

Chapter Three

Technology Background

3.1Sensors.

3.2 Cooling system.

3.3 Timing Clock.

3.4Security System.

3.5 LCD Screen.

3.6 GSM Transmitter.

3.7 Microprocessor (Arduino).

This chapter provides technical and theoretical background about all system elements and components ,required to implement the project successfully

3.1 Sensors

Several types of sensors are required in the project such as temperature sensor , optical sensor , in this section more details about each sensor are studied to choose the best one for each stage .

3.1.1 Humidity-Temperature Sensor

Heat is one of the most important types of energy and the temperature is measured in Relative humidity is defined as the .three global units Kelvin, Celsius and Fahrenheit ratio between the actual water vapor pressure of a sample of air and the pressure of saturation vapor at a given temperature. Relative humidity is measured by R.H%.

This sensor is to measure the temperature and humidity inside the pharmacy rooms in order to store it in good condition. The temperature must be within the range (15-25)C° If the temperature of the pharmacy exceeds 25 C°, this sensor will affect the sensitivity of the temperature increase and thus sends a signal to the Arduino Which operates the cooling system to reduce the temperature, and works to measure the humidity inside the pharmacy no more than 60% relative humidity in normal storage conditions, in case the humidity increased than 60% The sensor works to send a signal to Arduino to operate a system that reduces moisture.

The following table shows a comparison between different Humidity-Temperature Sensor.

Table 3.1 Comparison Between Humidity-Temperature Sensor

Features	RHT03	DHT11
Response time	6 s	2 s
Sensitivity Humidity	0.1% RH	0.5% RH
Sensitivity Temperature	0.1°C	+1 °C
Accuracy Humidity	±2% RH	± 5% RH
accuracy Temperature	±0.5°C	±2°C
Measurement Range Humidity	0-100% RH	20-90% RH
Measurement Range Temperature	-40 – 80 °C	0-50°C

The Sensor That will be used is DHT11, because it is fast and high accuracy, and because its output is a digital signal, also on the economic side its more affordable and available in the local market[13].

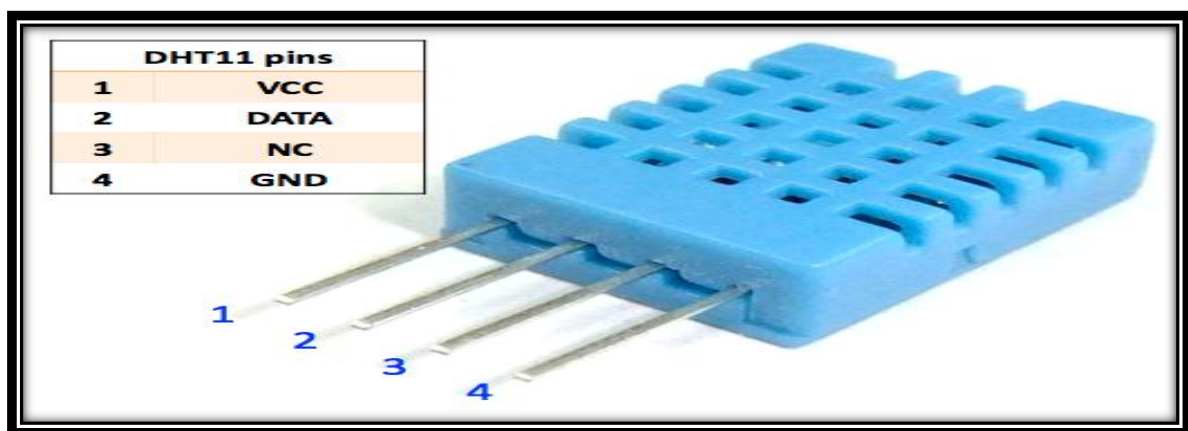


Fig 3.1 DHT11 Temperature & Humidity Sensor

3.2 Cooling system

A cooling system must be operated in order to store the medicine in good condition. This system is an air cooling fan inside the pharmacy. The fan is an electric device used for ventilation in the hot air to provide a comfortable atmosphere.

In its simplest form, the fan consists of an electric motor connected to the end of blades. When the engine rotates, the feathers generate an antenna current.

