CHAPTER 1

1. INTRODUCTION

1.1 HOME ENVIRONMENTAL MONITORING

Increase in the usage and availability of Internet in our daily lives, rendered the path to use it innovatively. One such trending and revolutionary usage is Automation. Automation is nothing but completion of a task without human intervention. In this concrete Jungle everyone are busy with their daily works and can't find time to complete each and every task at home. So home automation is a best Solution for this generation people where we can operate and control our home devices. Home Automation requires devices on which we operate (like heaters, Washing machines refrigerators etc..),sensors ,and a tablet, phone or a Computer. In our project we determined the physical variables like Temperature, ambient light and also some of the gases usually present in our home.

This Home automation is achieved by using Internet Of Things. In simple IOT is nothing but the integration of the physical devices, sensors over the network of cables and tablets, phones and Computers. This not only enables the accuracy, efficiency but also renders a high level of security. Usually IOT has four major components including sensing, heterogeneous accessing, information processing, application services and additional component like security and privacy.

In general home monitoring systems could monitor parameters such as temperature, gases such as methane, NH4, and ambient light .For this purpose various sensors that are being used are thermistor, MQ2, Light Dependent Resistor. All these sensors are analog in nature. The problem with the existing systems is that multiple analog sensors cannot be connected to a single Wifi module whereas this requires number of NodeMCU modules as a single node can be accessible to only one analog sensor
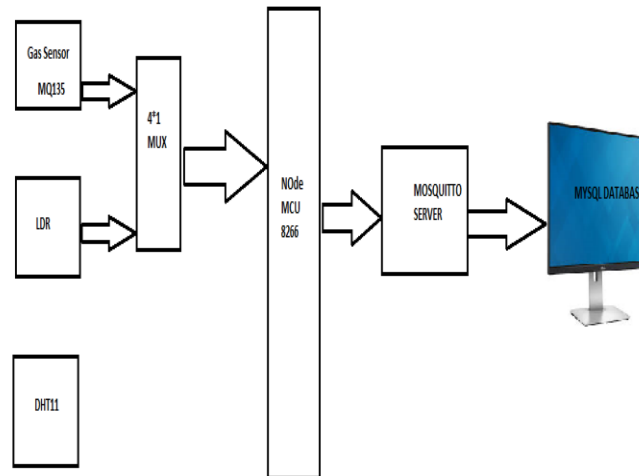
Fig 1.1 Basic block diagram

1.2 COMPONENTS DESCRIPTION

1.2.1 ESP2866

The ESP8266 Wi-Fi Module is an independent SOC with coordinated TCP/IP convention stack that can give any microcontroller access to your Wi-Fi organize. The ESP8266 is able to do either facilitating an application or off loading all Wi-Fi organizing capacities from another application processor. Each ESP8266 module comes pre-customized with an AT order set firmware, which means, you can essentially attach this to your Arduino gadget and get about as much Wi-Fi-capacity as a Wi-Fi Shield offers (and that is simply out of the case) The ESP8266 module is a to a great degree financially savvy board with a tremendous, and consistently developing, group.

This module has a sufficiently capable on-load up handling and capacity ability that enables it to be incorporated with the sensors and other application particular gadgets through its GPIOs with insignificant advancement in advance and negligible stacking amid runtime. Its high level of on-

chip joining considers insignificant outside hardware, including the front-end module, is intended to involve negligible PCB zone. The ESP8266 bolsters APSD for VoIP applications and Bluetooth co existence interfaces, it contains a self-aligned RF enabling it to work under every single working condition, and requires no outer RF parts.

There is a relatively boundless wellspring of data accessible for the ESP8266, all of which has been given by astonishing group bolster. In the Documents area underneath you will discover numerous assets to help you in utilizing the ESP8266, even guidelines on the best way to changing this module into an IOT (Internet of Things) arrangement!

Fig 1.2.1 ESP8266

So, the ESP8266 module is a TTL "Serial to Wireless Internet" gadget. Giving your microcontroller can converse with a TTL serial gadget (most do) you'll be ready to go! The first guidelines have been made an interpretation of from Chinese into secretive information sheets. We'll endeavor to change that with this Instructable.

The ESP8266 module is a 3v gadget, however it's no weakling. It draws a considerable amount of energy. Indeed, you'll most likely need to ensure that your circuit's energy supply can deal with no less than 1 amp of energy. (For my situation, I was utilizing a straightforward 7.5v 500ma power supply. When I began working with this module, I exchanged it for a 7.5v 1amp

power supply and had a lot of energy.) surprisingly there is justifiable reason purpose behind this; some YouTube recordings have surfaced as of late with people seeing anything from 500 meters to two or three miles of transmission ability from this module. That is a great deal of drive for $5.00

The ESP8266 collection, or own family, of Wi-Fi chips is produced by using Expressive structures, a fables semiconductor enterprise operating out of Shanghai, China. The ESP8266 collection presently consists of the ESP8266EX and ESP8285 chips.

ESP8266EX (surely referred to as ESP8266) is a gadget-on-chip (SoC) which integrates a 32-bit Ten silica microcontroller, preferred digital peripheral interfaces, antenna switches, RF balun, power amplifier, low noise receive amplifier, filters and strength control modules into a small package deal. It provides capabilities for two. Four GHz wireless (802.eleven b/g/n, supporting WPA/WPA2), trendy-cause input/output (sixteen GPIO), Inter-included Circuit (I²C), analog-to-virtual conversion (10-bit ADC), Serial Peripheral Interface (SPI), I²S interfaces with DMA (sharing pins with GPIO), UART (on devoted pins, plus a transmit-handiest UART may be enabled on GPIO2), and pulse-width modulation (PWM). The processor core, known as "L106" via Expressive, is based on Ten silica's Diamond preferred 106Micro 32-bit processor controller core and runs at 80 MHz (or over clocked to 160 MHz). It has a sixty four KB boot ROM, 64 KB preparation RAM and 96 KB statistics RAM. external flash memory can be accessed through SPI. The silicon chip itself is housed within a five mm × five mm Quad Flat No-Leads bundle with 33 connection pads — 8 pads along each aspect and one large thermal/floor pad within the middle.

1.2.2 NODE MCU

Node MCU is an open source IOT Platform. It has got its origin from ESP8266. The advancement in the ESP module resulted in the outcome of Node MCU. It is a spectacular combination of ESP with Wifi. Node MCU refers to firmware. Many IOT projects are widely

dependent on this module. It is designed for easy programming with USB capability. It provides access to GPIO (General Purpose Input /Output) as it consists of ten GPIOs. The programming part constitute of simple arduino programming which can be typically written in c or c++ programming language. Node consists of one analog pin which can be extended for further requirement as we did in this project.

Expressive Systems designed a micro controller named as ESP8266. The ESP8266 itself is a self-contained Wi-Fi networking solution offering as a bridge from existing micro controller to Wi-Fi and is also capable of running self-contained applications. This module comes with a built in rich assortment of pin-outs and a USB connector. With the help of a micro USB cable, you can connect Node MCU devkit to your laptop and flash it without any trouble, just like Arduino. It is also immediately breadboard friendly.

SPECIFICATIONS OF NODE MCU

- ➢ Voltage:3.3V.
- ➢ Wi-Fi Direct (P2P), soft-AP.
- ➢ Current consumption: 10uA~170mA.
- ➢ Flash memory attachable: 16MB max (512K normal).
- ➢ Integrated TCP/IP protocol stack.
- ➢ Processor: Ten silica L106 32-bit.
- ➢ Processor speed: 80~160MHz.
- ➢ RAM: 32K + 80K
- ➢ GPIOs: 17 (multiplexed with other functions).
- ➢ Analog to Digital: 1 input with 1024 step resolution.
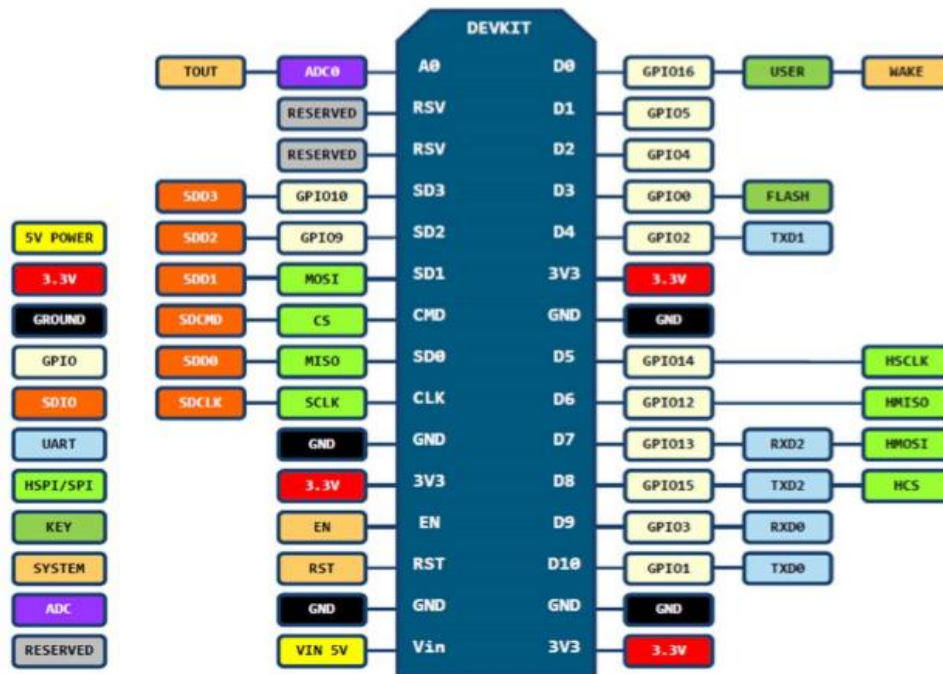- ➢ +19.5dBm output power in 802.11b mode
- ➢ 802.11 support: b/g/n

Fig 1.2.2. Pin Description of Node MCU

While composing GPIO code on Node MCU, you can't address them with real GPIO Pin Numbers. There are diverse I/O Index numbers appointed to each GPIO Pin which is utilized for GPIO Pin tending.

1.3 SENSORS

In the broadest definition, a sensor is a gadget, module, or subsystem whose reason for existing is to recognize occasions or changes in its condition and send the data to different hardware, every now and again a PC processor. A sensor is constantly utilized with different hardware, regardless of whether as basic as a light or as unpredictable as a PC.

Sensors are utilized as a part of ordinary protests, for example, touch-delicate lift catches (material sensor) and lights which diminish or light up by touching the base, other than incalculable utilizations of which the vast majority are never mindful. With propels in micro machinery and simple to-utilize microcontroller stages, the employments of sensors have extended past the conventional fields of temperature, weight or stream measurement, for instance

into MARG sensors. In addition, simple sensors, for example, potentiometers and power detecting resistors are still broadly utilized. Applications incorporate assembling and apparatus, planes and aviation, autos, pharmaceutical, mechanical technology and numerous different parts of our everyday life.

1.3.1 GAS SENSOR

A gas locator is a gadget that distinguishes the nearness of gases in a territory, regularly as a major aspect of a well being framework. This sort of hardware is utilized to identify a gas spill or different emanations and would interface be able to with a control framework so a procedure can be naturally closed down. A gas indicator can sound an alert to administrators in the region where the break is happening, giving them the chance to take off. This sort of gadget is critical in light of the fact that there are numerous gases that can be unsafe to natural life, for example, people or creatures.

Gas indicators can be utilized to identify ignitable, combustible and harmful gases, and oxygen exhaustion. This kind of gadget is utilized broadly in industry and can be found in areas, for example, on oil rigs, to screen make forms and developing advancements, for example, photovoltaic. They might be utilized as a part of firefighting.

Gas spill recognition is the way toward distinguishing possibly unsafe gas spills by sensors. These sensors more often than not utilize a perceptible caution to alarm individuals when a perilous gas has been identified. Introduction to harmful gases can likewise happen in activities, for example, painting, fumigation, fuel filling, development, unearthing of tainted soils, landfill tasks, entering limited spaces, and so on. Regular sensors incorporate flammable gas sensors, photo ionization indicators, infrared point sensors, ultrasonic sensors, electrochemical gas sensors, and semiconductor sensors. All the more as of late, infrared imaging sensors have come into utilization. These sensors are utilized for an extensive variety of uses and can be found in mechanical plants, refineries, pharmaceutical assembling, fumigation offices, paper mash factories, flying machine and shipbuilding offices, hazardous materials tasks, squander water treatment offices, vehicles, indoor air quality testing and homes.

Fig 1.3.1 Gas Sensor

The Grove - Gas Sensor (MQ2) module is helpful for gas spillage location (home and industry). It is reasonable for recognizing H2, LPG, CH4, CO, Alcohol, Smoke or Propane. Because of its high affectability and quick reaction time, estimation can be taken at the earliest opportunity. The affectability of the sensor can be balanced by potentiometer.

The Sensor esteems just mirrors the approximated pattern of gas fixation in a reasonable blunder go, it DOES NOT speak to the correct gas focus. The identification of specific parts noticeable all around for the most part requires a more exact and exorbitant instrument, which is impossible with a solitary gas sensor. In the event that your undertaking is gone for acquiring the gas fixation at an extremely exact level, at that point we don't suggest this gas sensor.

