**Circuit Explanation**

The basic circuit of the microcontroller consist of a power supply unit , External Crystal oscillator and a reset circuitry . The power supply consist of a voltage regulator which is used to regulate the voltage to a fixed voltage of 5v .Normally 7805 voltage regulators are used for this purpose.

Normally the crystal oscillator provided with the microcontrollers are of 16MHz and to 22pf capacitors are used with the microcontroller as decoupling capacitors for decreasing the noise.

**current sensor**

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The sensed current and the output signal can be:

* [Alternating current](http://en.wikipedia.org/wiki/Alternating_current) input,
  + analog output, which duplicates the wave shape of the sensed current
  + bipolar output, which duplicates the wave shape of the sensed current
  + unipolar output, which is proportional to the average or RMS value of the sensed current
* [Direct current](http://en.wikipedia.org/wiki/Direct_current) input,
  + unipolar, with a unipolar output, which duplicates the wave shape of the sensed current
  + digital output, which switches when the sensed current exceeds a certain threshold
* [Hall effect](http://en.wikipedia.org/wiki/Hall_effect) [IC](http://en.wikipedia.org/wiki/Integrated_circuit) sensor.
* [Transformer](http://en.wikipedia.org/wiki/Transformer) or [current clamp](http://en.wikipedia.org/wiki/Current_clamp) meter, (suitable for AC current only).
* [Resistor](http://en.wikipedia.org/wiki/Resistor), whose voltage is directly proportional to the current through it.
* [Fiber optic current sensor](http://en.wikipedia.org/wiki/Fiber_optic_current_sensor), using an [interferometer](http://en.wikipedia.org/wiki/Interferometry) to measure the phase change in the light produced by a magnetic field.
* [Rogowski coil](http://en.wikipedia.org/wiki/Rogowski_coil), electrical device for measuring alternating current (AC) or high speed current pulses.

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Hall Effect current sensors can measure all types of current signals i.e. AC,DC or pulsating current.

These sensors are currently being used widely in almost all the industries because of their vast applications and the type of output they provide, which can be manipulated and can be used for various application.

* Triple-channel device with digital interface allows for monitoring three separate voltages, eliminating the need for discrete devices for each voltage
* High accuracy: 80 µV maximum offset voltage and 0.5% gain error enable high peak current detection
* Integrate into applications with increasing common-mode voltage ranges: Common-mode range of 0 to 26V, supply range of 2.7 to 5.5V, and 160 mV maximum shunt
* Performance optimization under multiple operating conditions: Configurable alert monitoring scheme, programmable sample averaging, and independent bus and shunt voltage conversion times
* 70 µV maximum offset voltage and low gain error enables system power savings with smaller shunt resistors, while maintaining high accuracy
* High accuracy: Wide common-mode range of -14 to 80V and high common-mode rejection ratio of 120 dB maintains high accuracy in high voltage applications
* Measuring a voltage in any system is a “passive” activity as it can be done easily at any point in the system without affecting the system performance. However, current measurement is “intrusive” as it demands insertion of some type of sensor which introduces a risk of affecting system performance.
* Current measurement is of vital importance in many power and instrumentation systems. Traditionally, current sensing was primarily for circuit protection and control. However, with the advancement in technology, current sensing has emerged as a method to monitor and enhance performance.

Knowing the amount of current being delivered to the load can be useful for wide variety of applications. Current sensing is used in wide range of electronic systems, viz.,Battery life indicators and chargers, 4-20 mA systems, over-current protection and supervising circuits, current and voltage regulators, DC/DC converters, ground fault detectors, programmable current sources, linear and switch-mode power supplies,communications devices , automotive power electronics, motor speed controls and overload protection, etc. A current sensor is a device that detects and converts current to an easily measured output voltage, which is proportional to the current through the measured path.

When a current flows through a wire or in a circuit, voltage drop occurs. Also, a magnetic field is generated surrounding the current carrying conductor. Both of these phenomena are made use of in the design of current sensors. Thus, there are two types of current sensing: direct and indirect. Direct sensing is based on Ohm’s law, while indirect sensing is based on Faraday’s and Ampere’s law.

