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INDUSTRIAL AUTOMATION

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Abstract: Internet of Things (IoT) in industries has created a new revolution in industries. IoT in industry has given rise to the term "INDUSTRY 4.0" where systems are connected to each other over the internet and can communicate with each other to take necessary decisions (also called as M2M communication) through artificial intelligence. In this paper, we shall design a system which will automatically control and monitor the industrial applications and also allow the user to control the application from anywhere in the world. Having control over the applications over the internet is one of the best ways to deal with the industrial applications.

Keywords: Atmega328(Microcontroller),Realydrive,WIFI Module(ESP 8266), Powersupply, Motor,Heater,Bulb,LCD,,LED

INTRODUCTION:

Industrial Internet of Things (IoT) is the best way of connecting industrial machineries and sensors, to each other, over the internet, allowing the authorized user of the industry to use information from these connected devices to process the obtained data in a useful way. IoT-connected applications typically support data acquisition, aggregation, analysis, and visualization. The IoT architecture includes latest technologies such as computers, intelligent devices, wired and wireless communication and cloud computing [1]. Previously Bluetooth and RF (Radio Frequency) technologies were used to control and monitor the industrial applications but were limited to short distance. The operator had to be in the range of the Bluetooth connectivity or in the Radio Frequency

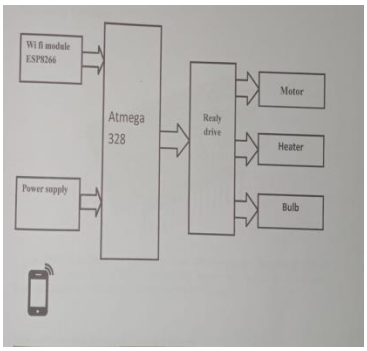
Ah yes, it is finally time to make your Arduino do something! We're going to start with the classic **hello world!** of electronics, a blinking light.

This lesson will basically get you up and running using the Arduino software and uploading a sketch to the Arduino board. Once you've completed this step we can continue to the really exciting stuff, which is when we start writing our own sketches!

These instructions mostly show Windows software. Except when indicated, the software (should be) identical on all platforms. Linux will be added once I figure out how to get it working (yay).

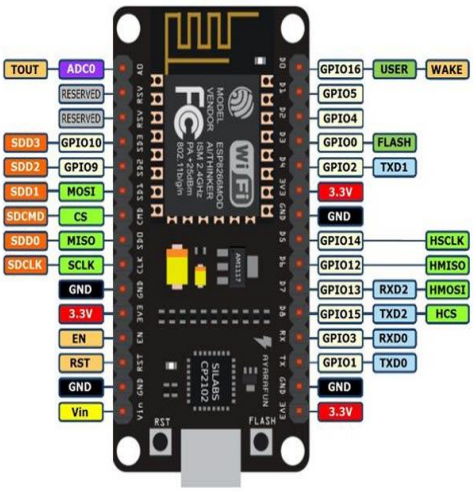
We just a USB cable and an Arduino. If you have an older Arduino you may also need an LED. Any LED is fine as long as it looks sort a like the photo, with a plastic Bulb and two legs.

BLOCK DIAGRAM:



MAJOR COMPONENTS USED:

NodeMCU ESP8266



NodeMCU is an open-source Lua based firmware and development board specially targeted for IoT based Applications. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module.

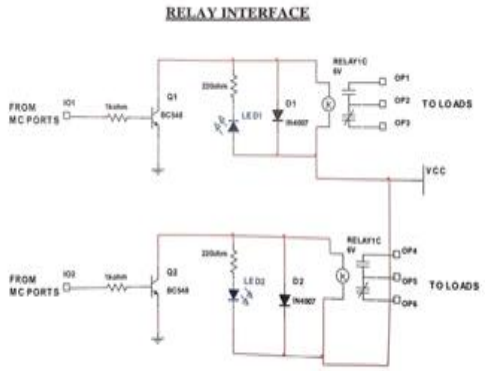
NodeMCU ESP8266 Specifications & Features

- Microcontroller: Tensilica 32-bit RISC CPU Xtensa LX106
- Operating Voltage: 3.3V
- Input Voltage: 7-12V
- Digital I/O Pins (DIO): 16
- Analog Input Pins (ADC): 1
- UARTs: 1
- SPIs: 1
- I2Cs: 1
- Flash Memory: 4 MB
- SRAM: 64 KB
- Clock Speed: 80 MHz
- USB-TTL based on CP2102 is included onboard, Enabling Plug n Play
- PCB Antenna
- Small Sized module to fit smartly inside your IoT projects

Serial Adapter :

There are many different USB to Serial adapters / boards. To be able to put ESP8266 into bootloader mode using serial handshaking lines, you need the adapter which breaks out RTS and DTR outputs. CTS and DSR are not useful for upload (they are inputs). Make sure the adapter can work with 3.3V IO voltage: it should have a jumper or a switch to select between 5V and 3.3V, or be marked as 3.3V only.