Gas indicators measure and show the convergence of specific gases in an air by means of various advancements. Normally utilized to avoid poisonous presentation and fire, gas identifiers are frequently battery worked gadgets utilized for wellbeing purposes. They are fabricated as convenient or stationary (settled) units and work by connoting abnormal amounts of gases through a progression of capable of being heard or noticeable pointers, for example, alerts, lights or a mix of signs. While a large number of the more seasoned, standard gas indicator units were initially created to distinguish one gas, present day multifunctional or multi-gas gadgets are equipped for identifying a few gases on the double. A few finders might be used as individual

units to screen little workspace regions, or units can be joined or connected together to make an assurance framework.

As indicators measure a predefined gas focus, the sensor reaction fills in as the reference point or scale. At the point when the sensors reaction outperforms a specific pre-set level, a caution will actuate to caution the client. There are different sorts of locators accessible and the greater part serves a similar capacity: to screen and caution of a perilous gas level. Be that as it may, while considering what sort of identifier to introduce, it is useful to think about the diverse sensor advancements.

1.3.2 THERMISTOR

A Thermistor is a kind of resistor whose protection is subject to temperature, more so than in standard resistors. The word is a portmanteau of warm and resistor. Thermistors are broadly utilized as inrush current limiters, temperature sensors (Negative Temperature Coefficient or NTC compose ordinarily), self-resetting over current defenders, and automatic warming components (Positive Temperature Coefficient or PTC write commonly).

Fig 1.3.1 Diagram of Thermistor

Thermistors are of two inverse principal writes:

With NTC Thermistors, protection diminishes as temperature rises. A NTC is normally utilized as a temperature sensor, or in arrangement with a circuit as an inrush current limiter.

With PTC Thermistors, a protection increment as temperature rises. PTC Thermistors are usually introduced in arrangement with a circuit, and used to secure against over current conditions, as resettable wires.

Thermistors contrast from protection temperature indicators (RTDs) in that the material utilized as a part of a Thermistor is by and large an artistic or polymer, while RTDs utilize unadulterated metals. The Thermistors are as globules, poles and plates yet RTDs are in various shapes and sizes. The temperature reaction is additionally unique; RTDs are helpful over bigger temperature ranges, while thermistors normally accomplish a more noteworthy accuracy inside a constrained temperature run, regularly −90 °C to 130 °C

A thermistor is a temperature-detecting component made out of sintered semiconductor material which shows an expansive change in protection corresponding to a little change in temperature. Thermistors more often than not have negative temperature coefficients which implies the protection of the thermistor diminishes as the temperature increments.

The Thermistor is a strong state temperature detecting gadget that demonstrations somewhat like an electrical resistor yet is temperature touchy. Thermistors can be utilized to deliver a simple yield voltage with varieties in surrounding temperature and all things considered can be alluded to as a transducer. This is on the grounds that it makes an adjustment in its electrical properties because of a physical change in warm.

A thermistor is essentially a two-terminal strong state thermally touchy transducer produced using delicate semiconductor based metal oxides with metallised or sintered associating leads

onto a clay circle or dot. This enables it to change its resistive incentive in extent to little changes in temperature. At the end of the day, as its temperature changes, so too does its protection and thusly its name, "Thermistor" is a blend of the words THERM-partner touchy res-ISTOR.

While the adjustment in protection because of warmth is by and large unfortunate in standard resistors, this impact can be put to great use in numerous temperature identification circuits. In this manner being non-straight factor protection gadgets, thermistors are normally utilized as temperature sensors having numerous applications to gauge the temperature of the two fluids and encompassing air.

Likewise, being a strong state gadget produced using exceedingly touchy metal oxides, they work at the sub-atomic level with the peripheral (valence) electrons ending up more dynamic and creating a negative temperature coefficient, or less dynamic delivering a positive temperature coefficient as the temperature of the thermistor is expanded. This implies they can have great reproducible protection verses temperature attributes enabling them to work up to temperatures.

While the basically utilized of thermistors are as resistive temperature sensors, being resistive gadgets having a place the resistor family, they can likewise be utilized as a part of arrangement with a segment or gadget to control the present moving through them. At the end of the day, they can likewise be utilized as present restricting gadgets.

Thermistors are accessible in a scope of sorts, materials and sizes relying upon the reaction time and working temperature. Likewise, hermetically fixed thermistors kill blunders in protection readings because of dampness entrance while offering high working temperatures and a minimized size. The three most basic composes are: Bead thermistors, Disk thermistors, and Glass epitomized thermistors.

These warmth subordinate resistors can work in one of two ways, either expanding or diminishing their resistive incentive with changes in temperature. At that point there are two sorts of thermistors accessible: negative temperature coefficient (NTC) of protection and positive temperature coefficient (PTC) of protection.

1.3.2.1 NEGATIVE TEMPERATURE COEFFICIENT THERMISTOR

Negative temperature coefficient of protection thermistors, or NTC thermistors for short, lessen or diminish their resistive incentive as the working temperature around them increments. By and large, NTC thermistors are the most generally utilized kind of temperature sensors as they can be utilized as a part of for all intents and purposes any sort of gear where temperature assumes a part.

NTC temperature thermistors have a negative electrical protection versus temperature (R/T) relationship. The generally vast negative reaction of a NTC thermistor implies that even little changes in temperature can cause noteworthy changes in its electrical protection. This makes them perfect for precise temperature estimation and control.

We said beforehand that a thermistor is an electronic segment whose protection is exceptionally subject to temperature so on the off chance that we send a steady current through the thermistor and after that measure the voltage drop crosswise over it, we would thus be able to decide its protection and temperature.

NTC thermistors decrease in protection with an expansion in temperature and are accessible in an assortment of base protections and bends.

Another imperative trademark is the "B" esteem. The B esteem is a material steady which is dictated by the earthenware material from which it is made and depicts the inclination of the resistive (R/T) bend over a specific temperature extend between two temperature focuses. Every thermistor material will have an alternate material steady and in this way an alternate protection versus temperature bend.

1.3.2.2 THERMISTOR TO MEASURE A TEMPRATURE VALUE

So how can we use a thermistor to measure temperature? Hopefully by now we know that a thermistor is a resistive device and therefore according to Ohms law, if we pass a current through it, a voltage drop will be produced across it. As a thermistor is an active type of a sensor, that is, it requires an excitation signal for its operation, any changes in its resistance as a result of changes in temperature can be converted into a voltage change.

The simplest way of doing this is to use the thermistor as part of a potential divider. A constant voltage is applied across the resistor and thermistor series circuit with the output voltage measured across the thermistor.

When the resistance of the thermistor changes due to changes in temperature, the fraction of the supply voltage across the thermistor also changes producing an output voltage that is proportional to the fraction of the total series resistance between the output terminals.

Thus the potential divider circuit is an example of a simple resistance to voltage converter where the resistance of the thermistor is controlled by temperature with the output voltage produced being proportional to the temperature. So the hotter the thermistor gets, the lower the voltage.

If we reversed the positions of the series resistor, RS and the thermistor, RTH, then the output voltage will change in the opposite direction, that is the hotter the thermistor gets, the higher the output voltage.

We can use NTC thermistors as part of a basic temperature sensing configuration using a bridge circuit as shown. The relationship between resistors R1 and R2 sets the reference voltage, VREF to the value required. For example, if both R1 and R2 are of the same resistive value, the reference voltage will be equal to half of the supply voltage. That is Vs/2.

As the temperature and therefore the resistance of the thermistor changes, the voltage at VTH also changes either higher or lower than that at VREF producing a positive or negative output signal to the connected amplifier.

The amplifier circuit used for this basic temperature sensing bridge circuit could act as a differential amplifier for high sensitivity and amplification, or a simple Schmitt-trigger circuit for ON-OFF switching.

The problem with passing a current through a thermistor in this way, is that thermistors experience what is called self-heating effects, that is the I2.R power dissipation could be high enough to create more heat than can be dissipated by the thermistor affecting its resistive value producing false results.

Thus it is possible that if the current through the thermistor is too high it would result in increased power dissipation and as the temperature increases, its resistance decreases causing more current to flow, which increases the temperature further resulting in what is known as Thermal Runaway. In other words, we want the thermistor to be hot due to the external temperature being measured and not by itself heating up.

Then the value for the series resistor, RS above should be chosen to provide a reasonably wide response over the range of temperatures for which the thermistor is likely to be used while at the same time limiting the current to a safe value at the highest temperature.

One way of improving on this and having a more accurate conversion of resistance against temperature (R/T) is by driving the thermistor with a constant current source. The change in resistance can be measured by using a small and measured direct current, or DC, passed through the thermistor in order to measure the voltage drop produced.

1.3.2.3 THERMISTOR USED FOR INRUSH CURRENT SUPPRESSION

We have seen that thermistors are primarily used as resistive temperature sensitive transducers, but the resistance of a thermistor can be changed either by external temperature changes or by changes in temperature caused by an electrical current flowing through them, as after all, they are resistive devices.

Ohm's Law tells us that when an electrical current passes through a resistance R, as a result of the applied voltage, power is consumed in the form of heat due to the I2R heating effect. Because of the self-heating effect of current in a thermistor, a thermistor can change its resistance with changes in current.

Inductive electrical equipment such as motors, transformers, ballast lighting, etc, suffer from excessive inrush currents when they are first turned-on. But series connected thermistors can be used to effectively limit these high initial currents to a sfe value. NTC thermistors with low values of cold resistance are generally used for current regulation.

Inrush current suppressors and surge limiters are types of series connected thermistor whose resistance drops to a very low value as it is heated by the load current passing through it. At the initial turn-on, the thermistors cold resistance value (its base resistance) is fairly high controlling the initial inrush current to the load.

As a result of the load current, the thermistor heats up and reduces its resistance relatively slowly to the point were the power dissipated across it is sufficient to maintain its low resistance value with most of the applied voltage developed across the load.

Due to the thermal inertia of its mass this heating effect takes a few seconds during which the load current increases gradually rather than instantaneously, so any high inrush current is restricted and the power it draws reduces accordingly. Because of this thermal action, inrush current suppression thermistors can run very hot in the low-resistance state so require a cool-

down or recovery period after power is removed to allow the resistance of the NTC thermistor to increase sufficiently to provide the required inrush current suppression the next time it is needed.

Thus the speed of response of a current limiting thermistor is given by its time constant. That is, the time taken for its resistance to change by by 63% (i.e. 1 to 1/e) of the total change. For example, suppose the ambient temperature changes from 0 to 100, then the 63% time constant would be the time taken for the thermistor to have a resistive value.
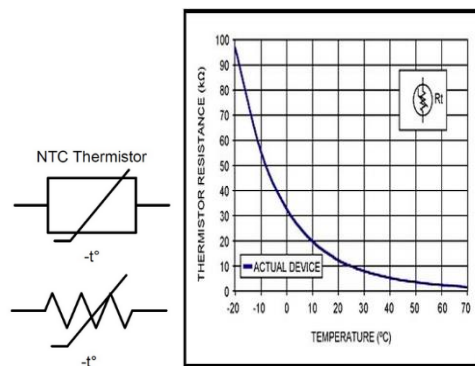
Fig 1.3.2.3 NTC electrical Symbol and graphical representation of NTC Thermistor resistance and temperature.

Thus NTC thermistors provide protection from undesirably high inrush currents, while their resistance remains negligibly low during continuous operation supplying power to the load. The advantage here is that they able to effectively handle much higher inrush currents than standard fixed current limiting resistors with the same power consumption.

A photo resistor (or light-subordinate resistor, LDR, or photograph conductive cell) is a light-controlled variable resistor. The protection of a photo resistor diminishes with expanding occurrence light power; at the end of the day, it shows photoconductivity. A photo resistor can be connected in light-delicate indicator circuits, and light-actuated and dim initiated exchanging circuits.

A photo resistor is made of a high protection semiconductor. Oblivious, a photo resistor can have a protection as high as a few mega ohms (Mω), while in the light, a photo resistor can have a

protection as low as a couple of hundred ohms. On the off chance that occurrence light on a photo resistor surpasses a specific recurrence, photons consumed by the semiconductor give bound electrons enough vitality to hop into the conduction band. The subsequent free electrons (and their opening accomplices) direct power, along these lines bringing down protection. The protection range and affectability of a photoresistor can significantly contrast among different gadgets. Also, exceptional photoresistors may respond generously distinctively to photons inside certain wavelength groups.

A photoelectric gadget can be either natural or outward. An inborn semiconductor has its own particular charge bearers and isn't a proficient semiconductor, for instance, silicon. In characteristic gadgets the main accessible electrons are in the valence band, and subsequently the photon must have enough vitality to energize the electron over the whole band hole. Outward gadgets have polluting influences, likewise called dopants, included whose ground state vitality is nearer to the conduction band; since the electrons don't have as far to bounce, bring down vitality photons (that is, longer wavelengths and lower frequencies) are adequate to trigger the gadget. On the off chance that an example of silicon has some of its molecules supplanted by phosphorus particles (polluting influences), there will be additional electrons accessible for conduction. This is a case of an outward semiconductor.

Photo resistors are less light-delicate gadgets than photodiodes or phototransistors: the two last segments are genuine semiconductor gadgets, while a photo resistor is a uninvolved part and does not have a PN-intersection. The photo resistivity of any photo resistor may fluctuate generally relying upon encompassing temperature, making them unacceptable for applications requiring exact estimation of or affectability to light photons.

Photo resistors additionally display a specific level of dormancy between introduction to light and the resulting diminish in protection, more often than not around 10 milliseconds. The slack time while going from lit to dull situations is considerably more noteworthy, frequently as long as one moment. This property makes them unacceptable for detecting quickly blazing lights, yet is now and then used to smooth the reaction of sound flag pressure.

