# A Wireless Home Automation System (SMART HOME) for Safety and Sustenance in a Home Environment Using ARDUINO UNO and NRF24L01

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*Abstract---* **Automation has become a ubiquitous process in this present time. Nowadays seeing an outcome without any human interference is a common view. This paper reviews the usage of automation in a normal home environment which is wireless and can be monitored easily on a screen. Moreover it also shows the safety measures to be taken for normal misfortunes like gas leakage, fire etc. in a house. The detailed information of this automated system is also given in here.**

*Keywords:* **Content analysis, batch processing, kernel division, memory segmentation**

## INTRODUCTION

A Smart home is one that provides its home owners features as comfort, safety, security, energy efficiency (low operation costs) and convenience at all times regardless of whether anyone is home.

"Smart Home" is the term commonly used to define a residence that has various appliances such as tube lights, fans, heating appliances, air conditioning, TVs, computers, entertainment audio & video systems, security, camera systems etc. that are capable of communicating with one another and can be controlled remotely by a time format and from any room in the home or from a distant location.

Installation of smart products give the home and its occupants various benefits - the same benefits that technology and personal computing have brought to us over the past 30 years – convenience, safety and conservation of time, money and energy [2].

Most homes do not have these appliances and systems built into them, therefore the most common and affordable approach is for the home owner to retrofit smart products into their own furnished homes by few easy modifications.

These features can prove really worthwhile as it clearly doesn't require human interference and it can also be modified as per usage and requirements.
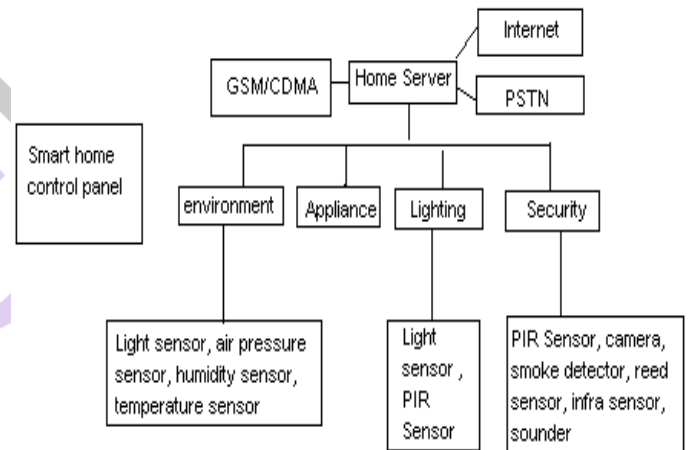


**Fig.1. A general smart home control panel**

## SERIAL COMMUNICATION:

In general, there are two types of communication channels – parallel and serial.

Serial communication is the process of sending data in the form of one bit at a time sequentially through a communication channel or a computer bus channel. This is the opposite process of parallel communication.

Serial communication is used generally for long distance communications and most computer network systems which minimizes the cable cost and also enhances synchronization. This also doesn't require any serializer, deserializer or SerDes. [5]

A serial communication channel requires fewer interconnecting cables (wires etc.) and thus occupies less space and this extra space allows better isolation from its surrounding.

These features makes a serial communication channel better than a parallel communication channel is various fields to reduce complexity and cost but the speed is reduced.

In this project serial communication is extensively used for proving the connections between the Arduino, nrf and with the systems because of the above mentioned advantages. [3]
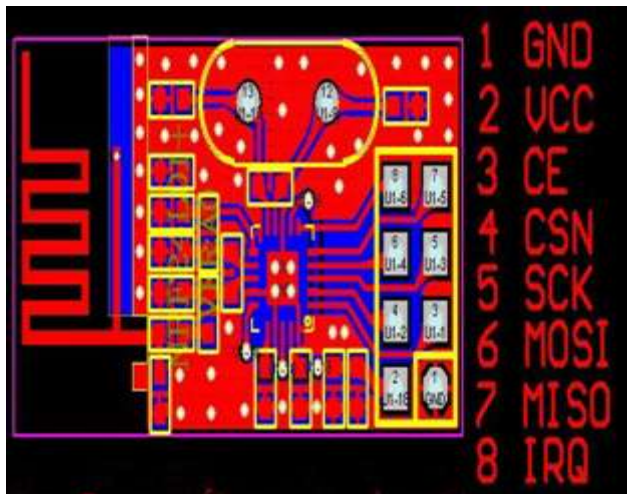
Fig.2. Schematic pin configuration for Arduino Uno

