in shopping malls where there is a large crowd and huge rush into malls. In the world of Automation this technology will replace the present barcode system which is present being followed. Hence this technology can help people to make their shopping easy and time saving too without any much human intervention. This also reduces manpower and shopping mall maintenance.

Fig.1 of LCD Display

Set amount in the purchasing material. Examples, first set amount Rs.1000 is set amount. total amount Rs.500.so buzzer off.

Fig 2 of LCD Display

The set amount Rs.1000 and purchasing total amount Rs.1500. So buzzer is on.

Fig 3 of LCD Display

Display shows accelerometer value is in normal and speed of trolley in normal..

The accelerometer value shows that downward inclination occurs and speed of trolley is reduced and slow speed is achieved.

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