Photograph resistors, otherwise called light ward resistors (LDR), are light delicate gadgets frequently used to show the nearness or nonattendance of light, or to quantify the light force. Oblivious, their protection is high, here and there up to 1MΩ, however when the LDR sensor is presented to light, the protection drops drastically, even down to a couple of ohms, contingent upon the light power. LDRs have an affectability that differs with the wavelength of the light connected and are nonlinear gadgets. They are utilized as a part of numerous applications however are now and again made out of date by different gadgets, for example, photodiodes and phototransistors.

1.3.2.4 WORKING MECHANISM

In light of the materials utilized, photograph resistors can be separated into two kinds; inborn and outward. Inherent photograph resistors utilize un doped materials, for example, silicon or germanium. Photons that fall on the gadget energize electrons from the valence band to the conduction band, and the consequence of this procedure are all the more free electrons in the material, which can convey current, and accordingly less protection. Extraneous photograph resistors are made of materials doped with pollutions, additionally called dopants. The dopants make another vitality band over the current valence band, populated by electrons. These electrons require less vitality to influence the change to the conduction to band on account of the littler vitality hole. The outcome is a gadget delicate to various wavelengths of light. In any case, the two kinds will display abatement in protection when enlightened. The higher the light force, the bigger the protection drop is. In this manner, the protection of LDRs is a backwards, nonlinear capacity of light power.

It is moderately straightforward the rudiments of how a LDR functions without digging into confused clarifications. It is first important to comprehend that an electrical current comprises of the development of electrons inside a material. Great conductors have countless electrons that can float in a provided guidance under the activity of a potential contrast. Encasings with a high protection have not very many free electrons, and consequently it is difficult to influence the them to move and thus a current to stream.

A LDR or photo resistor is made any semiconductor material with a high protection. It has a high protection in light of the fact that there are not very many electrons that are free and ready to move - most by far of the electrons are bolted into the gem grid and unfit to move. Accordingly in this state there is a high LDR protection.

As light falls on the semiconductor, the light photons are consumed by the semiconductor cross section and some of their vitality is exchanged to the electrons. This gives some of them adequate vitality to break free from the gem grid with the goal that they would then be able to direct power. This outcomes in a bringing down of the protection of the semiconductor and henceforth the general LDR protection.

The procedure is dynamic, and as more light sparkles on the LDR semiconductor, so more electrons are discharged to direct power and the protection falls further.

1.3.2.5 WAVE LENGTH DEPENDENCY

The affectability of a photograph resistor changes with the light wavelength. In the event that the wavelength is outside a specific range, it won't influence the protection of the gadget by any stretch of the imagination. One might say that the LDR isn't touchy in that light wavelength run. Diverse materials have distinctive special ghastly reaction bends of wavelength versus affectability. Outward light ward resistors are by and large intended for longer wavelengths of light, with a propensity towards the infrared (IR). When working in the IR go, mind must be taken to stay away from warm development, which could influence estimations by changing the protection of the gadget because of warm impacts. The figure appeared here speaks to the otherworldly reaction of photoconductive finders made of various materials, with the working temperature communicated in K and written in the enclosures.
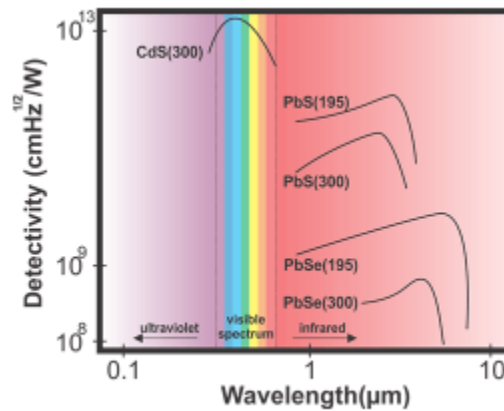
Fig 1.3.2.5Wave Length Dependency

1.3.2.6 SENSTIVITY

Light reliant resistors have a lower affectability than photograph diodes and photograph transistors. Photograph diodes and photograph transistors are genuine semiconductor gadgets which utilize light to control the stream of electrons and openings crosswise over PN-intersections, while light ward resistors are aloof segments, without a PN-intersection. On the off chance that the light force is kept steady, the protection may in any case differ fundamentally because of temperature changes, so they are delicate to temperature changes also. This property makes LDRs inadmissible for exact light force estimations.

1.3.2.7 LATENCY

Another fascinating property of photograph resistors is that there is time dormancy between changes in light and changes in protection. This wonder is known as the protection recuperation rate. It takes for the most part around 10 ms for the protection from drop totally when light is connected after aggregate obscurity, while it can take up to 1 second for the protection from ascend back to the beginning an incentive after the entire evacuation of light. Therefore the LDR can't be utilized where fast vacillations of light are to be recorded or used to incite control hardware, yet this same property is misused in some different gadgets, for example, sound compressors, where the capacity of the light ward resistor is to smooth the reaction.

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1.3.3 LDR (LIGHT DETECTING RESISTOR)

Photograph resistors are regularly utilized as light sensors. They are regularly used when it is required to identify the nearness and nonappearance of light or measure the light force. Illustrations are night lights and photography light meters. A fascinating specialist application for light ward resistors is the line following robot, which utilizes a light source and at least two LDRs to decide the required change obviously. In some cases, they are utilized outside detecting applications, for instance in sound compressors, on the grounds that their response to light isn't prompt, thus the capacity of LDR is to present a postponed reaction.

On the off chance that a fundamental light sensor is required, a LDR circuit, for example, the one in the figure can be utilized. The LED illuminates when the force of the light coming to the LDR resistor is adequate. The 10K variable resistor is utilized to set the edge at which the LED will turn on. In the event that the LDR light is beneath the limit force, the LED will stay in the off state. In true applications, the LED would be supplanted with a transfer or the yield could be wired to a microcontroller or some other gadget. In the event that a murkiness sensor was required, where the LED would light without light, the LDR and the two 10K resistors ought to be swapped.

1.3.3.1 CONSTRUCTION OF LDR

LDR's are light reliant gadgets whose protection is diminished when light falls on them and that is expanded oblivious. At the point when a light ward resistor is kept in dim, its protection is high. This protection is called as dim protection. It can be as high as 1012 Ω and if the gadget is permitted to ingest light its protection will be diminished radically. On the off chance that a steady voltage is connected to it and power of light is expanded the present begins expanding. Figure underneath indicates protection versus light bend for a specific LDR.
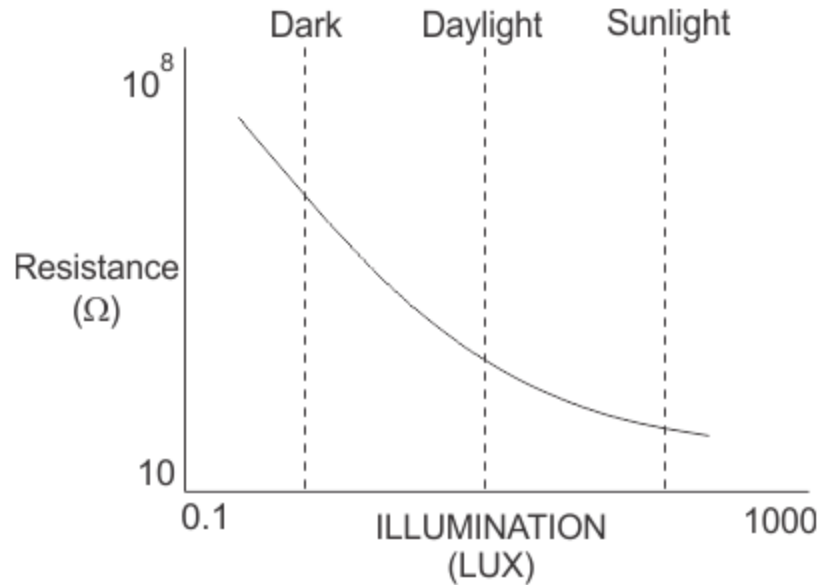
Fig 1.3.3.1 Graph of Resistance Vs Illumination

Photocells or LDR's are non straight gadgets. There affectability shifts with the wavelength of light episode on them. A few photocells may not in any manner reaction to a specific scope of wavelengths. In light of the material utilized distinctive cells have diverse ghostly reaction bends.

At the point when light is episode on a photocell it as a rule takes around 8 to 12 ms for the adjustment in protection from occur, while it takes at least one seconds for the protection from ascend back again to its underlying incentive after evacuation of light. This marvel is called as protection recuperation rate. This property is utilized as a part of sound compressors.

1.3.3.2 CONSTRUCTION OF PHOTOCELL

The structure of a light ward resistor comprises of a light delicate material which is kept on a protecting substrate, for example, earthenware. The material is saved in crisscross example keeping in mind the end goal to get the coveted protection and power rating. This crisscross zone isolates the metal kept territories into two locales. At that point the ohmic contacts are made on the either sides of the territory. The protections of these contacts ought to be as less as conceivable to ensure that the protection for the most part changes because of the impact of light

as it were. Materials ordinarily utilized are cadmium sulfide, cadmium selenide, indium antimonide and cadmium sulphonide. The utilization of lead and cadmium is stayed away from as they are destructive to the earth.
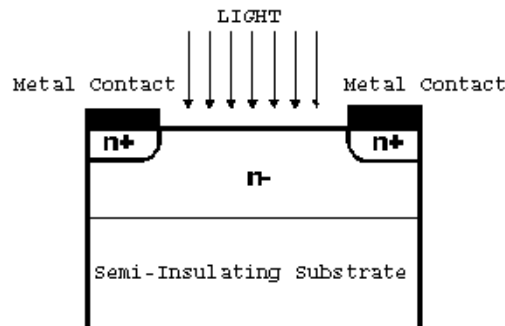
Fig 1.3.3.2 Diagram of Photo Cell

1.7 MOSQUITTO SERVER

Mosquitto is an open supply message broking that implements the MQTT Protocol. It is a light-weighted technique of carrying out messaging the usage of publish/subscribe version designed for extremely constrained devices. It helps in machine to machine communication and also in the IOT contexts. In MQTT , MQ stands for Telemetry Transport. It's been in usage since 1999. The main motto in designing this protocol is to minimize the network bandwidth and device resource requirements.

It uses publish/subscribe model (it has high scalability) which is an alternative to the client-server model . Here ,neither the publisher nor the subscriber know their existence. Still they can be able to communicate with the help of a broker who knows the existence of both. Here we used MQTT as broker which receives the incoming messages and distribute them accordingly. The main theme of publish/subscribe is the decoupling of publisher and receiver which is an event-driven process and is achieved in 3 different ways. Also there are many ways of filtering like Subject-based , Content-based and Time Based. MQTT uses the Subject based filtering and it does synchronization decoupling in such a way that they just know the hostname/IP and the port for publishing.

The MQTT convention gives a lightweight technique for doing informing utilizing a distribute /buy in show. This makes it appropriate for Internet of Things informing, for example, with low power sensors or cell phones, for example, telephones, implanted PCs or microcontrollers.

The Mosquitto venture likewise gives a C library to executing MQTT customers, and the extremely mainstream mosquitto_pub and mosquitto_sub charge line MQTT. Mosquitto is an open-source message specialist benefit that uses the MQTT convention to send and get messages, ordinarily with IOT (Internet of Things) gadgets.

The Mosquitto venture is a proposed open source venture under the Technology Container Project.
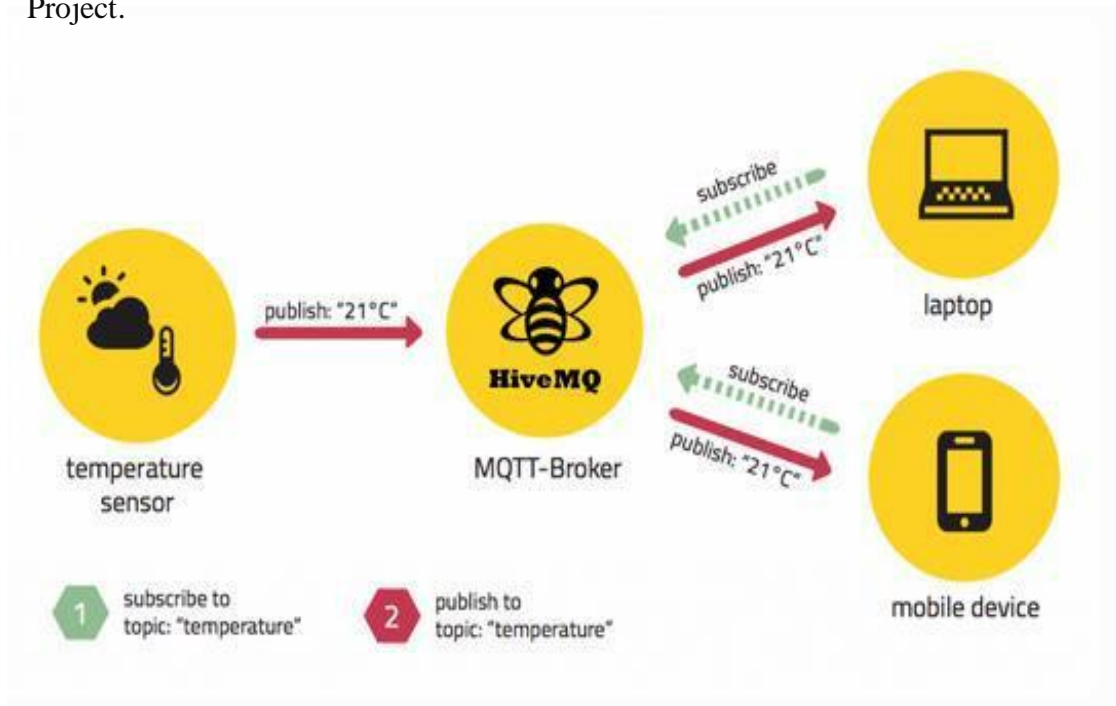
Fig 1.4.1 Basic MQTT publish/subscribe model.

