Chapter Three

System components

Overview

This chapter shows system block diagram and system components.

3.1 hardware block diagram

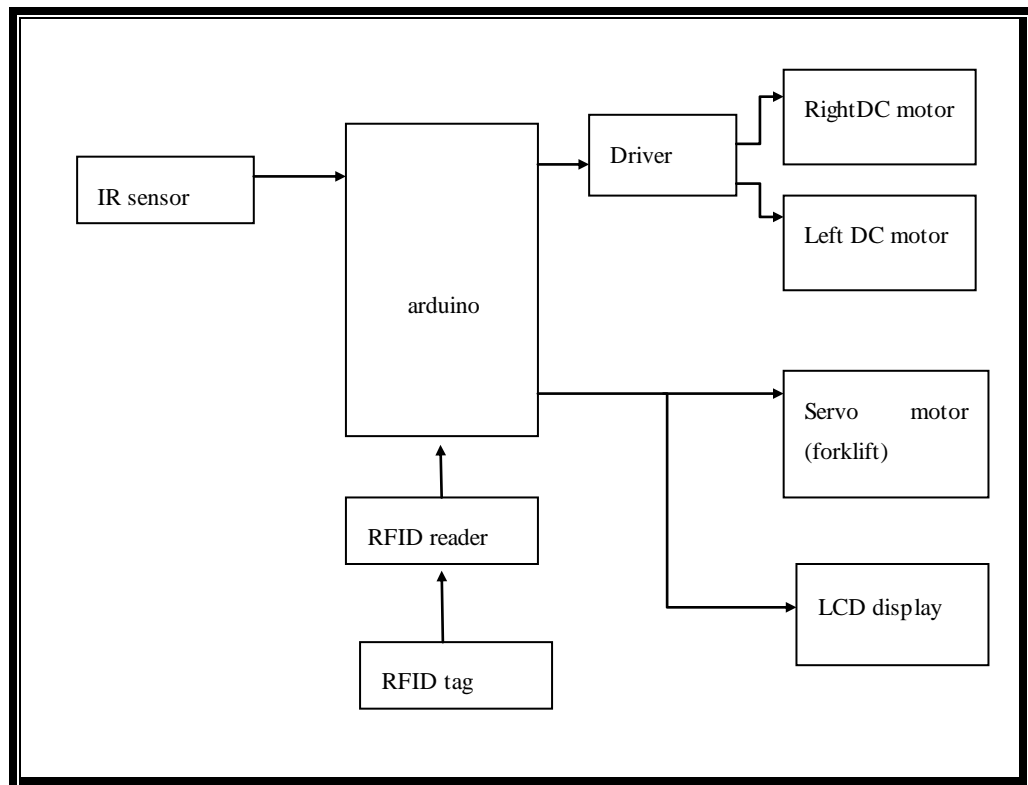This figure below shows the block diagram of the system.

Figure 3-1: Block diagram of the system

3.1.1arduino

Arduino is a controller, low cost computer on chip, which include:

-Microprocessor.

-A small amount of memory.

-Microcontroller at mega 32.

- Programmable memory (ROM).

- Analog to digital (A/D) and/or digital to analog (D/A) converters.

- Serial and/or parallel I/O ports.

- Timer.

Microcontroller used to control embedded applications, also used to control one or more task in the operation of a device or system such as mobile robots, traffic light control systems, temperature control system, and other embedded systems.

Microcontroller reduces the cost and size of application compared to the application that used separated microprocessor, memory and input/output devices.

In this project the microcontroller used is at mega 32 which is main controller of the system that receive signals from RFID reader , IR sensor and process the received signals to control the motor based on the result[24].

- Microcontroller ATMEGA 32:

The ATmega32 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, theATmega32 achieves throughputs approaching 1 MIPS per MHz allowing the system designed to optimize power consumption versus processing speed. It has the following features:

 - 32Kbytes of In-System Self-programmable Flash program memory.

   - 1024Bytes EEPROM.

- 2Kbyte Internal SRAM.

- 32 x 8 General Purpose Working Registers.