Direct Sensing involves measuring the voltage drop associated with the current passing through passive electrical components.

The reset circuitry used here consist of a switch and a resistor normally a HIGH signal is present in the mCLR pin of the microcontroller when the switch is pressed a LOW presents at the pin and microcontroller gets reset and as there is a resistor provided in circuit the Vcc and Ground never get direct short while resetting.

The microcontroller consist of an internal ADC module this ADC module is used to convert the ADC reading from the sensor to a digital value. The ADC provided with microcontroller is of 10 bit resolution. which reads value from 0-1023..The Devices which output the analog variation can communicate with controller using this module .

The Current measurement is done with the help of a current transformer a bridge rectifier and a Filter. This output is coupled to the ADC pin of the microcontroller. The voltage is sensed with the help of a step down transformer , bridge rectifier and a Filter and a voltage divider , This output is coupled to the ADC pin of the microcontroller. The relays are used to cutoff the load this relay are drived using transistor

The LCD is an external module used to display the details to the user. The LCD communicates with the microcontroller using parallel communication of the data . The data lines are connected to a port of the microcontroller and the control lines RS (register select ),E(enable),R/W (read /write),are connected to the corresponding pins .

The DS1307 operates as a slave device on the serial bus. Access is obtained by implementing a START condition and providing a device identification code followed by a register address. Subsequent registers can be accessed sequentially until a STOP condition is executed. When VCC falls below 1.25 x VBAT the device terminates an access in progress and resets the device address counter. Inputs to the device will not be recognized at this time to prevent erroneous data from being written to the device from an out of tolerance system. When VCC falls below VBAT the device switches into a low-current battery backup mode. Upon power-up, the device switches from battery to VCC when VCC is greater than VBAT + 0.2V and recognizes inputs when VCC is greater than 1.25 x VBAT.

Here relay is used for solenoid valve control. A relay is an [electrically](http://en.wikipedia.org/wiki/Electric) operated [switch](http://en.wikipedia.org/wiki/Switch). Many relays use an [electromagnet](http://en.wikipedia.org/wiki/Electromagnet) to mechanically operate a switch, but other operating principles are also used, such as [solid-state relays](http://en.wikipedia.org/wiki/Solid-state_relay). Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal. The first relays were used in long distance [telegraph](http://en.wikipedia.org/wiki/Electrical_telegraph" \o "Electrical telegraph)circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

A type of relay that can handle the high power required to directly control an electric motor or other loads is called a [contactor](http://en.wikipedia.org/wiki/Contactor" \o "Contactor). [Solid-state relays](http://en.wikipedia.org/wiki/Solid-state_relay) control power circuits with no [moving parts](http://en.wikipedia.org/wiki/Moving_parts), instead using a semiconductor device to perform switching. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called "[protective relays](http://en.wikipedia.org/wiki/Protective_relay)".

A simple electromagnetic relay consists of a coil of wire wrapped around a [soft iron core](http://en.wikipedia.org/wiki/Magnetic_core), an iron yoke which provides a low [reluctance](http://en.wikipedia.org/wiki/Magnetic_reluctance) path for magnetic flux, a movable iron [armature](http://en.wikipedia.org/wiki/Armature_(electrical_engineering)), and one or more sets of contacts (there are two in the relay pictured). The armature is hinged to the yoke and mechanically linked to one or more sets of moving contacts. It is held in place by a [spring](http://en.wikipedia.org/wiki/Spring_(device)) so that when the relay is de-energized there is an air gap in the magnetic circuit. In this condition, one of the two sets of contacts in the relay pictured is closed, and the other set is open. Other relays may have more or fewer sets of contacts depending on their function. The relay in the picture also has a wire connecting the armature to the yoke. This ensures continuity of the circuit between the moving contacts on the armature, and the circuit track on the [printed circuit board](http://en.wikipedia.org/wiki/Printed_circuit_board) (PCB) via the [yoke](http://en.wikipedia.org/wiki/Yoke), which is soldered to the PCB.

When an [electric current](http://en.wikipedia.org/wiki/Electric_current) is passed through the coil it generates a [magnetic field](http://en.wikipedia.org/wiki/Magnetic_field) that activates the armature, and the consequent movement of the movable contact(s) either makes or breaks (depending upon construction) a connection with a fixed contact. If the set of contacts was closed when the relay was de-energized, then the movement opens the contacts and breaks the connection, and vice versa if the contacts were open. When the current to the coil is switched off, the armature is returned by a force, approximately half as strong as the magnetic force, to its relaxed position. Usually this force is provided by a spring, but gravity is also used commonly in industrial motor starters. Most relays are manufactured to operate quickly. In a low-voltage application this reduces noise; in a high voltage or current application it reduces [arcing](http://en.wikipedia.org/wiki/Relay#Undesired_arcing).

When the coil is energized with [direct current](http://en.wikipedia.org/wiki/Direct_current), a [diode](http://en.wikipedia.org/wiki/Diode) is often placed across the coil to dissipate the energy from the collapsing magnetic field at deactivation, which would otherwise generate a [voltage spike](http://en.wikipedia.org/wiki/Voltage_spike) dangerous to [semiconductor](http://en.wikipedia.org/wiki/Semiconductor) circuit components. Some automotive relays include a diode inside the relay case. Alternatively, a contact protection network consisting of a capacitor and resistor in series ([snubber](http://en.wikipedia.org/wiki/Snubber" \o "Snubber) circuit) may absorb the surge. If the coil is designed to be energized with [alternating current](http://en.wikipedia.org/wiki/Alternating_current) (AC), a small copper "shading ring" can be crimped to the end of the solenoid, creating a small out-of-phase current which increases the minimum pull on the armature during the AC cycle.[[1]](http://en.wikipedia.org/wiki/Relay#cite_note-1)

Relays are used wherever it is necessary to control a high power or high voltage circuit with a low power circuit. The first application of relays was in long[telegraph](http://en.wikipedia.org/wiki/Electric_telegraph) systems, where the weak signal received at an intermediate station could control a contact, regenerating the signal for further transmission. High-voltage or high-current devices can be controlled with small, low voltage wiring and pilots switches. Operators can be isolated from the high voltage circuit. Low power devices such as [microprocessors](http://en.wikipedia.org/wiki/Microprocessor) can drive relays to control electrical loads beyond their direct drive capability. In an automobile, a starter relay allows the high current of the cranking motor to be controlled with small wiring and contacts in the ignition key.

Esp8266(node MCU) is a wifi module available to connect internet with atmega328 IC. Here we are building a wbpage using esp8266 for medicine booking purpose. And the details from the webpage are passed to the microcontroller through serial communication. And there should be a connection between microcontroller Tx and Esp8266 Rx pins.

LDR is light dependent resistor whose resistance decreases with increase in the intensity of light falling on it. The resistance is very high in darkness, almost high as 1MΩ but when there is light that falls on the LDR, the resistance is falling down to a few KΩ (10-20kΩ @ 10 lux, 2-4kOmega; @ 100 lux) depending on the model.

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optocoupler configuration forms the basis of a very simple solid state relay application which can be used to control any AC mains powered load such as lamps and motors. Also unlike a thyristor (SCR), a triac is capable of conducting in both halves of the mains AC cycle with zero-crossing detection allowing the load to receive full power without the heavy inrush currents when switching inductive loads.

**Optocouplers** and **Opto-isolators** are great electronic devices that allow devices such as power transistors and triacs to be controlled from a PC’s output port, digital switch or from a low voltage data signal such as that from a logic gate. The main advantage of opto-couplers is their high electrical isolation between the input and output terminals allowing relatively small digital signals to control much large AC voltages, currents and power.

An optocoupler can be used with both DC and AC signals with optocouplers utilizing a SCR (thyristor) or triac as the photo-detecting device are primarily designed for AC power-control applications. The main advantage of photo-SCRs and photo-triacs is the complete isolation from any noise or voltage spikes present on the AC power supply line as well as zero-crossing detection of the sinusoidal waveform which reduces switching and inrush currents protecting any power semiconductors used from thermal stress and shock.