So a connection of any client will be always with a broker .Any device from a microcontroller up (here we used NodeMCU) to a fullfledged server and has MQTT libraries running can act as a MQTT client. Provided it should be connected to an MQTT broker over any kind of network. This broker decides who is interested in receiving those messages and then sends the messages to all subscribed clients. Also authentication and authorization of clients must be taken care by the

broker. These two will communicate using MQTT protocol which is based on the top of TCP/IP .Prerequisites are both the client and broker need to have a TCP/IP Stack.

MQTT-SN (right now being renamed from MQTT-S) is a convention got from MQTT, intended for connectionless hidden system transports, for example, UDP. The meaning of the MQTT-SN convention is held at MQTT.org. It is less develop than MQTT, the determination being distributed in 2008, by Andy Stanford-Clark and Hong Linh Truong, both of IBM.

Both MQTT and MQTT-SN are customer server conventions, for which a server is expected to circulate messages between the customer applications. They likewise both utilize the distribute buy in worldview, as opposed to queuing: an accepting application buys in to themes of intrigue, and the sending application distributes messages to subjects. The distributer is disassociated from any supporters - it has no learning of whether any application is accepting its messages. MQTT and MQTT-SN are experiencing an expansion in enthusiasm as a result of the movement and attention around the Internet of Things, to which they are suited.

After a few IBM servers were delivered amid the 2000s, Really Small Message Broker (RSMB) was discharged onto IBM alphaWorks in 2008. It's point was to be a moderate MQTT server, and as indicated by the standard alphaWorks rehearses, was shut source and discharged under an assessment just permit. Amid the accompanying two years, it picked up a little however excited after. In 2010, Roger Light found out about MQTT and RSMB from an Andy Stanford-Clark introduction. He made Mosquitto to be an open source other option to RSMB.

From that point forward Mosquitto has picked up its very own energetic after, and has developed to incorporate capacities not accessible in RSMB. It has been incorporated into a few Linux dispersions. RSMB has had MQTT-SN abilities included however not discharged outside of IBM. Presently we have the opportunity to bring Mosquitto and RSMB back together as one Eclipse venture, exploiting the joint effort of the creators of both past tasks.

The Mosquitto venture gives a little server execution of the MQTT and MQTT-SN conventions. Little implies that:

1. Only fundamental capacity is incorporated (contingent aggregation can be utilized to have the capacity to preclude unneeded capacity for a specific application),

2. That capacity is coded as effectively as could be allowed,

3. The facades are as straightforward as feasible for the capacity gave.

The server has the accompanying highlights, which are not depicted in the MQTT particular:

1. An MQTT connect, to enable Mosquitto to associate with other MQTT servers.

2. The capacity to secure interchanges utilizing SSL/TLS.

3. User approval - the capacity to confine client access to MQTT subjects.

Mosquitto can interpret and exchange messages amongst MQTT and MQTT-SN, so it can go about as an entryway between gadgets which speak with either convention.

Mosquitto stays up with the latest with any MQTT or MQTT-SN determination changes, for example the result of the OASIS MQTT particular institutionalization. Mosquitto clings to the convention determinations and principles as nearly as could reasonably be expected, so it might be utilized as a part of conformance testing. Any included non-standard conduct is discretionary.

Mosquitto gives a lightweight server execution of the MQTT and MQTT-SN conventions, written in C. The purpose behind composing it in C is to empower the server to keep running on machines which don't have limit with regards to running a JVM. Sensors and actuators, which are frequently the sources and goals of MQTT and MQTT-SN messages, can be little and ailing in control. This additionally applies to the inserted machines to which they are associated, which is the place Mosquitto could be run.

Ordinarily, the present usage of Roger Light's Mosquitto has an executable in the request of 120kB that expends around 3MB RAM with 1000 customers associated. There have been reports of effective tests with 100,000 associated customers at humble message rates.

And also tolerating associations from MQTT customer applications, Mosquitto has an extension which enables it to interface with other MQTT servers, including other Mosquitto occasions. This enables systems of MQTT servers to be developed, passing MQTT messages from any area in the system to some other, contingent upon the arrangement of the extensions.

Overshadowing has turned into a conspicuous goal for ventures engaged with M2M through the formation of the M2M Industry Working Group and the quantity of related activities being made.

Roger trusts that conveying Mosquitto to Eclipse will expand its presentation for the two clients and conceivable supporters of the undertaking. By contributing RSMB to Eclipse, IBM would like to reinforce the MQTT people group inside Eclipse, and empower the capacities gave by RSMB to be delighted in by a more extensive crowd.

The proposed Mosquitto venture is reciprocal with existing Eclipse extends that make utilization of MQTT, for example, Paho and Koneki. Paho gives MQTT customer libraries in different dialects. The Mosquitto venture is correlative to Paho by giving the required server which permits customer gadgets and applications to speak with each other. The mix of Paho and Mosquitto will permit finish MQTT and MQTT-SN based M2M answers for be manufactured.

1.5 MULTIPLEXER

In gadgets, a multiplexer (or mux) is a gadget that chooses one of a few simple or advanced information flags and advances the chose contribution to a solitary line. A multiplexer of {\display style 2^{n}} 2^{n} sources of info has n select lines, which are utilized to choose which input line to send to the output. Multiplexers are for the most part used to build the measure of information that can be sent over the system inside a specific measure of time and

bandwidth.[1] A multiplexer is likewise called an information selector. Multiplexers can likewise be utilized to actualize Boolean elements of different factors.

An electronic multiplexer makes it feasible for a few signs to share one gadget or asset, for instance, one A/D converter or one correspondence line, rather than having one gadget for every information flag.

On the other hand, a demultiplexer (or demux) is a gadget taking a solitary information flag and choosing one of numerous information yield lines, which is associated with the single information. A multiplexer is regularly utilized with a reciprocal demultiplexer on the less than desirable end.

An electronic multiplexer can be considered as a various information, single-yield switch, and a demultiplexer as a solitary information, different yield switch. The schematic image for a multiplexer is an isosceles trapezoid with the more extended parallel side containing the information pins and the short parallel side containing the yield pin. The schematic on the correct demonstrates a 2-to-1 multiplexer on the left and an equal switch on the right. The {display style sel} sel wire interfaces the coveted contribution to the yield.

1.5.1 BASIC MULTIPLEXING SWITCH
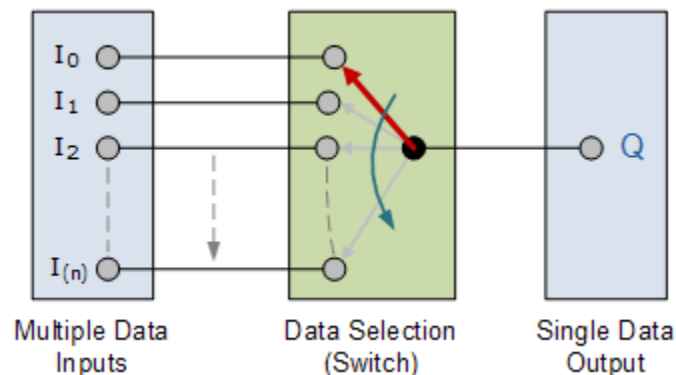
Fig 1.5.1 Block Diagram of Multiplexing Switch

Multiplexing is the non specific term used to depict the activity of sending at least one simple or computerized motions over a typical transmission line at various circumstances or speeds and all things considered, the gadget we use to do only that is known as a Multiplexer.

The multiplexer, abbreviated to "MUX" or "MPX", is a combinational rationale circuit intended to switch one of a few information lines through to a solitary basic yield line by the use of a control flag. Multiplexers work like quick acting various position turning switches associating or controlling numerous information lines called "channels" each one in turn to the yield.

Multiplexers, or MUX's, can be either advanced circuits produced using fast rationale entryways used to switch computerized or double information or they can be simple composes utilizing transistors, MOSFET's or transfers to switch one of the voltage or current contributions through to a solitary yield.

The most essential kind of multiplexer gadget is that of a restricted rotating switch as appeared.

The turning switch, additionally called a wafer switch as each layer of the switch is known as a wafer, is a mechanical gadget whose information is chosen by pivoting a pole. At the end of the day, the revolving switch is a manual switch that you can use to choose singular information or flag lines essentially by turning its contributions "ON" or "OFF". So how might we choose every datum input naturally utilizing a computerized gadget.

In computerized hardware, multiplexers are otherwise called information selectors since they can "select" each info line, are developed from singular Analog Switches encased in a solitary IC bundle instead of the "mechanical" sort selectors, for example, ordinary regular switches and transfers.

They are utilized as one strategy for lessening the quantity of rationale doors required in a circuit outline or when a solitary information line or information transport is required to convey at least two diverse computerized signals. For instance, a solitary 8-channel multiplexer.

For the most part, the choice of each info line in a multiplexer is controlled by an extra arrangement of information sources called control lines and as indicated by the paired state of these control inputs, either "HIGH" or "LOW" the fitting information input is associated straightforwardly to the yield. Regularly, a multiplexer has a considerably number of 2n information input lines and various "control" inputs that compare with the quantity of information inputs.

Note that multiplexers are diverse in activity to Encoders. Encoders can switch a n-bit input example to numerous yield lines that speak to the paired coded (BCD) yield likeness the dynamic information.

We can assemble a straightforward 2-line to 1-line (2-to-1) multiplexer from essential rationale NAND entryways as appeared.

1.6 MYSQL DATABASE

A database is a composed accumulation of data. A social database, all the more prohibitively, is a gathering of compositions, tables, questions, reports, sees, and different components. Database planners normally sort out the information to show parts of reality in a way that backings forms requiring data, such as demonstrating the accessibility of rooms in lodgings in a way that backings finding an inn with opening.

A database-administration framework (DBMS) is a PC programming application that interfaces with end-clients, different applications, and the database itself to catch and examine information. A universally useful DBMS permits the definition, creation, questioning, refresh, and organization of databases.

A database isn't for the most part compact crosswise over various DBMSs, yet extraordinary DBMSs can interoperate by utilizing guidelines, for example, SQL and ODBC or JDBC to enable a solitary application to work with in excess of one DBMS.

CHAPTER 2

LITERATURE SURVEY

2.1. Reference paper 1

TITLE: IOT Based Smart Environmental Monitoring Using Arduino.

AUTHOR: Ajay, Dr. Baswaraj Gadgay.

This paper presents a large number of research efforts that make use of wireless sensors for achieving environment monitoring applications. Internet of Things, there is connectivity between computers and other physical devices such as vehicles and buildings,embedded with sensors and network connectivity that enable the reading from sensors and actuators to be monitored from the internet . In this paper we are using Arduino is an easy-to-use hardware and software based on open-source prototyping platform.Originally Arduino was created as tool for fast prototyping, aimed for students without any background in electronics and programming. Later, the Arduino board started to change to adapt to new needs and challenges. The Air quality sensor detects the samples absorbed by the electro-catalytic sensing electrode contain gas molecules. Next, they pass through a diffusion medium and electrochemically react to an appropriate sensing electrode potential. The electric current generated by the reaction is directly proportional to the gas concentration. This current is converted to voltage for a meter or recorder readout . Most of the currently available humidity sensors are constructed based on a porous sintered body structure ceramics and utilize the ionic type humidity sensing principle. By water adsorption on the ceramic surfaces, their electrical properties would change and this change encompasses the resistance, capacitance or electrolytic conduction depending upon the sensor type . The modified inverted pendulum design used in this project is very responsive to low-frequency seismic vibrations and is fairly inexpensive to construct. It's an extremely simple design, yet highly capable of detecting low-frequency seismic waves. The sensor produces an analog voltage representation of the seismic wave in lieu of a mechanical tracing, as is the case in the classical design. Tracking the environmental parameters' variation is essential in order to determine the quality of our environment. The collected data encompass important details for a variety of organizations and agencies . An LDR (Light dependent resistor), as its name suggests, offers resistance in response to the ambient light. The resistance decreases as the intensity of incident light increases, and vice versa. In the absence of

light, LDR exhibits a resistance of the order of mega-ohms which decreases to few hundred ohms in the presence oflight. It can act as a sensor, since a varying voltage drop can be obtained in accordance with the varying light. It is made up of cadmium sulphide (CdS) .
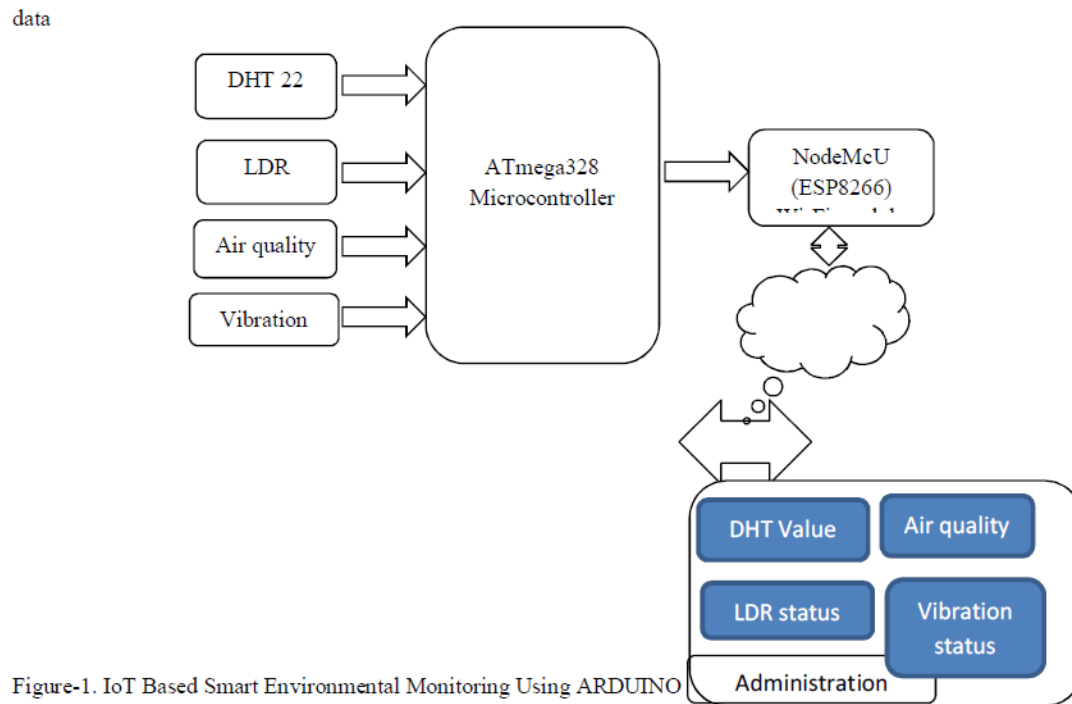
Figure-1. IoT Based Smart Environmental Monitoring Using ARDUINO

Fig. 2.1.1 IOT based smart Environmental system using Arduino.

2.1.1. RESULTS:

The experimental setup has done with different locations like crowd areas, Gardens, Traffic zones etc. The sensors values of these are listed shown below.

Fig 2.1.2 Sensor values in garden area
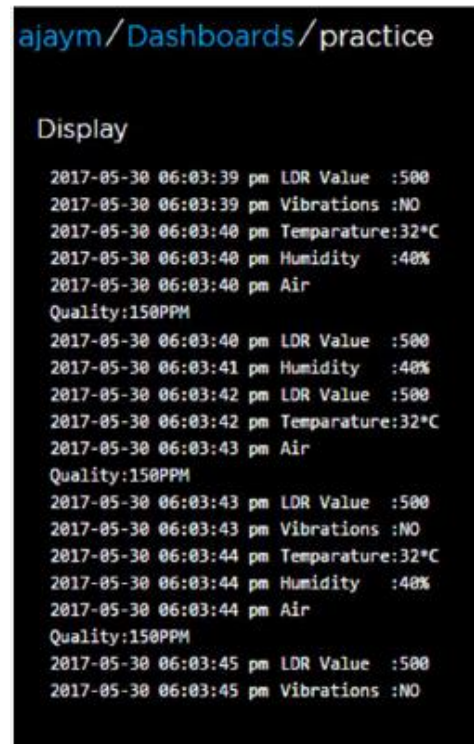
Fig 2.1.3 Sensor values in Crowd area

Fig 2.1.4 Sensor values in Traffic area

It can be used to predict the onset of bad weather using such as changing temperature and humidity. Raising the awareness of how society is affected the region's environmental policies

and have the knowledge basis to push for the change. The analysis presented in this paper represents a starting point for the selection of a direction in the implementation of IoT-based environmental monitoring applications, providing an overview of the potential and challenges of each one of the three developed wireless sensors.

2.2 Reference paper 2

TITLE: A Review Paper on Home Automation System Based on Internet of Things Technology

AUTHOR: Swati Tiwari , Rahul Gedam

Consequently, we will often be implicitly linked into the new utility. Some examples of new services include immediate and continuous access to the right information for the task at hand, be it, traveling to work or a meeting, exercising, shopping, socializing, or visiting a doctor. Sometimes these activities will be virtual activities, or even include the use of avatars or robots. Many outputs and displays for users may be holographic. Credit cards should disappear and biometrics like voice or retinas will provide safe access to buildings, ATMs, and transportation systems. A sensing and actuation utility will not only exist in public spaces, but also extend into the home, apartments, and condominiums. Here people will be able to run health, energy, security, and entertainment apps on the infrastructure. Installing and running new apps will be as easy as plugging in a new toaster into the electric utility. One app may help monitor and control heart rate, another perform financial and investments services, another automatically ordering food and wine, or even predicting a impending medical problem that should be addressed early to mitigate or even avoid the problem. Humans will often be integral parts of the IoT system. The Industrial Internet is also a form of IoT where the devices (things) are objects in manufacturing plants, dispatch centers, process control industries, etc.

Fig 2.2.1 Applications of IOT

According to Jayavardhana[1], the term Internet of Things was first coined by Kevin Ashton in 1999 in the context of supply chain management. However, in the past decade, the definition has been more inclusive covering wide range of applications like healthcare, utilities, transport, etc. Although the definition of 'Things' has changed as technology evolved, the main goal of making a computer sense information without the aid of human intervention remains the same. A radical evolution of the current Internet into a Network of interconnected objects that not only harvests information from the environment (sensing) and interacts with the physical world (actuation/ command/control), but also uses existing Internet standards to provide services for information transfer, analytics, applications, and communications. Fueled by the prevalence of devices enabled by open wireless technology such as Bluetooth, radio frequency identification (RFID), Wi-Fi, and telephonic data services as well as embedded sensor and actuator nodes, IoT has stepped out of its infancy and is on the verge of transforming the current static Internet into a fully integrated Future Internet. The Internet revolution led to the interconnection between people at an unprecedented scale and pace. The next revolution will be the interconnection between objects to create a smart environment.

In 2014, Nikhil Singh,[2] Shambhu Shankar Bharti, Rupal Singh, Dushyant Kumar Singh, developed Remotely Controlled Home Automation System. They made server and android based Home automation system. The program is designed such that if no one is at home then all home appliances automatically switched off. For designed purpose we have used Proteus Design Suite. The design consist a simple home automation design having a "motion sensor" for counting number of people inside home, "a speed controlled fan" ,"a light bulb", "a LCD" for displaying status of home appliances. "a microcontroller ic" for controlling devices "a port" for connection purpose.

CONCLUSION: As we saw in literature section the scope of internet on things on current era. We also saw what home automation is and the issues that still need to be solved. So in this paper basically we study about internet of things and we did the comparative study on home automation technique. There are still lots of future scope on home automation using IoT

2.3 Reference paper 3

TITLE: A Survey on WiFi Based Air Pollution Monitoring System.

AUTHOR: Santosh G Bhandarakawathe, Prof.S. B. Somani

The concept of Internet of Things (IOT) is also emerging very fast where everything around us comes with an internet connectivity for monitoring and control. Monitoring the environmental parameters and initiating a control action from internet is also part of this concept. In our proposed work, we design an environment monitoring system, capable of monitoring and control of environmental parameters like temperature, CO, NO2, SO2, PM2.5 &10. Also, we focus on design of a low cost system that is capable of not only remotely monitoring the environment variables like temperature and industrial pollutants but also initiates some control action like switching devices ON/OFF from the internet. This system uses Wireless sensor Networks for sensing the environment parameters in the area under supervision. Sensors Node has been designed to measure the temperature, CO, SO2, NO2, PM2.5&10. The Control node has been designed to initiate the control action. The Central Monitoring is based on ARM11 raspberry pi board.

Nihal Kularatna and B.H.Sudantha [1] offered biological air tainting screen process in the year 2008.The plan relies upon the IEEE 1451 standard. In this postulation STIM rich transducer interface module was created which comprise of microcontroller and gathering of different sensors like CO2, CO, NO2, O3.This additionally utilized Personal PC for graphical portrayal. STIM associated with the PC by means of transducer free interface which utilizes IEEE 1451 standard.

Y.J.Jung and Y.K.Lee [2] created air contamination checking framework utilizing Geosensor organize in 2008.Geosensor system is utilized to the distinguish the state of remote place. In this setting model and idea of adaptable examining interim change was acquainted with expands the battery lifetime. Setting show planned which decides the contaminated regions what's more, likewise caution message and wellbeing rules send to the general population around there.

Raja Vara Prasad et al. [3] In 2011 proposed a realtime remote contamination observing. This framework depended on the multihop information total algorithm.Calibrated gas sensors were interfaced to remote sensor bits, in that Libelium WASP bit was utilized which comprise of preparing unit and correspondence unit. All gas sensors were associated with sensor board on rotational premise. The gathered information were sending to base station. Multihop information collection calculation was utilized to build a checking range.

Abdullah Kadri et al. [4] in 2013 exhibited constant air contamination observing in view of Machine to machine correspondence. The framework was executed with different observing station which comprise of various vaporous and meteorological sensors. Each observing station speaks with the backend server through M2M correspondence which utilizes GPRS arranges.

Anuj Kumar et al. [7] in 2013 conducted a review on environmental monitoring system. The review discussed distinctive procedures and different equipment utilized as a part of the earth checking frameworks. It also considered the parameters like low cost, low power consumption, reliability, and signal to noise ratio and RF interference.

CONCLUSION: Averting environmental pollution is one of the tedious tasks since the humans are responsible for this hazardous nature which poses threat to whole world. And we are responsible to eradicate pollution problems. Virtually all emissions vary from time to time. It is an excellent concept that will show a new dimension. Although the general and specific objective is very similar, the Technological solutions employed are very different

2.4 Reference paper 4

TITLE: Review on Environment Monitoring System and Energy Efficiency.

AUTHOR: Nikita Gaikwad, Yogita Mistry

The Environment monitoring is one of the applications of wireless sensor network. The most serious environment pollution is air pollution because different air pollutant causes damage to human health and causes global warming. To avoid such effect on human health and climate change Environment monitoring systems are used. This paper provides the short overview of different environmental air pollution monitoring systems and Energy efficiency in WSN to reduced the power consumption of system.

Octavian A.Postolache, J.M.Dias and P.M.B Silva Girao [1] in 2009 executed Smart sensor organize for indoor and outside air quality observing. In this framework sensor hubs are introduced in various rooms and it comprise of tin dioxide sensors which was hardwired or remotely associated with the focal unit. It additionally estimated the convergence of temperature and dampness for precision. In this the idea of numerous information single yield neural systems was actualized to remunerate temperature and moistness impact on gas focus. Wi-Fi innovation was utilized for correspondence.

Ridha Soua and Pascale Minet [2] directed a study on vitality productive methods in 2011.In condition observing application energyconsumption is the real issue since it is difficult to utilize batteries for expansive scale application.Therefore keeping in mind the end goal to build the lifetime of network,this paper talked about the information lessening, control decrease, topology control, vitality proficient steering procedures.

Sandra Sentra et al. [3] presented control sparing and vitality streamlining procedures in 2011.This paper clarified the equipment engineering for vitality mindful sensor arrangement and vitality parameters are considered in the transmission framework.

Fahed Awad et al. [4] presented control sparing system in 2012.The fundamental concentrated on the grouping calculation to limit the power consumption.Clustering convention utilizes the detecting scope matrix.In this rule of virtual field drive is connected on each group in a system that made the sensor hub to move to legitimate area to amplify the detecting scope and diminished the transmitted power.

A.R.Al-Ali, Imran Zualkernan and FadiAloul [5] displayed Mobile GPRS sensors for contamination checking. This included Data obtainment unit, GPRS modem, and GPS module and pollution server. In this DAQ unit, GPRS and GPS were related with the microcontroller by methods for RS-232 Interface in conclusion collected data was sending to the contamination server.

CONCLUSION: It has been observed that wireless sensor network based environment monitoring systems are low cost, small size and easily reliable. But these systems cannot be used for large area because each node is usually energized by energy limited battery. This paper performs review on environment monitoring systems and different techniques to improve the energy consumption .so that in future this systems are used for large scale environment monitoring .This WSN based monitoring systems can also be used in habitat monitoring , indoor living monitoring , forest monitoring .

2.5 Reference paper 5

TITLE: Internet of Things (IoT) based Sensors to Cloud system using ESP8266 and Arduino Due.

AUTHOR: Mr. Nerella Ome , Mr. G. Someswara Rao

The system proposed in this paper is an advanced solution for monitoring the weather conditions at a particular place and make the information visible anywhere in the world. The technology behind this is Internet of Things (IoT), which is an advanced and efficient solution for connecting the things to the internet and to connect the entire world of things in a network. Here things might be whatever like electronic gadgets, sensors and automotive electronic equipment. The system deals with monitoring and controlling the environmental conditions like temperature, relative humidity, light intensity and sound level with sensors and send this information to the cloud and then plot the sensor data as graphical statistics. The data updated from the implemented system can be accessible in the internet from anywhere in the world.
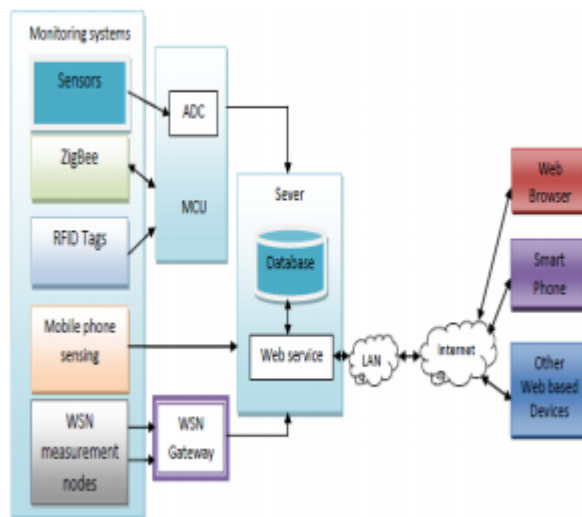
Fig 2.5.1 Exsisting System model
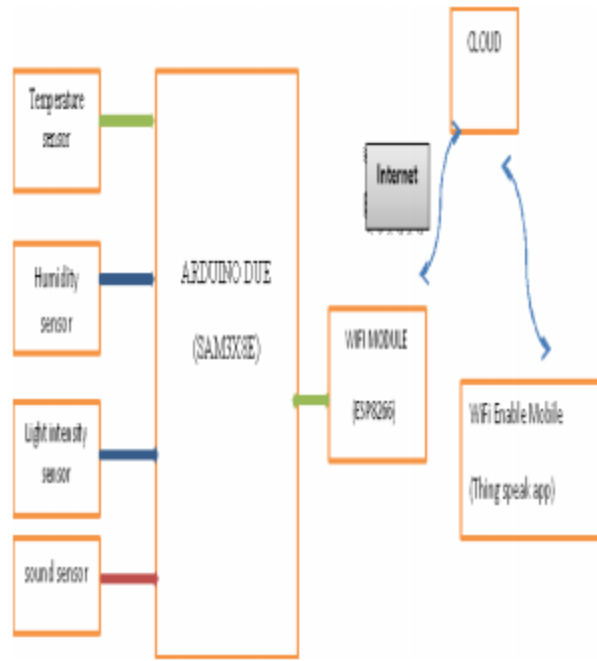
Fig 2.5.2 Block diagram of the implementation model

An embedded system designed for environmental monitoring system.The embedded device is placed in particular area for testing purpose. The sound sensor detects sound intensity levels in that area and DHT11sensor and LDR will record the Temperature ,Humidity and Light intensity in that region, if the threshold limit is crossed the corresponding controlling action will be taken (like issuing message alarm or buzzer or LED blink).All the sensor devices are connected through wifi module. The embedded system with its components for reading and to store the Sensors reading to Thing speak platform(cloud). After successful completion of sensing, the data will be processed and stored in database for future reference. After completing the analysis on data the threshold values will be set for controlling purpose.

RESULTS:

1. Create an account on Thing speak platform.

2. Connect Arduino Due board to system through USB cable.

 3. After connecting select board and COM port in Arduino IDE.

Fig 2.5.3 Arduino IDE Window for Board and COM port selection

4. Develop an Arduino Code for sensors to cloud system in Arduino IDE ,compile and upload the code in Arduino Due board

Fig 2.5.4 Arduino IDE Window for Compilation successful.
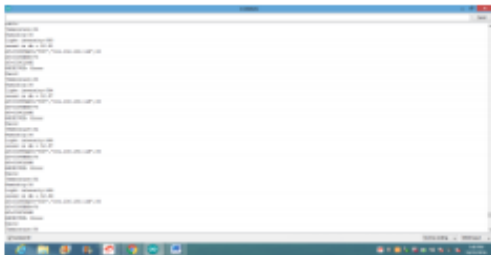
Fig 2.5.5 Sensors Result and Wi-Fi status on Serial monitor

CONCLUSION: By keeping the embedded devices in the environment for monitoring enables self protection (i.e., smart environment) to the environment. To implement this need to deploy the sensor devices in the environment for collecting the data and analysis. By deploying sensor devices in the environment, we can bring the environment into real life i.e. it can interact with other objects through the network. Then the collected data and analysis results will be available to the end user through the Wi-Fi. The smart way to monitor environment and an efficient, low

cost embedded system is presented with different models in this paper. In the proposed architecture functions of different modules were discussed. The sensors to cloud system with Internet of Things (IoT) concept experimentally tested for monitoring four parameters. It also sent the sensor parameters to the cloud (Thing speak). This data will be helpful for future analysis and it can be easily shared to other end users. This model can be further expanded to monitor the developing cities and industrial zones for pollution monitoring. To protect the public health from pollution, this model provides an efficient and low cost solution for continuous monitoring of environment.

CHAPTER-3

THEORETICAL ANALYSIS

3.1 SENSORS   FUNCTIONING:

3.1.1: GAS SENSOR :

Gas Sensor (MQ2) module is valuable for fuel spillage area (home and undertaking). It is fitting for perceiving H2, LPG, CH4, CO, Alcohol, Smoke or Propane. Due to its high affectability and quick reaction time, estimation can be taken as quick as could sensibly be normal. The affectability of the sensor can be adjusted by potentiometer

Gas sensor Function :

SensorValue = AnalogRead(A0);

SensorVoltage=SensorValue/1024*5.0;

3.1.2 THERMISTOR :

Thermistor, a sort of resistor whose protection relies upon temperature. In our project we used a Negative temperature Coefficient Thermistor whose resistance decreases with increase in temperature and thereby it acts as a temperature sensor. Because of its high sensitivity it is capable to sense even small changes in the temperature.

FUNCTION :

R2 = R1 * (1023.0 / (float)Vo - 1.0);

logR2 = log(R2)

Temp = (1.0 / (c1 + c2*logR2 + c3*logR2*logR2*logR2)); Temp = Temp - 273.15;

Temp = ((Temp * 5.0)/ 9.0 - 70.0);

where R1 =10k ohms ;

c1= c1 = 1.009249522e-03, c2 = 2.378405444e-04, c3 = 2.019202697e-07;

3.1.3 LDR :

Light Dependent Resistor or photocell is a light-controlled variable resistor whose protection diminishes with the expansion in the force of light: Photo Conductivity. Because of their low cost,ease of manufacturing they are widely using in many applications. They are made from semiconductor materials to enable them to have light sensitive properties

FUNCTION:

```
String d="";
  digitalWrite(D2,HIGH);
  digitalWrite(D3,LOW);
  digitalWrite(D4,LOW);
 int l = analogRead(A0);
 d=d+"light intensity " +String(l);
 int z=d.length() + 1;
 d.toCharArray(ldr,z);
```

3.2 INTERFACING THE SENSORS TO THE MUX:

All the 3 sensors are interfacing with the HC4051 MUX by using the pin configuration of the IC .It is an analog multiplexer so it gives an ease to multiplex the senosrs.

3.3. INTODUCTION TO THE MOSQUITTO SERVER:

MQTT stands for MQ Telemetry Transport. It is a publish/subscribe, extremely simple and lightweight messaging protocol, designed for constrained devices and low-bandwidth, high-latency or unreliable networks. The design principles are to minimise network bandwidth and device resource requirements whilst also attempting to ensure reliability and some degree of

assurance of delivery. These principles also turn out to make the protocol ideal of the emerging "machine-to-machine" (M2M) or "Internet of Things" world of connected devices, and for mobile applications where bandwidth and battery power are at a premium.

3.3.1 Starting a MQTT through terminal.

Since it is a client-server model we can have 2 separate host systems or a single system as client and server .In our project we have used single system as Client and server .For this we have to use 2 separate terminal windows .

3.3.2 Starting of MQTT Client in terminal.

3.3.3 Publishing the data at the Client side of the MQTT .

.3.4 INTRODUCTION TO MYSQL DB:

In previous times people use to store the information in books and then in Computers. But with the increase in the size of the information ,It's been difficult to store all the bulk information in a single system and it's accessing. .Database is simply a huge memory storage which not only helps us to store the bulk information and also to update and access it.

A database consists of many tables .Just like the conventional tables, even these also consists of rows and columns .the column consists of the datatype and the rows consists of the records for the datatype. Every row can be accessed with a unique element : Primary key. Even 2 different tables can also be put together to access the information using a special element: Foreign key.

In general there are many types in databases like relational DB, Cloud DB, Object-oriented DB etc.. In our project we are using a relational Database :SQL . It is an open source that helps any one to access ,update and add the information to the DB. It can also work with client-server and embedded systems and is very fast ,reliable and accurate.

```
 Welcome to MySQL Terminal. Commands end with ; or \g.
 Script version: 1.0.0
 Please type mysql -h [host] -u [user] -p [password] and press "Enter" to start.

> mysql -u root -p
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 884
Server version: 5.4.3-beta-community

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.
> use world
Database changed
> select * from city limit 10
+----+---------------+-------------+---------------+------------+
| ID | Name          | CountryCode | District      | Population |
+----+---------------+-------------+---------------+------------+
| 1  | Kabul         | AFG         | Kabol         | 1780000    |
| 2  | Qandahar      | AFG         | Qandahar      | 237500     |
| 3  | Herat         | AFG         | Herat         | 186800     |
| 4  | Mazar-e-Sharif| AFG         | Balkh         | 127800     |
| 5  | Amsterdam     | NLD         | Noord-Holland | 731200     |
| 6  | Rotterdam     | NLD         | Zuid-Holland  | 593321     |
| 7  | Haag          | NLD         | Zuid-Holland  | 440900     |
| 8  | Utrecht       | NLD         | Utrecht       | 234323     |
| 9  | Eindhoven     | NLD         | Noord-Brabant | 201843     |
| 10 | Tilburg       | NLD         | Noord-Brabant | 193238     |
+----+---------------+-------------+---------------+------------+
10 rows in set (0.0010840892791748 sec)
>
```

3.4. MQSQL database and creation of tables in it through terminal.

CHAPTER-4

EXPERIMENTAL INVESTIGATION

4.1 INTODUCTION TO ARDUINO IDE 1.8.5 :

Arduino is an open source platform which renders us to build the electronic projects that can make our daily life much better and also many innovative methods to perform a task. In order to interface the Arduino with the system we need to have the software that can be used to write the code.

Also all the necessary hardware connections are to be made   on the breadboard along with the Arduino. Since the main motto of using this Arduino is to make things automatic. In   order to achieve that we need to code the logic of the components in order to meet our requirements we use IDE 1.8.5 software . Not only arduino we can also connect many components like raspberrypi, nodemcu. All we need to do is to import the required library and install it in the IDE .In this we will have to   take care of the port to which the real hardware is connected . In precise it is also known as Programmable circuit boards .

In our project we used NodeMCU , So we need to install the libraries of t in our IDE. In our project we need to monitor the surroundings .It means that   we need to use the   appropriate sensors along with node .For some of the sensors we need to install libraries also and it has to done according to the requirement. Since we are going to collect and store the values in the database   and   also use a client-server model we should also include the necessary logic and its functions in our project code. So this software will provides some standard factors that help us to is use it extend the functions other than the conventional   Microcontroller.
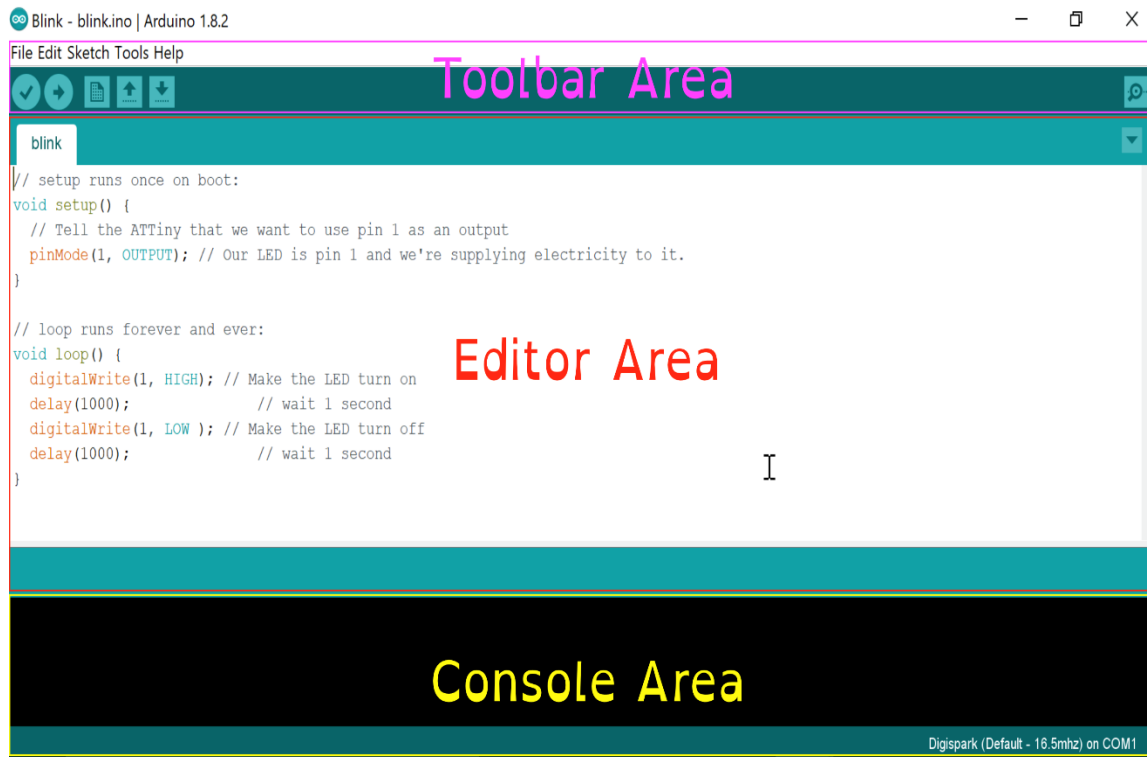
4.1 Typical IDE layout.

4.2 MULTIPLEXING OF SENSORS :

The main motto of this project is to multiplex the analog sensors to the only analog pin of NodeMCU. For this purpose we have used HC4051 MUX. It has 8 I/P & O/P channels. Also a power and ground pins .