## COMMUNICATION WORKING PRINCIPLE:

Communications in an Arduino & NRF are done through various templates and are differentiated into various backgrounds. The basic processes are discussed here as follows.

*Communications for Closed Loop Process Automation*: In this, processes are controlled by networked ICS equipment and by process automation devices that gather process status (e.g. switch positions or motor RPM), run preconfigured process control algorithms, and send commands to implement the process changes which are dictated by the executed control algorithms (e.g. raise motor RPM, open a breaker, or turn a pump on). This cyclic and closed loop control cycle repeats itself as often as tens of milliseconds.

*Communications for Configuration and System Engineering*: The configuration and system engineering communications allow personnel to change settings or configurations in networked ICS devices to change the behavior of the equipment accordingly. For example, ICS personnel may use a remote engineering access connection to make changes to the process control algorithm executing in a networked process automation device.

*Communications for Process Data Archiving and Retrieval*: The subsets of the process status values, executed commands, and received system alarms are typically in the ICS network that simultaneously exhibit a high loss potential and a high potential for electronic compromise (which are highly vulnerable to cyber-attack) are high priority areas where application of security improvements are likely to yield the greatest benefit. [1]

Arduino plays a vital role one basis designing of the various automation. It gives an overall idea of the home automated system.

## WORKING OF ARDUINO UNO:

The Arduino Uno is a microcontroller board based on the 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, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller. It is simply connected to a computer with a USB cable or powered with an AC-to-DC adapter or battery.

*Accessing the Arduino Uno:*

Microcontrollers need to be programmed with software. Programs are written in the free, downloadable Integrated Development Environment (IDE) designed for the Arduino. The IDE includes three sections integrated together: the programmatic text editor, the compiler, and the debugger. The text editor is where code is written or pasted. The complier compiles code when the Upload to I/O Board‟ button is pressed. [4]

A single button to compile code is a unique instance. The serial monitor can be used for debugging and monitoring data from your program. The debugger provides feedback, fostering confidence to move forward at a rapid pace.

The IDE can be downloaded on many platforms which helps the Arduino grow at its current rate. It is compatible with the major computing platforms: Linux, Windows and Mac.

Arduino draws off both the Wiring and processing code and software libraries in the IDE through software libraries. Experienced users may need to access and alter specific aspects of the Arduino code, such as libraries and this option is available to them. [6]

**Fig.3. Coding in the processing software    screen**
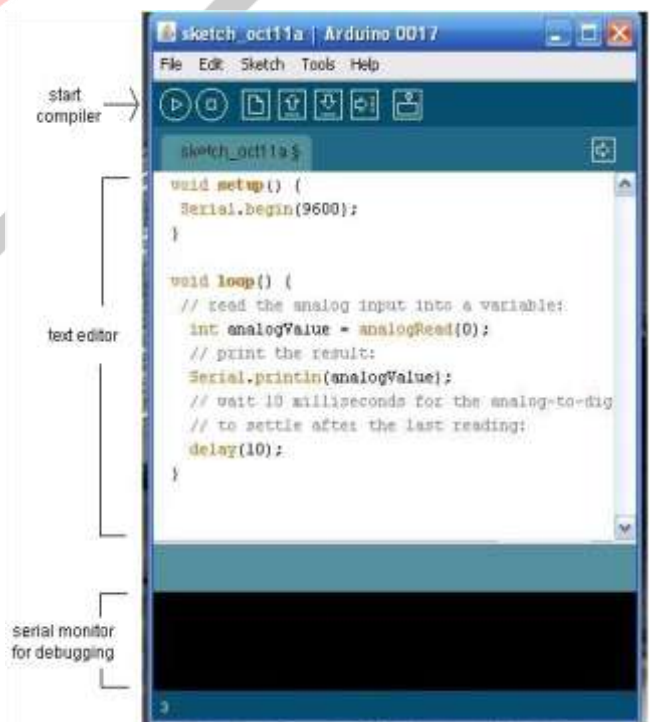
## NRF24L01

The nRF24L01 is a highly integrated, ultra-low power (ULP) 2Mbps RF transceiver IC for the 2.4GHz ISM (Industrial, Scientific and Medical) band. With peak RX/TX currents lower than 14mA, a sub μA power down mode, advanced power management, and a 1.9 to 3.6V supply range, the nRF24L01 provides a true ULP solution enabling months to years of battery lifetime when running on coin cells or AA/AAA batteries. The Enhanced Shock Burst hardware protocol accelerator additionally offloads time critical protocol functions from the application microcontroller enabling the implementation of advanced and robust wireless connectivity with low cost 3rd-party microcontrollers. [7]

The nRF24L01 integrates a complete 2.4GHz RF transceiver, RF synthesizer, and baseband logic including the Enhanced Shock Burst hardware protocol accelerator supporting a high-speed SPI interface for the application controller. No external loop filter, resonators, or VCO reactor diodes are required, only a low cost ±60ppm crystal, matching circuitry, and antenna.

It has a worldwide license-free 2.4GHz ISM band operation and it also gives 1Mbps and 2Mbps on-air data-rate.
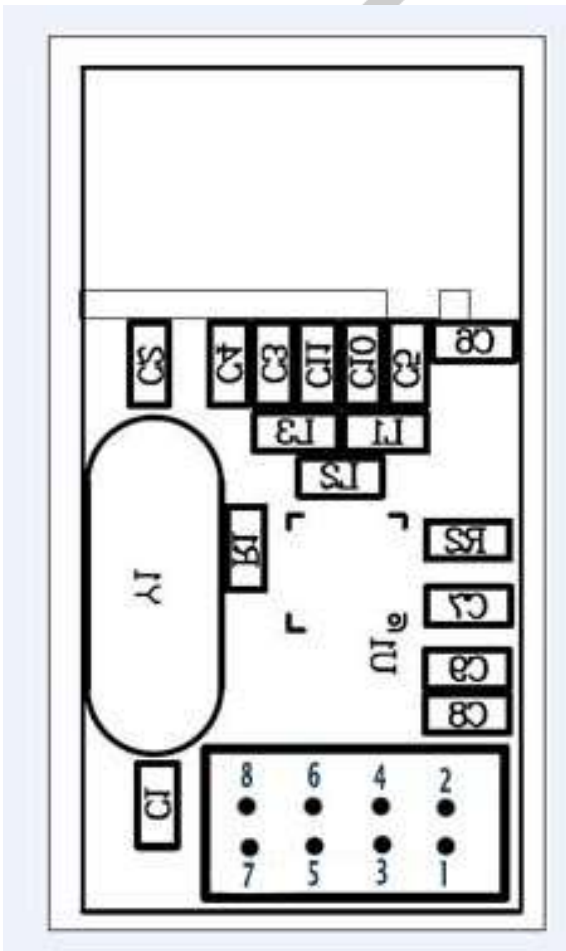


**Fig.4. Mirror image showing nrf pin Configuration**

## APPLICATION AND USAGE IN HOME ENVIRONMENT:

➤ Automated control of doors and windows as per a time format and occupancy.

➤ Efficient usage of lights, air conditioners and other appliances depending upon the number of occupants and a previously setup time schedule as required.

➤ Prevention and safety measures taken in times of misfortunes like gas leakage in kitchen, fire from short circuit etc.

➤ Automatic opening of windows and doors in case of gas leakage added with a unique alarm notification.

➤ Water sprinklers and unique alarm notification for fires.

➤ Monitoring and manual master control of all parameters through a destined screen.

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