POWER SUPPLY:

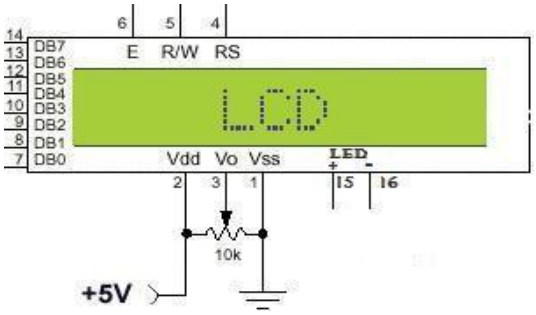


Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other type of energy to an output load or group of loads is called a power supply unit or PSU. In this project, a +5V DC regulated power supply is derived from the power supply unit designed and implemented. The Figure shows the circuit diagram designed to get the +5V DC regulated power supply for the project. A full wave rectifier is a device that has two or more diodes arranged so that load current flows in the same direction during each half cycle of the ac supply.

The circuit diagram shows the connection of Relay Driver Circuit. When the logic signal from the Buffer O/P is applied to base of the transistor through resistor 1KOhm the starts conducting, it energizes the relay. The transistor act as a small signal amplifier resistor of 1KOhm is used to provide proper emitter base voltage to turn the transistor to ON state from OFF state.

Relay is an electromechanical switch & it works on the principled energizing an electromagnet. It consists of primary coil, 2 contacts one is normally open contact ―NO‖ & the other is normally closed contact ―NC‖& pole normally identified a common. When relay is in off state the pole is connected to normally closed (NC contact).The load is connected to the relay as shown in above circuit diagram. The load may be a fan or dc motor or heater coil, when transistor starts conducting current starts flowing through the coil. Which develops its own magnetic flux when the strength of current is suitable, a sufficient flux when produced attracts the pole to make contact with normally open position _NO‘. Hence the load connected to it performs its operation until the contact is broken. A diode connected in parallel across the primary coil is to eliminate the effect of back EMF on the transistor. Relays have great application in industry. Using the principle of energizing an Electromagnet we can handle large voltages & current application.

LIQUID CRYSTAL DISPLAY (LCD):



The LCD panel used in this block interfaced with micro-controller through output port. This is a 16 character × 2Line LCD module, capable of display numbers, characters, and graphics. The display contains two internal byte-wide registers, one for commands (RS=0) and the second for character to be displayed (RS=1). It

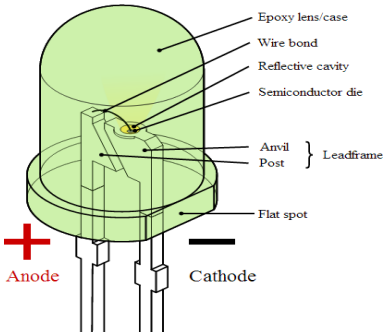
also contains a user programmed Ram area (the character RAM) character that can be formed using dot matrix that can be programmed to generate any desired. Two distinguished between these areas, the hex command byte will be signify that the display RAM address 00h is chosen.

LCD can add a lot to our application in terms of providing a useful interface for the user, debugging an application or just giving it a ―professional‖ look. The most common type of LCD controller is the Hitachi 44780 which provides a relatively simple interface between a processor and an LCD. Using this inter is often not attempted by inexperienced designers and programmers because it is difficult to find good documentation on the interface, initializing the interface can be problem and the displays themselves are expensive.

Connection to a PC parallel port is mostly simple. These displays can handle eight bit input directly. They also need two extra lines to control which kind of data has just arrived and when the data is meant to be stable. Those signals are also called RS (Register Select, instruction or data register) and EN (enable).

So it has to control ten data lines (8 bits + RS + EN) and one common ground (GND) line, which make eleven lines to the parallel port. Data read back is not supported by the driver and so it does not require extra line for this. The following table shows the needed connection.

LED'S:



A **light-emitting diode** (**LED**) is a semiconductor light source. LEDs are used as indicator lamps in many devices and are increasingly used for other lighting.

The LED consists of a chip of semiconducting material doped with impurities to create a *p-n junction*. As in other diodes, current flows easily from the p-side, or anode, to the n-side, or cathode, but not in the reverse direction. Charge-carriers—electrons and holes—flow into the junction from electrodes with different voltages. When an electron meets a hole, it falls into a lower energy level, and releases energy in the form of a photon.

The wavelength of the light emitted, and thus its color depends on the band gap energy of the materials forming the *p-n junction*. In silicon or germanium diodes, the electrons and holes recombine by a *non-radiative transition*, which produces no optical emission, because these are indirect band gap materials. The materials used for the LED have a direct band gap with energies corresponding to near-infrared, visible, or near-ultraviolet light.

LED development began with infrared and red devices made with gallium arsenide. Advances in materials science have enabled making devices with ever-shorter wavelengths, emitting light in a variety of colors.

LEDs are usually built on an n-type substrate, with an electrode attached to the p-type layer deposited on its surface. P-type substrates, while less common, occur as well. Many commercial LEDs, especially GaN/InGaN, also use sapphire substrate.