Since Node MCU has only one analog sensor pin it's difficult to connect all the sensor pins to the Node. So we multiplexed the analog sensors using HC4051 Mux. It is an 8*1 mux where we can have 8 analog sensors connected to the mux and thereby it can be connected to the only analog pin of the node. . Since in our project we have considered only 3 sensors, we connected them to the 13,14 and 15 pins respectively. We know that any 8*1 mux will have 3 selector pins. .Here 11,10 and 9 are the select pins .since our project confined to only 3 sensors we used only 2 select lines. .But this can be extended to 8 analog sensors using 3 select lines
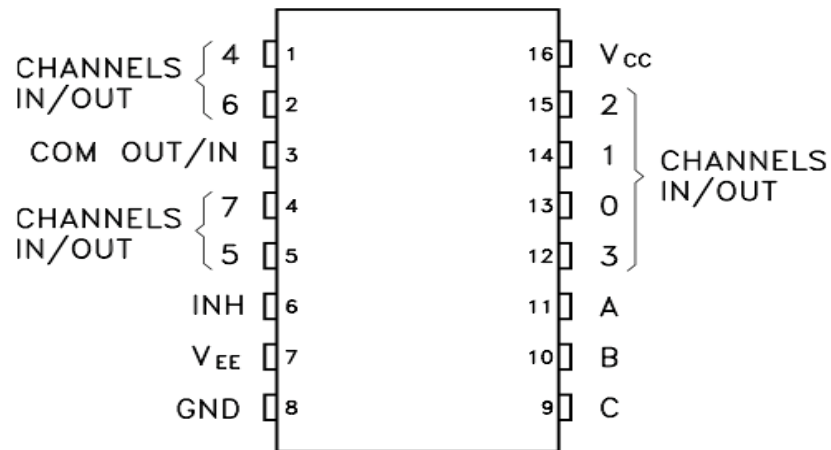
4.2.1   Conventional HC4051 pin Configuration.
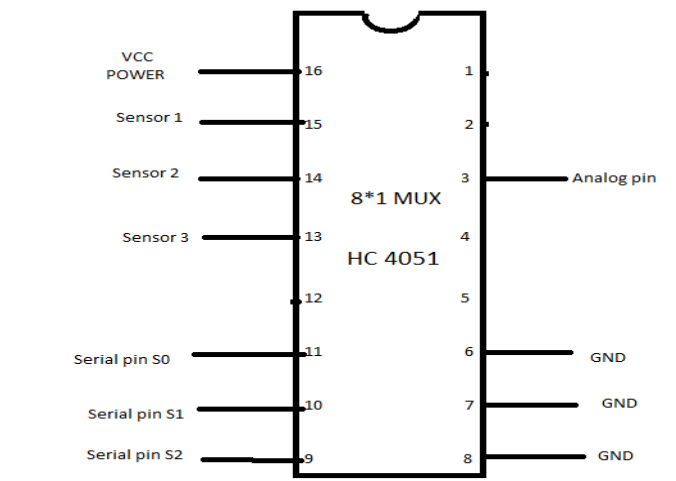
4.2.2   Sensors Connection to Mux.

4.3 INTERFACING   OF MUX TO NODE :

The output of the mux is connected to the analog pin of node .Ground pins of the mux and node are connected. Similarly the voltage pins of the mux and node are connected. The key feature is the connection of the select lines. Since we used only 2 select lines. Those are connected to the digital pins D2 and D3 of the mux.
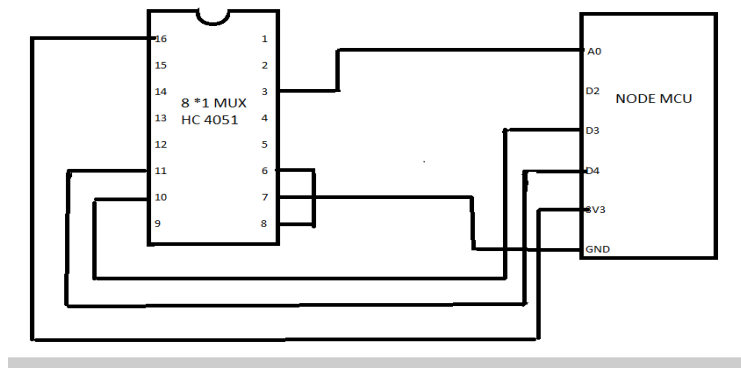
4.3 Connection of MUX to the NodeMCU.

4.4 CONNECTION OF NODE TO MQTT:

Since we are achieving at automation , everything has to executed logically and functionally. So We need to include the logic of MQTT client server model in our multiplexing logic so that the sensor values will be displayed at the server end.

Here in the Node MCU interfacing with multiple analog sensors logic we have included the logic of MQTT connection establishment. We have to mention the hostname/IP and port of the broker .Also the broker and the client should be connected over same kind of network. Prior uploading the logic into Node MCU mosquito server and client libraries should be installed and the MQTT broker should be kept ready to publish and subscribe the sensor values
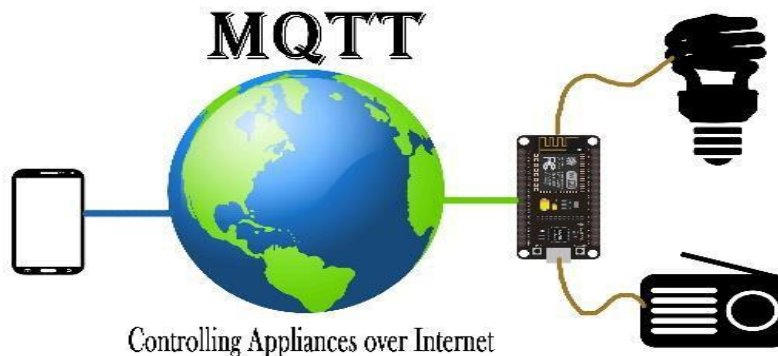
4.4. Basic diagram to demonstrate node to MQTT connection for publishing the data

4.5 STORING THE DATA FROM MQTT TO DATABASE :
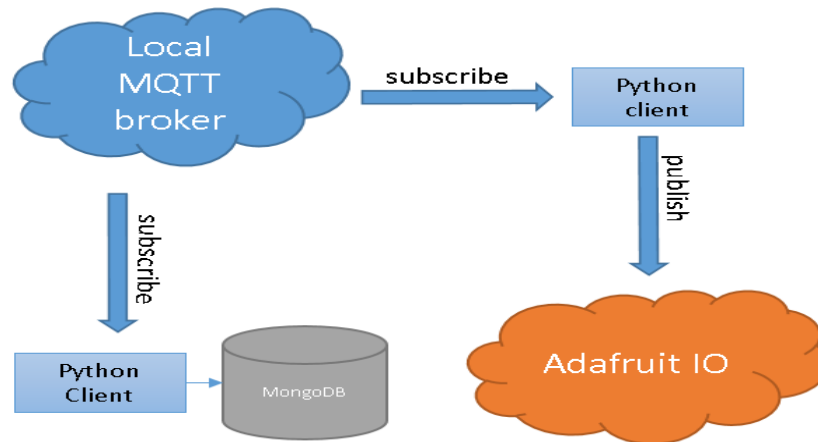
4.5 Storing the sensor values from the MQTT
to the DB using python Scripts.

The obtained sensor values at the Mosquitto client, they are directly stored into a log file using python scripts. Next MYSQL database has to be installed at the server side and username and password are to be created to avoid authentication and authorization problems. Next a database and tables depending our requirement are to be created to store the log files To make this backend process to occur automatically we again used python script files where we mention all the credentials to store and update the DB.

CHAPTER-5

RESULTS AND DISCUSSIONS:

Instead of combining and multiplexing the 3 sensors at a time we have executed the logic of each sensor individually.
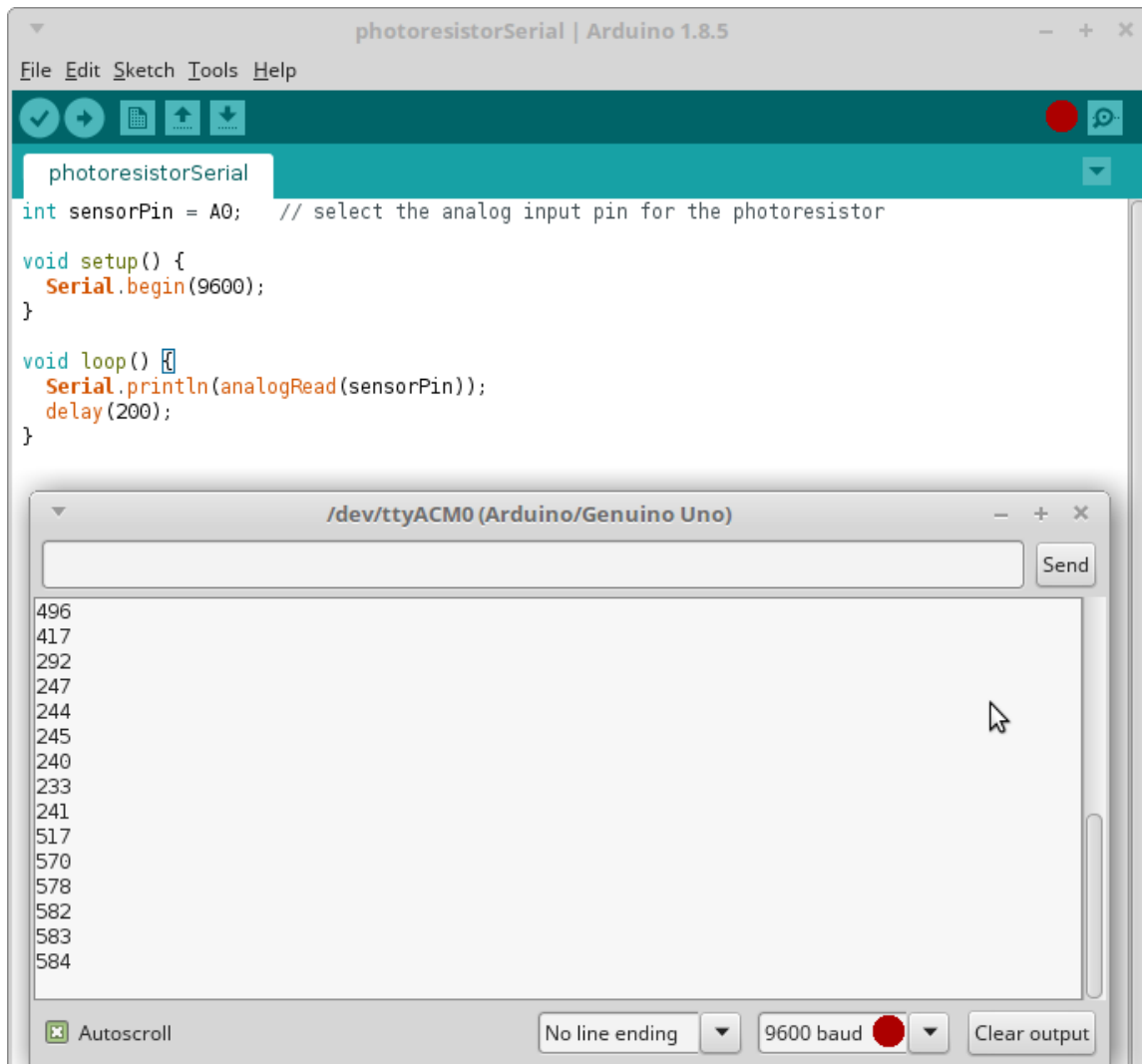
```
sensor voltage = 0.32 V
sensor voltage = 0.32 V
sensor voltage = 0.33 V
sensor voltage = 0.33 V
sensor voltage = 0.40 V
sensor voltage = 0.32 V
sensor voltage = 0.32 V
sensor voltage = 0.30 V
sensor voltage = 0.33 V
sensor voltage = 0.23 V
sensor voltage = 0.25 V
sensor voltage = 0.26 V
sensor voltage = 0.34 V
sensor voltage = 0.34 V
sensor voltage = 0.25 V
sensor voltage = 0.27 V
sensor voltage = 0.36 V
sensor voltage = 0.29 V
sensor voltage = 0.39 V
sensor voltage = 0.40 V
sensor voltage = 0.32 V
sensor voltage = 0.33 V
sensor voltage = 0.33 V
sensor voltage = 0.33 V
sensor voltage = 0.40 V
sensor voltage = 0.33 V
sensor voltage = 0.36 V
sensor voltage = 0.37 V
sensor voltage = 0.32 V
sensor voltage = 0.41 V
sensor voltage = 0.34 V
sensor voltage = 0.43 V
```