-Two 8-bit Timer/Counters with Separate prescalers and Compare Modes.
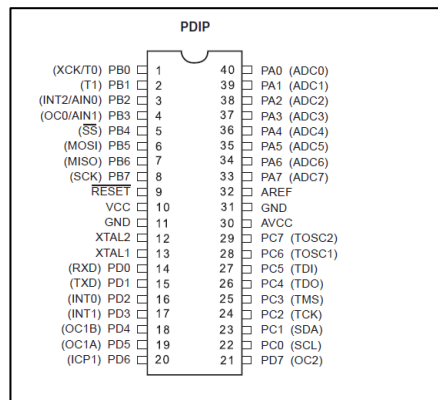
 -Four PWM Channels.

Pin description:


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                         PDIP

    (XCK/T0) PB0 ⌷ 1      40 ⌷ PA0 (ADC0)
        (T1) PB1 ⌷ 2      39 ⌷ PA1 (ADC1)
   (INT2/AIN0) PB2 ⌷ 3    38 ⌷ PA2 (ADC2)
   (OC0/AIN1) PB3 ⌷ 4     37 ⌷ PA3 (ADC3)
        (SS) PB4 ⌷ 5      36 ⌷ PA4 (ADC4)
      (MOSI) PB5 ⌷ 6      35 ⌷ PA5 (ADC5)
      (MISO) PB6 ⌷ 7      34 ⌷ PA6 (ADC6)
       (SCK) PB7 ⌷ 8      33 ⌷ PA7 (ADC7)
           RESET ⌷ 9      32 ⌷ AREF
             VCC ⌷ 10     31 ⌷ GND
             GND ⌷ 11     30 ⌷ AVCC
           XTAL2 ⌷ 12     29 ⌷ PC7 (TOSC2)
           XTAL1 ⌷ 13     28 ⌷ PC6 (TOSC1)
       (RXD) PD0 ⌷ 14     27 ⌷ PC5 (TDI)
       (TXD) PD1 ⌷ 15     26 ⌷ PC4 (TDO)
      (INT0) PD2 ⌷ 16     25 ⌷ PC3 (TMS)
      (INT1) PD3 ⌷ 17     24 ⌷ PC2 (TCK)
     (OC1B) PD4 ⌷ 18      23 ⌷ PC1 (SDA)
     (OC1A) PD5 ⌷ 19      22 ⌷ PC0 (SCL)
      (ICP1) PD6 ⌷ 20     21 ⌷ PD7 (OC2)
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Figure3-2: microcontroller at mega 32

-Port A (PA7:PA0):

Port A serves as the analog inputs to the A/D Converter. Also serves as an 8-bit bi-directional I/O port, if the A/D Converter is not used. Port pins can provide internal pull-up resistors (selected for each bit). The Port A output buffers have symmetrical drive characteristics with both high sink and source capability. When pins PA0 to PA7 are used as inputs and are externally pulled low, they will source current if the internal pull-up resistors are activated. The Port A pins are tri-stated when a reset condition becomes active, even if the clock is not running [24].

-Port B (PB7:PB0):

Port B is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port B output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port B pins that are externally pulled low will source current if the pull-up resistors are activated. The Port B pins are tri-stated when a reset condition becomes active, even if the clock is not running [24].

-Port C (PC7: PC0):

Port C is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port C output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port C pins that are externally pulled low will source current if the pull-up resistors are activated. The Port C pins

are tri-stated when a reset condition becomes active, even if the clock is not running. If the JTAG interface is enabled, the pull-up resistors on pins PC5 (TDI), PC3 (TMS) and PC2 (TCK) will be activated even if a reset occurs [24].

-Port D (PD7:PD0):

Port D is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port D output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port D pins that are externally pulled low will source current if the pull-up resistors are activated. The Port D pins are tri-stated when a reset condition becomes active, even if the clock is not running [24].

3.1.2 Motors:

A motor is an electromechanical device that converts electrical energy to mechanical energy. This mechanical energy is used for rotating a gripper, belt, wheels …etc.

The motors that used in the project are servo motor; it moves the fork lifter up or down depends on the output of the microcontroller. DC motor; it moves the robot forward, right, lift and reverse depends on the output of the microcontroller [26].

3.1.2.1 Servo Motor:

Servo motor is a type of motors whose output shaft can be moved to a specific angular position by sending it a coded signal.

The servo motor will maintain the position of the shaft as long as you keep applying the coded signal. When you change the coded signal, the angular position of the shaft will change. A common type of servo provides position control. Servos are commonly electrical or partially electronic in nature, using an electric motor as the primary means of creating mechanical force. Other types of servos use hydraulics, pneumatics, or magnetic principles.

Positioning servomechanisms were first used in military fire-control and marine navigation equipment [29].

- **Servo Motor Working Principle:**

The servo motor has some control circuits and a potentiometer (a variable resistor, aka pot) that is connected to the output shaft. The potentiometer allows the control circuitry to monitor the current angle of the servo motor. If the shaft is at the correct angle, then the motor shuts off. If the circuit finds that the angle is not correct, it will turn the motor the correct direction until the angle is correct. The output shaft of the servo is capable of travelling somewhere around 180 degrees [29].

- **Advantages of Servo Motor Over Stepper Motor**:

The basic difference between servo and stepper motors is the use of feedback. Servo motors have a position encoder attached to the drive motor that reports the actual position of the motor shaft

back to the motor controller. Therefore, the servo controller may take the corrective action whenever any positioning error exists. However, stepper controllers can only issue a move command, and the user has no way to be sure that the motor has actually reached the desired position. Servo motor systems always know exactly where the motor is at, so all step commands are executed and no lost of pulses. Servo motors work with full torque at high speeds whereas the torque of stepper motors falls off as the motor speed increases. This problem of stepper motors is caused by the electrical time constant and poor current utilization. Servo systems draw power only as required, and the power drain is proportional to the load torque applied to the motor. While stepper motors must have high currents applied at all times, even while they are stationary with little or no load. Stepper motor resolution may be increased via a process, called micro stepping, in which currents are applied to the motor windings in proportion to the desired position between normal steps [29].

3.1.2.2 Gear DC Motor:

A geared DC Motor has a gear assembly attached to the motor. The speed of motor is counted in terms of rotations of the shaft per minute and is termed as RPM .The gear assembly helps in increasing the torque and reducing the speed. Using the correct combination of gears in a gear motor, its speed can be reduced to

any desirable figure. This concept where gears reduce the speed of the vehicle but increase its torque is known as gear reduction. This Insight will explore all the minor and major details that make the gear head and hence the working of geared DC motor. DC motor in the system used to control of robot's wheels.figure3-3 shown the robot wheel [26].

Figure3-3: the robot wheel.

3.1.3 Motor Driver Circuit (L293D):

The L293D is IC consists of two H-bridge.it is commonly used for application such as relay drivers, motor and other high voltage current application.L293D in the system used to make the microcontroller output suitable to the motor input [27].

3.1.4 Sensors:

Advice that measure or detect a real world condition, such as pressure, heat, speed and convert the condition into analog or digital representation.

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Sensors are sophisticated devices that are frequently used to detect and respond to electrical or optical signals. A sensor converts s the physical parameter (for example: light, speed, etc.) into a signal which can be measured electrically [25].

The sensor type used in RFID warehouse robot is infrared sensor.

3.1.4.1 IR Sensor:

An IR sensor consists of an emitter, detector and associated circuitry. The circuit required to make an IR sensor consists of two parts; the emitter circuit and the receiver circuit. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, its resistance and correspondingly, its output voltage, change in proportion to the magnitude of the IR light received. This is the underlying principle of working of the IR sensor [25].

- **Principle working:**

An Infrared (IR) sensor is used to detect obstacles in front of the robot or to differentiate between colors depending on the configuration of the sensor. The picture shown is a very simple black box model of the IR Sensor. The sensor emits IR light and

gives a signal when it detects the reflected light[25]..Figure3-4 below show the Principle working.
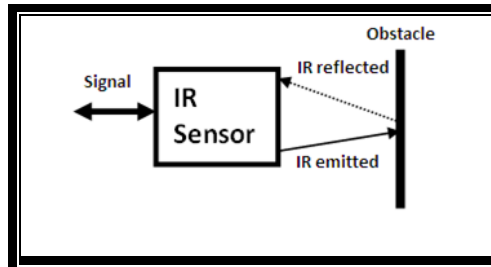

Figure3-4: the Principle working

3.1.5 Power Supply:

A power supply is a device that supplies electric power to an electrical load. The term is most commonly applied to electric power converters that convert one from of electrical energy to another, though it may also refer to devices that convert another form of energy (chemical, mechanical, water, solar) to electrical energy.

Every power supply most obtain the energy it supplies to its load, as well as any energy it consumes while performing that task, from an energy source. Depending on its design, a power may be obtain energy from:

-Electrical energy transmission systems. For example passive tag.

-Energy storage devices such as batteries and fuel cells

-Electromechanical systems such as generators and alternators.

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-Solar power.

-Water power.

- **Type of Power Supply:**
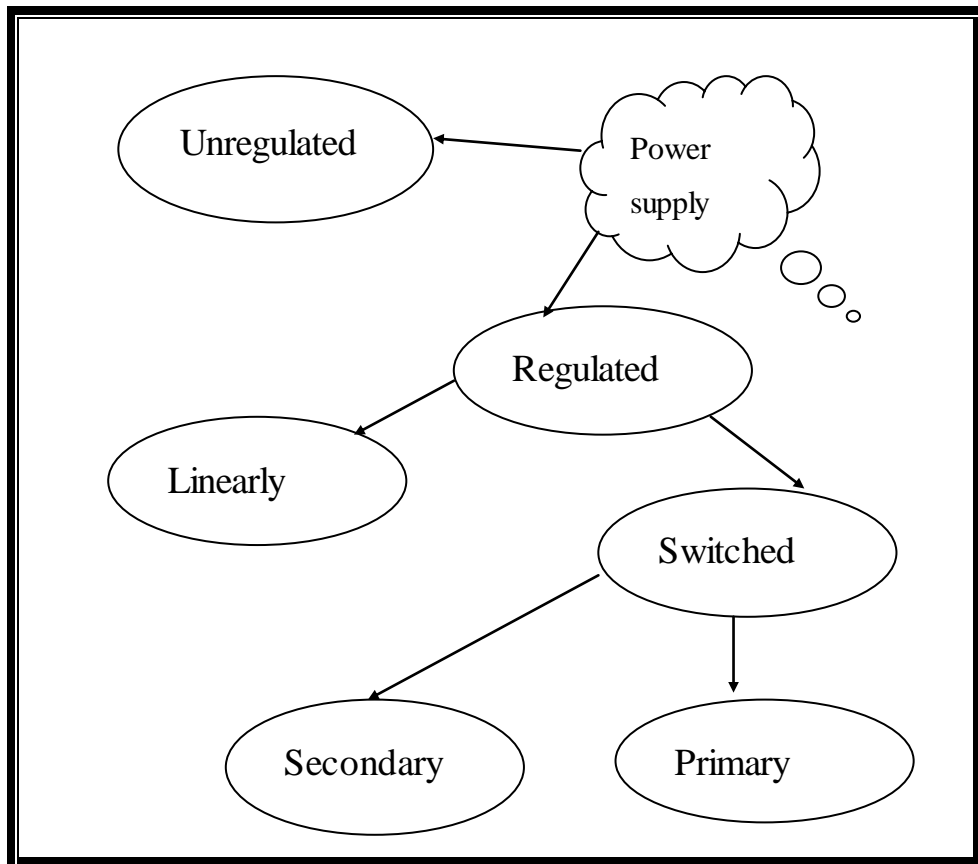
  The power supply shown in the block diagram

Figure 3-5: power supply overview

The table below shown summarize of power supply types.

Table3-1: summarize of power supply types.

type	Uses	examples
Unregulated	Used for simple electromechanical applications that does not required exact output voltages.	Supply of contactors.
Regulated	Used for all application that required a very exact output voltage.	For highly precise medical devices.

AC to DC convertor they take an input of 220 volt AC and give an output voltage around 5 volts DC.