Most materials used for LED production have very high refractive indices. This means that much light will be reflected back into the material at the material/air surface interface. Thus, light extraction in LEDs is an important aspect of LED production, subject to much research and development.

APPLICATIONS OF INDUSTRIAL AUTOMATION :

Industrial IoT is defined as a **network of devices, machinery and sensors connected** to each other and to the Internet, with the purpose of collecting data and analyze it to apply this information in continuous process improvement. There are many Industrial IOT applications out there, and they have driven an increasing number of companies to engage in this new paradigm to improve their productivity and optimize their expenses and profits.

This is a market that is constantly expanding – one that major players have already adopted. Even though studies show different figures when it comes to accurate predictions of the market value of IoT in the upcoming years, the most important reports agree that investment will increase threefold at the very least.

To have access to this competitive advantage, one would be wise to know the main IoT applications and how to implement the system.

The main Industrial IOT applications:

Studies published by Deloitte show the importance given by the business world to generating IoT environments: in its Industry 4.0' report, 94% of the survey participants stated that digital transformation is an essential strategic objective for the organization. While this is a global trend,

in the case of the industrial sector, businesses need to be aware of the usefulness of Industrial IOT applications to generate processes that remain relevant in the upcoming years.

- Automated and remote equipment management and monitoring....
- Predictive maintenance. .
- Faster implementation of improvements. .
- Pinpoint inventories.
- Quality control. ...
- Supply chain optimization...
- Plant safety improvement.

BENEFITS OF INDUSTRIAL AUTOMATION:

First off, it's useful to explain just what IoT is and how it can revitalize modern operations. IoT is the application of connected smart devices to monitor, automate, and predict all kinds of industrial processes and outcomes. These technologies offer everything from enhanced worker protections through factory floor monitoring systems to the predictive maintenance possibilities currently revolutionizing the fleet management industry.

Widespread implementation of such systems changes the ways manufacturers, supply chains, and warehouse managers function more effectively. With IoT, data-driven insights power greater results. For many businesses, this can mean:

- Greater energy efficiency
- Reduced costs
- Better quality products
- Improveddecision-making potential

In short, the automation and data-gathering capabilities of IoT devices make for a more efficient workplace. As less energy is used, product efficiency is enhanced, and metrics are assessed, industrial businesses have the potential to streamline practices like never before. Since every downtime incident causes an average loss of $17,000, the application of IoT in predictive maintenance alone can mean substantial savings.

These benefits of IoT are the reason widespread adoption of this technology is so desirable. As of now, many companies across industries are already using it to great effect.

Code:

```
#include<LiquidCrystal.h>

LiquidCrystal lcd(7, 6, 5, 4, 3, 2);
String Rx = "";
 int Fan = 9;
 int Light = 10;
 int Heater = 11;
String F = "", L = "", H = "";

void LCD_Display(String ROW1, String ROW2, int Time)
{
lcd.clear();
lcd.setCursor(0, 0);
 lcd.print(ROW1);
 lcd.setCursor(0, 1);
 lcd.print(ROW2);
 delay(Time);
 }

void setup()
{
 Serial.begin(9600);
 lcd.begin(16, 2);
 LCD_Display("WEL-COME", "   ", 2000);
 pinMode(Fan, OUTPUT);
pinMode(Light, OUTPUT);
pinMode(Heater, OUTPUT);

  digitalWrite(Fan, LOW);
 digitalWrite(Light, LOW);
 digitalWrite(Heater, LOW);
//  LCD_Display("   Light OFF   ", "           ", 1000);
 //  LCD_Display("    Fan OFF    ", "           ", 1000);
  //  LCD_Display("   Heater OFF   ", "           ", 1000);
 }

void loop()
{
  if (Serial.available() > 0)
  {
  Rx = "";
 while (Serial.available() > 0)
{
 //Receive data;
 delay(10);
 }
 if (-1 != Rx.indexOf("A"))
{
  digitalWrite(Light, HIGH);
  L = "";
  L = "A";
  }
  else if (-1 != Rx.indexOf("a"))
  {
```

```
 digitalWrite(Light, LOW);
 L = "";
 L = "a";
}
 else if (-1 != Rx.indexOf("B"))
{
  digitalWrite(Fan, HIGH);
 F = "";
 F = "B";
}
else if (-1 != Rx.indexOf("b"))
 {
 digitalWrite(Fan, LOW);
 F = "";
 F = "b";
 }
 else if (-1 != Rx.indexOf("C"))
 {
 digitalWrite(Heater, HIGH);
 H = "";
 H = "C";
 }
 else if (-1 != Rx.indexOf("c"))
 {
 digitalWrite(Heater, LOW);
 H = "";
 H = "c";
 }
}

 if (L == "A")
 LCD_Display("    Light ON    ", "           ", 1000);
 else
LCD_Display("   Light OFF   ", "           ", 1000);


 LCD_Display(" Fan ON     ", "           ", 1000);
 else
 LCD_Display(" Fan OFF    ", "           ", 1000);
  if (H == "C")
 LCD_Display("Heater ON    ", "           ", 1000);
else
 LCD_Display("Heater OFF   ", "           ", 1000);
}
```

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RESULT: