Identification (RFID) uses electromagnetic fields to automatically identify and track tags attached to objects. The tags contain electronically stored information. Passive tags collect energy from a nearby RFID reader's interrogating radio waves. Active tags have a local power source (such as a battery) and may operate hundreds of meters from the RFID reader. Unlike a barcode, the tag need not be within the line of sight of the reader, so it may be embedded in the tracked object. RFID is one method of automatic identification and data capture (AIDC).

RFID technology consists of three main components:

- **An RFID Tag**

Figure 4.3: RFID Tags

It consists of a silicon microchip attached to a small antenna and mounted on a substrate and encapsulated in different materials like plastic or glass veil and with an adhesive on the back side to be attached to objects. Tags have special features such as shape, size and weight. Consideration of these features depends on environment tag being used. Classified tag's physical features are as under:

- Smart labels can embed in layers type materials such as papers.
- Small tags can embed objects other then flat panel such as clothes and keys.
- Plastic disks can use for attaching with durable objects and use in tough environments such as pallets tagging use in open air.

- **An RFID Reader**

Figure 4.4: RFID Reader

It consists of a scanner with antennas to transmit and receive signals and is responsible for communication with the tag and receives the information from the tag. A single reader can operate on multiple frequencies and this functionality can have anti-collision algorithm/procedures for deducting multiple tags at one time. RFID reader works as middle-ware between tag and user application. Reader is the central part of the RFID system and communicates with tags and computer program, it supply tags information to a computer program after reading each tags unique ID. It can also perform writing onto tag, if the tag is supported. Its key features include:

- High speed Interference
- High accuracy
- Overloaded reading (fail to read)
- Multiple reading (tags)

- **A Processor or a Controller**: It can be a host computer with a Microprocessor or a microcontroller which receives the reader input and process the data.

CHAPTER 5

REQUIREMENT SPECIFICATIONS

Hardware Components

NodeMCU

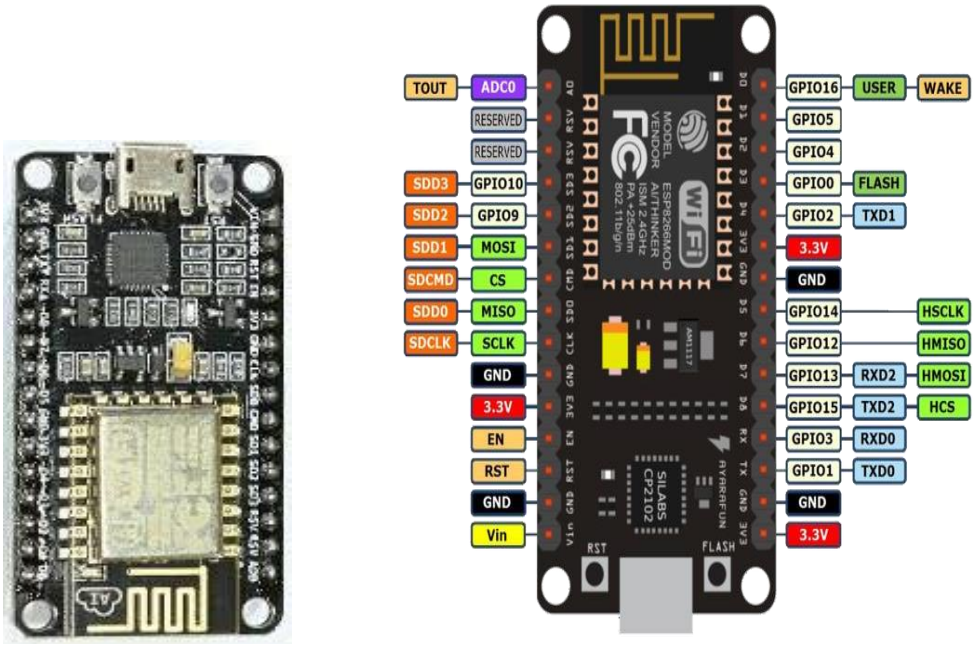

Figure 5.1: NodeMCU

NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the development kits. The firmware uses the Lua scripting language. It is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. NodeMCU provides access to the GPIO (General Purpose Input/Output) and a pin mapping table is part of the API documentation.

NodeMCU Dev Kit has Arduino like Analog (i.e. A0) and Digital (D0-D8) pins on its board. It supports serial communication protocols i.e. UART, SPI, I2C etc. Using such serial protocols we can connect it with serial devices like I2C enabled LCD display, Magnetometer HMC5883, MPU-6050 Gyro meter + Accelerometer, RTC chips, GPS modules, touch screen displays, SD cards etc. NodeMCU Development board

is featured with WiFi capability, analog pin, digital pins and serial communication protocols. NodeMCU provides access to the GPIO (General Purpose Input/Output) and a pin mapping table is part of the API documentation.

5.1.2 Relay

Figure 5.2: Relay Switch

Relays are switches that open and close circuits electromechanically or electronically. Relays control one electrical circuit by opening and closing contacts in another circuit. As relay diagrams show, when a relay contact is normally open (NO), there is an open contact when the relay is not energized. When a relay contact is Normally Closed (NC), there is a closed contact when the relay is not energized.

In either case, applying electrical current to the contacts will change their state. Relays are generally used to switch smaller currents in a control circuit and do not usually control power consuming devices except for small motors and Solenoids that draw low amps.

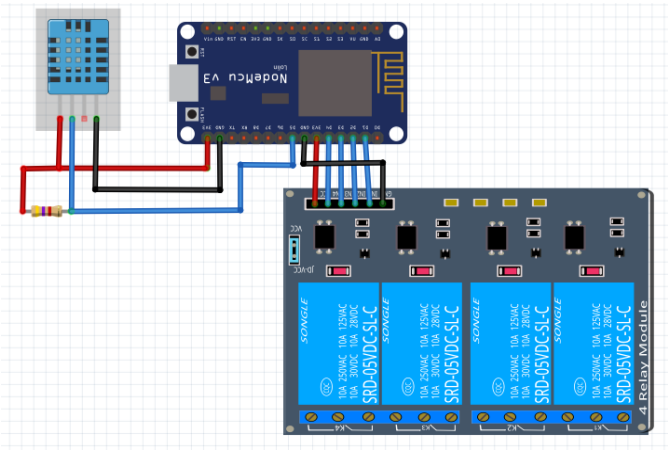

Figure 5.3: 4 Channel Relay connection with NodeMCU and DHT11