5.1   Converting the physically sensed gas values

by the sensor into voltages
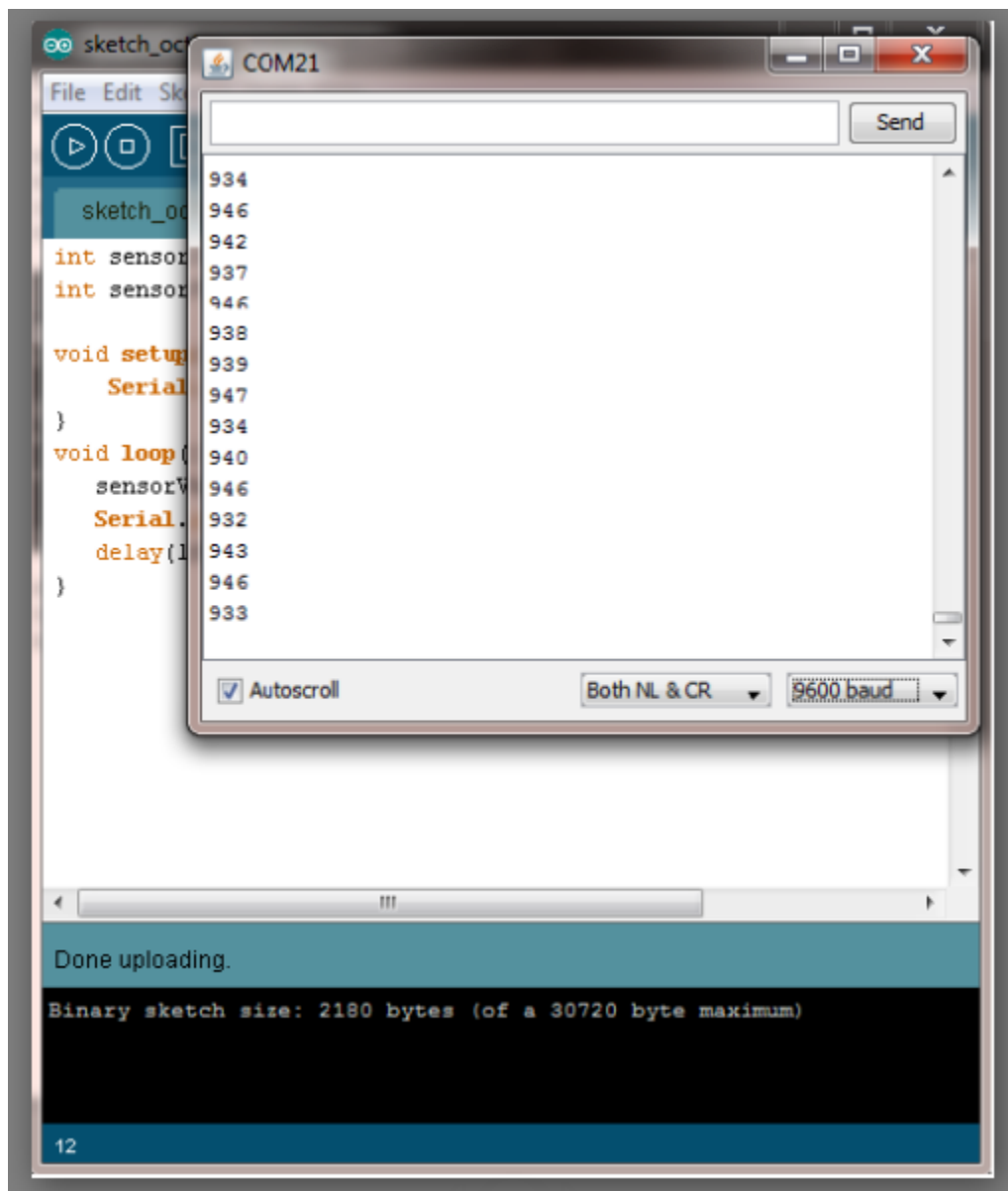
5.2   LDR logic output values at the serial monitor.

Since we are multiplexing the sensors ,we have used the thermistor that helped us to plot the temperature. If we want to obtain more physical variable values we can use different sensors like DHT Sensors.

5.3   Thermistor values obtained in serial monitor.

5.4. SERIAL MONITOR OUTPUT DISPLAYING TEMPERATURE, LIGHT INTENSITY PARAMETERS

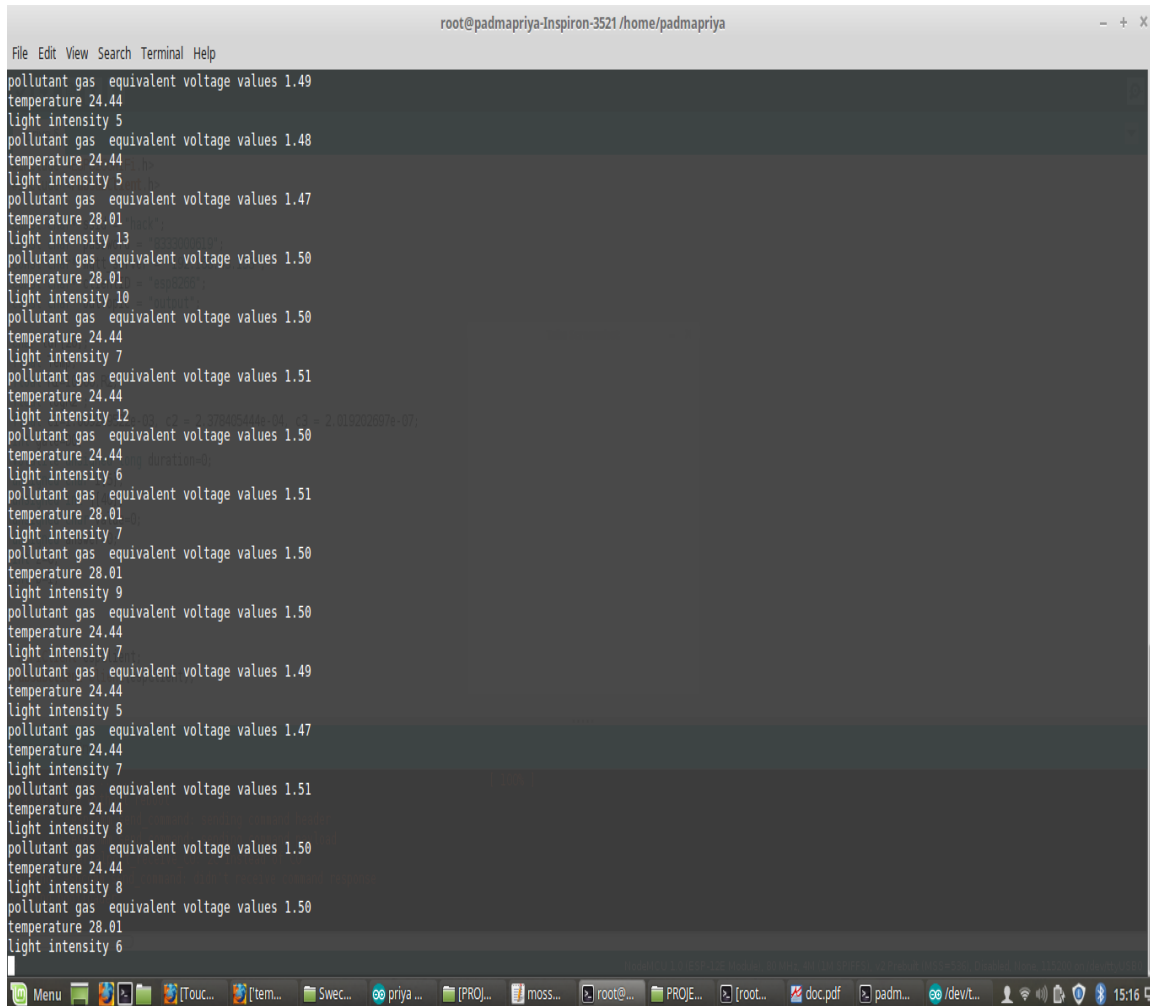Finally we have combined all the 3 analog sensors and multiplexed them using HC4051 mux .

```
sensor voltage = 1.62 V
Temperature= 12.93
light intensity 6
sensor voltage = 1.67 V
Temperature= 17.35
light intensity 7
sensor voltage = 1.67 V
Temperature= 19.94
light intensity 7
sensor voltage = 1.68 V
Temperature= 19.94
light intensity 6
sensor voltage = 1.68 V
Temperature= 18.61
light intensity 6
sensor voltage = 1.68 V
Temperature= 16.16
light intensity 7
sensor voltage = 1.67 V
Temperature= 18.61
light intensity 7
sensor voltage = 1.67 V
Temperature= 18.61
light intensity 8
sensor voltage = 1.67 V
Temperature= 17.35
light intensity 7
sensor voltage = 1.63 V
Temperature= 21.34
light intensity 7
sensor voltage = 1.64 V
Temperature= 19.94
light intensity 7
sensor voltage = 1.63 V
Temperature= 21.34
light intensity 6
sensor voltage = 1.61 V
Temperature= 21.34
light intensity 7
sensor voltage = 1.63 V
Temperature= 21.34
light intensity 8

Autoscroll
```

5.4 Physical variables detected using the sensors are displayed at the Serial Monitor.

5.5 OUTPUT AT MOSQUITTO SERVER RECEIVED FROM NODEMCU OVER WIFI USING MQTT PROTOCOL

As we have executed the logic of MQTT in the multiplexing of sensors, the client of the mosquito will automatically publish the sensor values at the server. If we open the serial monitor we can be able to see the messages of the MQTT starting and the wifi connecting messages.
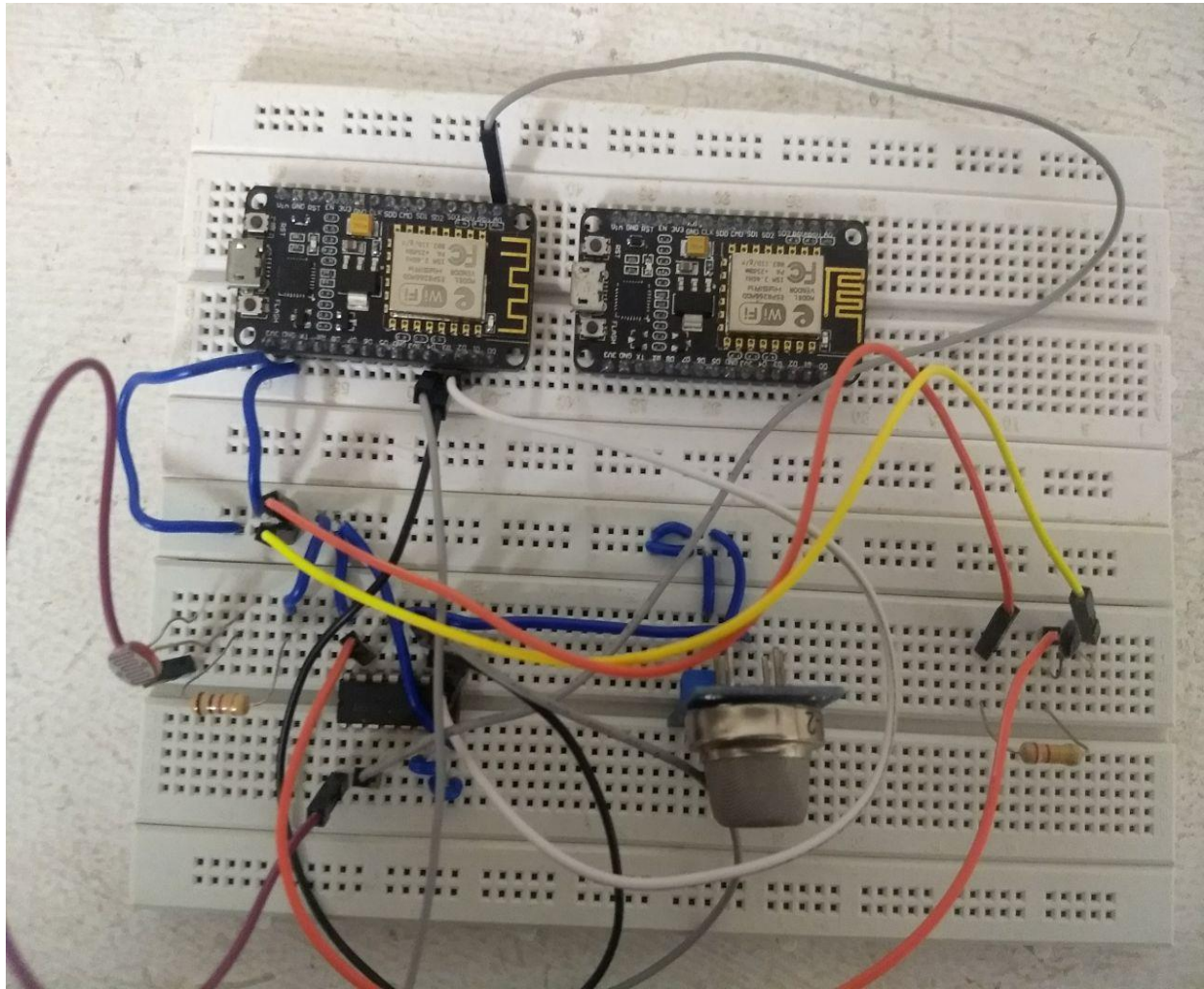

5.5 Published Sensor values at the MQTT server side.

5.6 Hardware multiplexing of sensors with NodeMCU.

CHAPTER-6

CONCLUSION

In our Project we have mainly implemented the connection of multiple sensors to Node MCU through MUX and thereby using it for Home Automation This data is then published using Mosquitto and thereby pushed in to a Database. With the increase in the data we can also distribute the stored data. For true redundancy to prevent site failures and downtime caused by natural disasters. It also provides the availability, scalability and reliability of a single server

.

CHAPTER-7

FUTURESCOPE:

This can also be extended to 8 analog sensors and we can achieve get more devices connected through the network. It even gives us the more chance to control and operate many devices. By using Machine Learning, the data stored in the database can be plotted and analyzed. Here we considered only one Node MCU which confines the weather of only one place. It can be extended to many Node MCU in order to determine the weather at many places and even analyzing them gives the weather at many different places.

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