The fan operates on the basis of generating a difference in pressure and thus displacing the air from the higher pressure point towards the lower pressure resulting from the movement of the blades. This operation is done by fan blades (slanting) that displace air touching the blade surface as they rotate. Because the air is removed from one side of the blade surface, the pressure rises slightly on one surface and creates a partial vacuum on the other surface of the blade. Because pressure (air here) is equal, it drives a quantity of air away from the airless surface towards it to fill this vacuum. This process continues with fan rotation[14].

The fans produce a large quantity of air current but at low pressure, we will use the fan Model Type: EC-4010xxxx, It has several features >17DBA Noise, Life Hour50000, Fan Speed 6000RPM, Voltage 5VDC and Dimension :40 x 40 x 10 mm.

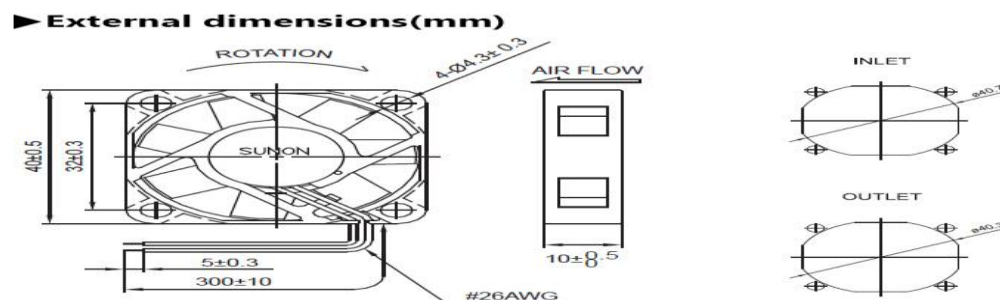


Fig 3.5 Fan Model Type: EC-4010xxxx

3.3 Timer Controller

To gain an accurate timing for the medicine expiration date, there is something required : (a timekeeping chip). The DS1302 trickle-charge timekeeping chip contains a real-time clock/calendar and 31 bytes of static RAM. RTC is found in several electronic devices that need to save time. It is connected with a micro-controller via a simple serial interface of pins. The 4 pins will be connected to another digital pins of the micro-controller. The real-time clock is used to reduce the consumption ; this is known as the most accurate calendar that provides informations per seconds, minutes, hours, day, date, month, and year . At the end of the month, an automatically adjusted happens in less than 31 days, and that happens for months including corrections for leap year. The clock works in either the 24-hour or 12-hour format with an AM/PM indicator .RTCs often have an alternative power source, so users can continue saving time when the main power source is off or unavailable. This alternative power source then is normally a lithium battery[15]



Fig 3.6 Real Time Clock (RTC)

3.4 Security System

3.4.1 Keypad

The Smart pharmacy will be secured by using 4 pins with its numbers in order to make it hardly reachable to the children. that pin is needed when the expiration date of the medicine is occurred, and when you want to open the medicine or to refill it once again or when you want to throw it away. The system is connected with a servo locker using matrix style keyboard with the Arduino which is controlled. A keyboard is a set of buttons that arranged in a panel; that panel includes numbers, digits, symbols or alphabetical letters. It consists of a matrix of rows and columns that connect its rows to be a feeding source and its columns as a part- feeder route[16] .

The button may be functioned as a switch, and if you press on it, it allows the current to pass through.

The 7 pins will be connected to the digital pins of the micro-controller

- 4-1 are the rows
- 5-7 are the columns

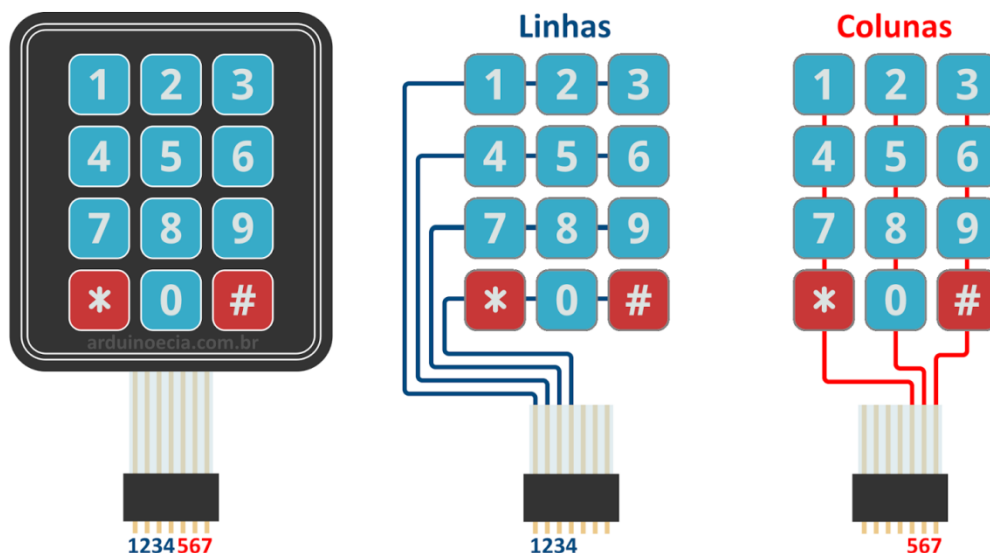


Fig 3.7 Keypad

3.4.2 Servo Motor

A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration . always rotates at full speed. This type of servomotor is a basic form of simple and cheap devices used for models controlled by Arduino ,It consists of a suitable motor coupled to a sensor for position feedback. Stander Servo Motor, It's an engine that is able to rotate from 0 to 180 in both directions with clockwise and counterclockwise. Also it works with DC motors. Standard Servo Motor has many distinctive features: Firstly the linear S relationship between voltage and speed. Secondly It's specialized in developing the motor shaft which we call it the potentiometer. The Potentiometer is a variable resistance that leads to change the outside voltage. Due to the value of the voltage appears, the electronic circuit determines the position of the motor shaft.. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors[17].

When the signal pin of the motor enters the Analog PWM Pin set Arduino will drive the servo motor to rotate 180 degrees to open the mechanical fan such as the lock.

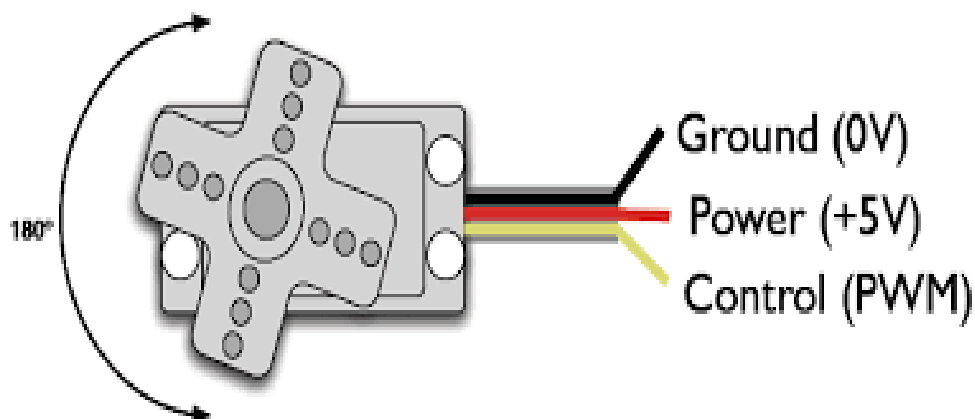


Fig 3.8 Servo Motor

3.5 LCD Screen

Smart Pharmacy will show the date, clock, prescription and doctor's prescription for Crystal Library's LSD library allowing us to control the LED screens compatible with the Hitachi HD44780 driver. There are many of them out there, and we will use the 16-pin interface. It is connected with Arduino through pin number[18]. LED has a parallel interface, which means that the microcontroller has to handle multiple pins and interface simultaneously to control the screen. The interface consists of the following pins:

Select between the controls in the LEED memory for which you are writing data. You can choose either the data log, which holds what goes on the screen, or the help log, where the LED controller is looking for instructions on what to do next. Read / Write (R / W) pin which selects read mode or write mode, Enable pin which lets write to records ,8 pins data (D0-D7). The cases of these pins (high or low) are the bits you write to a record when you write, or the values you read when reading them.

The Hitachi-compatible LCD monitors can be controlled in two modes: 4-bit or 8-bit. The 4-bit mode requires seven I / O pins from Arduino, while 8-bit mode requires 11 pins. To display the text on the screen, you can do most of the thing in 4-bit mode.



Fig 3.9LDC Crystal

3.6 GSM Transmitter

The Arduino GSM shield allows the Arduino board to connect to the Internet, send and receive SMS, and make voice calls using the GSM library. Among other things, GSM supports incoming and outgoing voice calls, and data communications[19].

To access a network, it must be shared with a mobile phone operator, a device compatible with a receiver such as a shield or a mobile phone, and a subscriber ID card (SIM) card. The network operator provides a SIM card that contains information such as a mobile number, and can store limited amounts of contacts and SMS. SIM card operates on a network that can be used within the surrounding area.

Although the GSM connection is identical with the Arduino only the 2, 3, 7 and GND digital pins are used to connect between Arduino and the modem.

SIM900a will use shield implant provides a way to use sniffer cell phone network to receive data from remote location. This shield allows this to be achieved through short message service methods.



Fig 3.10GSM Shield

3.7 Controller (Arduino)

Microprocessor is a very important part in our system and it is the brain of the system that connect and control all sensors, achieve security for the system and sending SMS messages. Arduino controller is used for simplicity to deal with it and compatibility with other electronics , its supplied with 5 v minimum voltage via external battery or by directly connecting by USB cable which enables the user to upload the code and also to supply it with the required 5 v to fully enable its features[20] .

There are many types of Arduino microcontroller Arduino UNO and Arduino MEGA. the Arduino MEGA 2560 is designed for more complex projects and it more suitable for our project because it has more digital and analog pins that give the best coverage of the pharmacy if more than one sensor is needed to measure temperature in the smart pharmacy's chambers .

Pins mapping for the Arduino MEGA by 0-53 digital pins and 2-13 PWM A0 – A15 Analog pins .

The 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.

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 Uno 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[22].
- 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 50mA.
- GND. Ground pins.

Each of the 54 digital pins on the Mega can be used as an input or output, using pin Mode, digital Write, and digital Read () 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.

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, 3, 18, 19, 20 and 21 . 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[23].
- PWM: 2-13 . Provide 8-bit PWM output with the analog Write () function.

- SPI: 50 (SS), 51 (MOSI), 52 (MISO), 53 (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[24].

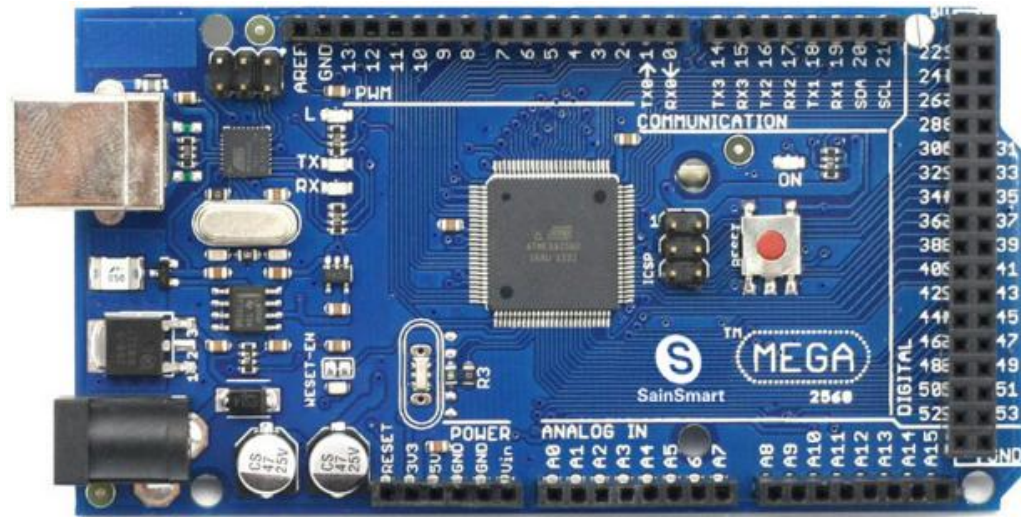


Fig 3.11

Arduino MEGA 2560